Elite Mathematics
Pearson Edexcel International GCSE

IGCSE LINEAR · 4MA1

Linear Classified Questions

1354 past-paper questions grouped by topic.

1354	2020–2026	Questions
topic placements	55 past papers	checked by Dr Eslam



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TOPIC

Number Toolkit

Every past-paper question on this topic, 2020 to 2026.

EP SPECIMEN

Question 36

3 marks | Number Toolkit

36 Here is a list of numbers.

2 9 15 17 21 25 27

From the list, write down

(a) the two prime numbers,

.....

(1)

(b) a square number that is also odd and greater than 10,

.....

(1)

(c) a cube number.

.....

(1)

(Total for Question 36 is 3 marks)

EP SPECIMEN

Question 37

2 marks | Number Toolkit

37 Use the information that $23 \times 47 = 1081$ to write down the value of

(a) 2.3×4.7

.....

(1)

(b) $1081 \div 4.7$

.....

(1)

(Total for Question 37 is 2 marks)

Question 10

3 marks | Number Toolkit

10 The table gives information about the population and the total amount of money, in dollars, spent on healthcare for two countries in 2016

Country	Total population	Total spent on healthcare ($)
Austria	8.7×10^6	4.2×10^{10}
Luxembourg	6.3×10^5	3.7×10^9

Work out how much more was spent **per person** on healthcare in Luxembourg than in Austria.
Give your answer correct to the nearest whole number.

..... dollars

(Total for Question 10 is 3 marks)

Question 1

3 marks | Number Toolkit

1 Write 4500 as a product of powers of its prime factors.
Show your working clearly.

.....

(Total for Question 1 is 3 marks)

4MA1/1HR JUNE 2026

Question 2

3 marks | Number Toolkit

2 Write 504 as a product of powers of its prime factors.
Show your working clearly.

.....

(Total for Question 2 is 3 marks)

TOPIC

Prime Factors, HCF & LCM

Every past-paper question on this topic, 2020 to 2026.

Question 2

4 marks | Prime Factors, HCF & LCM

2 (a) Find the highest common factor (HCF) of 56 and 84
Show your working clearly.

.....

(2)

(b) Find the lowest common multiple (LCM) of 60 and 72
Show your working clearly.

.....

(2)

(Total for Question 2 is 4 marks)

4MA1/2HR JANUARY 2020

Question 1

3 marks | Prime Factors, HCF & LCM

1 (a) Write $5^{17} \times 5^{2}$ as a single power of 5

.....

(1)

(b) Write 800 as a product of its prime factors.
Show your working clearly.

.....

(2)

(Total for Question 1 is 3 marks)

Question 2

2 marks | Prime Factors, HCF & LCM

2 Find the lowest common multiple (LCM) of 28 and 105

(Total for Question 2 is 2 marks)

Question 10

3 marks | Prime Factors, HCF & LCM

10 $A = 2 \times 3^{43}$
$B = 16 \times 3^{37}$

(a) Find the highest common factor (HCF) of A and B.

.....

(1)

(b) Express the number $A \times B$ as a product of powers of its prime factors.
Give your answer in its simplest form.

.....

(2)

(Total for Question 10 is 3 marks)

Question 9

4 marks | Prime Factors, HCF & LCM

9 $A = 2^8 \times 3^5 \times 11^4$ $B = 2^6 \times 3 \times 11^8$

(a) Find the highest common factor (HCF) of A and B.

.....

(2)

(b) Find the lowest common multiple (LCM) of $2A$ and $3B$.
Give the LCM as a product of powers of its prime factors.

.....

(2)

(Total for Question 9 is 4 marks)

Question 9

2 marks | Prime Factors, HCF & LCM

9

$$A = 2^3 \times 3^2 \times 5^2 \times 11$$
$$B = 2^4 \times 3 \times 5^4 \times 13$$

Find the lowest common multiple (LCM) of A and B.
Give your answer as a product of powers of prime numbers.

(Total for Question 9 is 2 marks)

4MA1/2H MAY 2021

Question 1

3 marks | Prime Factors, HCF & LCM

1 Write 600 as a product of powers of its prime factors.
Show your working clearly.

(Total for Question 1 is 3 marks)

Question 7

3 marks | Prime Factors, HCF & LCM

7 Write 3.6×10^3 as a product of powers of its prime factors.
Show your working clearly.

(Total for Question 7 is 3 marks)

Question 6

4 marks | Prime Factors, HCF & LCM

6 (a) Work out the lowest common multiple (LCM) of 36 and 120

.....

(2)

$A = 5^2 \times 7^4 \times 11^p$
$B = 5^m \times 7^{n-5} \times 11$

m, n and p are integers such that
$m > 2$
$n > 10$
$p > 1$

(b) Find the highest common factor (HCF) of A and B
Give your answer as a product of powers of its prime factors.

.....

(2)

(Total for Question 6 is 4 marks)

Question 7

3 marks | Prime Factors, HCF & LCM

7 Find the lowest common multiple (LCM) of 28, 42 and 63
Show your working clearly.

(Total for Question 7 is 3 marks)

4MA1/2HR JUNE 2022

Question 2

3 marks | Prime Factors, HCF & LCM

2 Write 1200 as a product of powers of its prime factors.
Show your working clearly.

(Total for Question 2 is 3 marks)

Question 3

4 marks | Prime Factors, HCF & LCM

3 (a) Find the highest common factor (HCF) of 56 and 84
Show your working clearly.

.....

(2)

(b) Find the lowest common multiple (LCM) of 60 and 72
Show your working clearly.

.....

(2)

(Total for Question 3 is 4 marks)

Question 12

3 marks | Prime Factors, HCF & LCM

12 $P = 3^3 \times 5^2 \times 7$
$Q = 3^2 \times 5 \times 7^2$

(a) Write down the highest common factor (HCF) of P and Q

.....

(1)

$P = 3^3 \times 5^2 \times 7$
$Q = 3^2 \times 5 \times 7^2$

(b) Work out the value of $P^3 \times Q$
Give your answer in the form $3^x \times 5^y \times 7^z$ where x, y and z are positive integers.

.....

(2)

(Total for Question 12 is 3 marks)

4MA1/1HR MAY 2023

Question 1

3 marks | Prime Factors, HCF & LCM

1 Write 2250 as a product of powers of its prime factors.
Show your working clearly.

(Total for Question 1 is 3 marks)

Question 2

4 marks | Prime Factors, HCF & LCM

2 Sandeep wants to buy some packets of pens and some boxes of pencils for his stationery shop.

Each packet of pens contains 9 pens.
Each box of pencils contains 12 pencils.

Each packet of pens costs £7.60
Each box of pencils costs £4.80

Sandeep can only buy full packets of pens and full boxes of pencils.
He wants to buy exactly the same number of pens as pencils.

Work out the minimum amount Sandeep needs to pay.

£.....

(Total for Question 2 is 4 marks)

Question 8

4 marks | Prime Factors, HCF & LCM

8 (a) Write 300 as a product of its prime factors.
Show your working clearly.

.....

(2)

$A = 2 \times 2 \times 2 \times 3 \times 3 \times 5$

$B = 2 \times 2 \times 3 \times 3 \times 3 \times 5$

(b) Find the lowest common multiple (LCM) of $5A$ and $7B$
Show your working clearly.

.....

(2)

(Total for Question 8 is 4 marks)

Question 7

2 marks | Prime Factors, HCF & LCM

7 $A = 5^3 \times 7^3 \times 11^6$ and $B = 5^6 \times 7^2 \times 11^4$

Find the highest common factor (HCF) of A and B
Give your answer as a product of powers of its prime factors.

(Total for Question 7 is 2 marks)

4MA1/2HR JUNE 2024

Question 1

3 marks | Prime Factors, HCF & LCM

1 Write 1400 as a product of powers of its prime factors.
Show your working clearly.

(Total for Question 1 is 3 marks)

Question 3

2 marks | Prime Factors, HCF & LCM

3 Find the highest common factor (HCF) of 72 and 108
Show your working clearly.

(Total for Question 3 is 2 marks)

Question 11

4 marks | Prime Factors, HCF & LCM

11 $A = 2^5 \times 5 \times 7^2$

$B = 2^3 \times 5^3 \times 7^4$

(a) Write down the highest common factor (HCF) of $5A$ and $2B$
Give your answer as a product of prime factors.

.....

(2)

$A = 2^5 \times 5 \times 7^2$

$B = 2^3 \times 5^3 \times 7^4$

(b) Work out the value of $(AB)^2$
Give your answer as a product of prime factors.

.....

(2)

(Total for Question 11 is 4 marks)

Question 6

2 marks | Prime Factors, HCF & LCM

6 $A = 2^3 \times 5^4 \times 7 \times 11$

$B = 2^2 \times 5^2 \times 7^2$

$C = 2^2 \times 5^3 \times 7^4$

Find the highest common factor (HCF) of A, B and C
Write your answer as a product of prime factors.

(Total for Question 6 is 2 marks)

4MA1/1HR JUNE 2025

Question 1

2 marks | Prime Factors, HCF & LCM

1 Find the lowest common multiple (LCM) of 45 and 70

(Total for Question 1 is 2 marks)

Question 2

3 marks | Prime Factors, HCF & LCM

2 Write 1400 as a product of powers of its prime factors.
Show your working clearly.

(Total for Question 2 is 3 marks)

Question 2

3 marks | Prime Factors, HCF & LCM

2 Write 1400 as a product of powers of its prime factors.
Show your working clearly.

(Total for Question 2 is 3 marks)

Question 17

4 marks | Prime Factors, HCF & LCM

17 $A = 3^2 \times 5^4$ $B = 2^5 \times 3^2$ $C = 2^3 \times 5^6$

(a) Work out the value of $(ABC)^3$

Give your answer as a product of powers of its prime factors.

.....

(2)

(b) Work out $(5 \times 10^{150}) \times (3 \times 10^{140})$

Give your answer as a product of powers of its prime factors.

.....

(2)

(Total for Question 17 is 4 marks)

4MA1/2H JUNE 2026

Question 11

2 marks | Prime Factors, HCF & LCM

11 Find the highest prime number that is a factor of 3.6×10^{24}

.....

(Total for Question 11 is 2 marks)

TOPIC

Fractions

Every past-paper question on this topic, 2020 to 2026.

Question 2

3 marks | Fractions

2 Show that $5\frac{1}{3} - 2\frac{6}{7} = 2\frac{10}{21}$

(Total for Question 2 is 3 marks)

Question 2

3 marks | Fractions

2 Show that $3\frac{1}{5} \times 2\frac{5}{8} = 8\frac{2}{5}$

(Total for Question 2 is 3 marks)

Question 3

3 marks | Fractions

3 Show that $4\frac{2}{3} + 3\frac{4}{5} = 8\frac{7}{15}$

(Total for Question 3 is 3 marks)

Question 1

3 marks | Fractions

1 Show that $3\frac{3}{4} \times \frac{7}{9} = 2\frac{11}{12}$

(Total for Question 1 is 3 marks)

4MA1/1HR JANUARY 2021

Question 1

3 marks | Fractions

1 Show that $3\frac{1}{5} \times 1\frac{5}{6} = 5\frac{13}{15}$

(Total for Question 1 is 3 marks)

Question 2

3 marks | Fractions

2 Show that $2\frac{4}{7} \div 1\frac{1}{8} = 2\frac{2}{7}$

(Total for Question 2 is 3 marks)

Question 2

3 marks | Fractions

2 Show that $6\frac{3}{4} \div 2\frac{4}{7} = 2\frac{5}{8}$

(Total for Question 2 is 3 marks)

4MA1/2H JUNE 2022

Question 4

3 marks | Fractions

4 Show that $5\frac{1}{3} - 2\frac{6}{7} = 2\frac{10}{21}$

(Total for Question 4 is 3 marks)

Question 6

3 marks | Fractions

6 Show that $2\frac{2}{3} + 3\frac{3}{4} = 6\frac{5}{12}$

(Total for Question 6 is 3 marks)

Question 4

3 marks | Fractions

4 Show that $2\frac{4}{7} \times 3\frac{1}{9} = 8$

(Total for Question 4 is 3 marks)

4WM1/01 MAY 2025

Question 1

3 marks | Fractions

1 Without using a calculator, work out

$$3\frac{2}{3} \times 2\frac{4}{7}$$

Show each stage of your working.
Give your answer as a mixed number in its simplest form.

(Total for Question 1 is 3 marks)

Question 2

3 marks | Fractions

2 Show that $2\frac{1}{4} \times 1\frac{5}{7} = 3\frac{6}{7}$

(Total for Question 2 is 3 marks)

Question 3

3 marks | Fractions

3 Show that $3\frac{5}{7} + 1\frac{2}{3} = 5\frac{8}{21}$

(Total for Question 3 is 3 marks)

Question 3

4 marks | Fractions

3 A box contains only

9 red bricks
43 blue bricks
and some yellow bricks

$\frac{7}{20}$ of the bricks are yellow bricks.

Each brick weighs 35 grams.

Work out the total weight of the yellow bricks.

..... grams

(Total for Question 3 is 4 marks)

4MA1/1H JUNE 2026

Question 1

3 marks | Fractions

1 Show that $4\frac{1}{7} - 2\frac{3}{5} = 1\frac{19}{35}$

(Total for Question 1 is 3 marks)

4MA1/1HR JUNE 2026

Question 1

3 marks | Fractions

1 Show that $2\frac{4}{5} \times 3\frac{3}{7} = 9\frac{3}{5}$

(Total for Question 1 is 3 marks)

Question 1

3 marks | Fractions

1 Show that $4\frac{1}{7} - 2\frac{3}{5} = 1\frac{19}{35}$

(Total for Question 1 is 3 marks)

4MA1/2HR JUNE 2026

Question 17

2 marks | Fractions

17 Use algebra to show that $0.\dot{8}1\dot{4} = \frac{22}{27}$

(Total for Question 17 is 2 marks)

TOPIC

Fractions, Decimals & Percentages

Every past-paper question on this topic, 2020 to 2026.

EP SPECIMEN

Question 15

2 marks | Fractions, Decimals & Percentages

15 Write these numbers in order of size. Start with the smallest number.

$0.62 \quad \frac{5}{8} \quad 61\% \quad \frac{2}{3} \quad \frac{3}{5}$

.....

(2)

(Total for Question 15 is 2 marks)

EP SPECIMEN

Question 16

2 marks | Fractions, Decimals & Percentages

16 (a) Write $\frac{7}{40}$ as a decimal.

.....

(1)

(b) Write $\frac{7}{40}$ as a percentage.

..... %

(1)

(Total for Question 16 is 2 marks)

EP SPECIMEN

Question 17

3 marks | Fractions, Decimals & Percentages

17 The students in a class travel to school by walking, by bicycle or by bus.

$\frac{3}{8}$ of the students walk. 0.35 of the students cycle. The rest travel by bus.

11 students travel by bus.

Work out the number of students in the class.

.....

(3)

(Total for Question 17 is 3 marks)

EP SPECIMEN

Question 18

2 marks | Fractions, Decimals & Percentages

18 Which is larger, $\frac{13}{20}$ or 0.66?

You must show your working.

.....

(2)

(Total for Question 18 is 2 marks)

EP SPECIMEN

Question 19

2 marks | Fractions, Decimals & Percentages

19 Mia took two tests.
She scored 34 out of 40 in the first test.
She scored 87% in the second test.

In which test did Mia get the better score? You must show how you get your answer.

.....

(2)

(Total for Question 19 is 2 marks)

EP SPECIMEN

Question 20

2 marks | Fractions, Decimals & Percentages

20 Write 0.0375 as a fraction in its simplest form.

.....

(2)

(Total for Question 20 is 2 marks)

EP SPECIMEN

Question 21

3 marks | Fractions, Decimals & Percentages

21 A water tank is $\frac{2}{5}$ full.

120 litres of water are added to the tank.
The tank is now 65% full.

Work out the capacity of the tank.

..... litres

(3)

(Total for Question 21 is 3 marks)

TOPIC

Recurring Decimals

Every past-paper question on this topic, 2020 to 2026.

Question 16

2 marks | Recurring Decimals

16 Use algebra to show that the recurring decimal $0.28\dot{1}\dot{3} = \frac{557}{1980}$

(Total for Question 16 is 2 marks)

Question 18

3 marks | Recurring Decimals

18 $0.4\dot{x}$ is a recurring decimal.
x is a whole number such that $1 \leqslant x \leqslant 9$

Find, in terms of x, the recurring decimal $0.4\dot{x}$ as a fraction.
Give your fraction in its simplest form.
Show clear algebraic working.

(Total for Question 18 is 3 marks)

Question 14

2 marks | Recurring Decimals

14 Use algebra to show that the recurring decimal $0.6\dot{1}\dot{2} = \frac{101}{165}$

(Total for Question 14 is 2 marks)

4MA1/1HR JUNE 2025

Question 16

2 marks | Recurring Decimals

16 Use algebra to show that the recurring decimal $0.6\dot{1}\dot{2} = \frac{101}{165}$

(Total for Question 16 is 2 marks)

TOPIC

Percentages

Every past-paper question on this topic, 2020 to 2026.

Question 12

5 marks | Percentages

12 Zimo is going on holiday.
He makes 3 separate payments to cover the total cost of his holiday.

The following table shows how much money Zimo pays to the holiday company.

Payment	Amount paid
Payment 1	$\frac{2}{5}$ of the total cost
Payment 2	45% of the total cost
Payment 3	$405

Work out how much Zimo has to pay for Payment 2

$.....

(Total for Question 12 is 5 marks)

Question 10

3 marks | Percentages

10 The people working for a company work in Team A or in Team B.

number of people in Team A : number of people in Team B = 3 : 4

$\frac{4}{5}$ of Team A work full time.

24% of Team B work full time.

Work out what fraction of the people working for the company work full time.
Give your fraction in its simplest form.

(Total for Question 10 is 3 marks)

Question 8

3 marks | Percentages

8 In 2018, the population of Sydney was 5.48 million.
This was 22% of the total population of Australia.

Work out the total population of Australia in 2018
Give your answer correct to 3 significant figures.

..... million

(Total for Question 8 is 3 marks)

4MA1/1HR JUNE 2022

Question 4

4 marks | Percentages

4 The language department of a college has 180 students.
Each student studies exactly one of French, German, Italian or Spanish.

15 students study French.
45% of the students study German.

Express the percentage of students studying Italian or Spanish as a percentage of those studying French or German.

.....%

(Total for Question 4 is 4 marks)

Question 8

5 marks | Percentages

8 Behnaz makes 300 celebration cards so that

$$\text{number of birthday cards} : \text{number of anniversary cards} : \text{number of congratulations cards} = 7:5:3$$

$\frac{2}{5}$ of the birthday cards have numbers on them.

36% of the anniversary cards have numbers on them.

None of the congratulations cards have numbers on them.

Work out what fraction of the 300 cards have numbers on them.

Give your answer in its simplest form.

(Total for Question 8 is 5 marks)

Question 13

5 marks | Percentages

13 Antoine is going on holiday.
He makes 3 separate payments to cover the total cost of his holiday.

The following table shows how much money Antoine pays to the holiday company.

Payment	Amount paid
Payment 1	$\frac{3}{8}$ of the total cost
Payment 2	45% of the total cost
Payment 3	\$406

Work out how much Antoine has to pay for Payment 2

\$ .....

(Total for Question 13 is 5 marks)

Question 8

5 marks | Percentages

8 Ishir plants 600 bulbs in a garden.
He plants tulip bulbs, crocus bulbs and daffodil bulbs so that

number of tulip bulbs : number of crocus bulbs : number of daffodil bulbs = 9 : 4 : 2

45% of the tulip bulbs are for yellow flowers.

$\frac{5}{8}$ of the crocus bulbs are for yellow flowers.

All of the daffodil bulbs are for yellow flowers.

Work out the number of bulbs that are for yellow flowers.

(Total for Question 8 is 5 marks)

Question 7

4 marks | Percentages

7 Shop **A** and Shop **B** have offers for buying the same type of laptop.

The normal price of the laptop in Shop **A** is different to the normal price of the laptop in Shop **B**

Shop A	**Shop B**
Our normal price £475 Get 16% off our normal price	Get 15% off our normal price Only pay £408

Which shop gives more money off their normal price?
Show your working clearly.

(Total for Question 7 is 4 marks)

Question 4

4 marks | Percentages

4 Pete plants a total of 960 trees in a park.
He plants only apple trees, cherry trees and pear trees such that

number of apple trees : number of cherry trees : number of pear trees = 6 : 7 : 3

65% of the cherry trees will grow morello cherries.

Work out the number of trees that will grow morello cherries.

(Total for Question 4 is 4 marks)

Question 9

3 marks | Percentages

9 Hari scored 140 points playing a game on Tuesday.
This was 12% more points than he scored playing the game on Monday.

Work out the number of points that Hari scored playing the game on Monday.

(Total for Question 9 is 3 marks)

4MA1/2HR JUNE 2026

Question 27

4 marks | Percentages

27 Bryan owns a house.

During 2024, the value of Bryan's house increased by $x\%$
During 2025, the value of Bryan's house increased by $2x\%$

Overall, during 2024 and 2025, the value of Bryan's house increased by 38.88%

Work out the value of x
Show clear algebraic working.

$x =$ .....

(Total for Question 27 is 4 marks)

TOPIC

Compound Interest & Depreciation

Every past-paper question on this topic, 2020 to 2026.

Question 8

6 marks | Compound Interest & Depreciation

8 In 2021, the value of Asha's apartment was 634 400 euros.
The value of Asha's apartment had increased by 4% from its value in 2020

(a) Work out the value of Asha's apartment in 2020

..... euros
(3)

Pam bought a boat.

In each year after Pam bought the boat, the value of the boat depreciated by 15%

(b) Work out the total percentage by which the value of the boat had depreciated by the end of the second year after Pam bought the boat.

..... %
(3)

(Total for Question 8 is 6 marks)

Question 8

3 marks | Compound Interest & Depreciation

8 Hamish buys a new car for $20 000
The car depreciates in value by 19% each year.

Work out the value of the car at the end of 3 years.
Give your answer to the nearest $.

$.....

(Total for Question 8 is 3 marks)

Question 11

3 marks | Compound Interest & Depreciation

11 Max invests \$6000 in a savings account for 3 years.
The account pays compound interest at a rate of 1.5% per year for the first 2 years.

The compound interest rate changes for the third year.
At the end of 3 years, there is a total of \$6311.16 in the account.

Work out the compound interest rate for the third year.
Give your answer correct to 1 decimal place.

..... %

(Total for Question 11 is 3 marks)

Question 8

3 marks | Compound Interest & Depreciation

8 Harold bought an antique clock for £1200
The clock increased in value by 8% per year.

Find the value of the clock exactly 3 years after Harold bought the clock.
Give your answer correct to the nearest £.

£.....

(Total for Question 8 is 3 marks)

Question 13

3 marks | Compound Interest & Depreciation

13 Jan invests \$8000 in a savings account.
The account pays compound interest at a rate of x% per year.

At the end of 6 years, there is a total of \$8877.62 in the account.

Work out the value of x.
Give your answer correct to 2 decimal places.

$x =$ .....

(Total for Question 13 is 3 marks)

Question 7

6 marks | Compound Interest & Depreciation

7 Chen invests 40 000 yuan in a fixed-term bond for 3 years.

The fixed-term bond pays compound interest at a rate of 3.5% each year.

(a) Work out the value of Chen's investment at the end of 3 years.
Give your answer to the nearest yuan.

..... yuan

(3)

Wang invested P yuan.
The value of his investment decreased by 6.5% each year.

At the end of the first year, the value of Wang's investment was 30 481 yuan.

(b) Work out the value of P.

$P =$ .....

(3)

(Total for Question 7 is 6 marks)

4MA1/1HR JANUARY 2021

Question 7

3 marks | Compound Interest & Depreciation

7 Kuro invests 50 000 yen for 3 years in a savings account.
She gets 2.4% per year compound interest.

Work out how much money Kuro will have in her savings account at the end of the 3 years.
Give your answer correct to the nearest yen.

..... yen

(Total for Question 7 is 3 marks)

Question 14

4 marks | Compound Interest & Depreciation

14 Simon bought a house at the beginning of 2018
The value of Simon's house had decreased by 15% by the end of 2018

The house increased in value during both 2019 and 2020
The percentage increases in the value of the house during 2019 and 2020 were the same.

The value of Simon's house at the end of 2020 was 2.85% greater than the amount he paid for his house at the beginning of 2018

Calculate the percentage increase in the value of the house during 2019

.....%

(Total for Question 14 is 4 marks)

Question 11

6 marks | Compound Interest & Depreciation

11 Chengbo sold a house for 180 000 yuan.

The amount for which he sold the house is 24% more than the amount he paid for the house.

(a) Work out how much Chengbo paid for the house.
Give your answer correct to 3 significant figures.

..... yuan
(3)

Zhi bought a house on 1st January 2017
When she bought the house, its value was 120 000 yuan.

The value of the house increased by 1.8% per year.

(b) Work out the value of Zhi's house on 1st January 2020
Give your answer correct to 3 significant figures.

..... yuan
(3)

(Total for Question 11 is 6 marks)

Question 7

4 marks | Compound Interest & Depreciation

7 Ali and Badia each have 25 000 dollars to invest.

Cyclone Bank	Tornado Bank
Invest 25 000 dollars 4.5% compound interest per year for 3 years	Invest 25 000 dollars Receive 1150 dollars interest each year for 3 years

Ali invests in the Cyclone Bank for 3 years.
Badia invests in the Tornado Bank for 3 years.

By the end of the 3 years, Ali will have received more interest than Badia.

How much more?
Show your working clearly.
Give your answer correct to the nearest dollar.

..... dollars

(Total for Question 7 is 4 marks)

Question 5

3 marks | Compound Interest & Depreciation

5 Shane invests 7200 dollars for 3 years in a savings account.
He gets 2.5% per year compound interest.

How much money will Shane have in his savings account at the end of 3 years?
Give your answer to the nearest dollar.

..... dollars

(Total for Question 5 is 3 marks)

Question 11

3 marks | Compound Interest & Depreciation

11 Himari invests 200 000 yen for 3 years in a savings account paying compound interest.

The rate of interest is 1.8% for the first year and x% for each of the second year and the third year.

The value of the investment at the end of the third year is 209 754 yen.

Work out the value of x
Give your answer correct to one decimal place.

$x =$ .....

(Total for Question 11 is 3 marks)

Question 6

6 marks | Compound Interest & Depreciation

6 Asha bought an apartment.

The table gives information about the value of apartments, in euros, and the annual service charge band.

Value (x euros)	Service charge band
$x \geqslant 700\,000$	A
$600\,000 \leqslant x < 700\,000$	B
$500\,000 \leqslant x < 600\,000$	C
$400\,000 \leqslant x < 500\,000$	D
$0 < x < 400\,000$	E

In 2021, the value of Asha's apartment was 634 400 euros.

The value of Asha's apartment had increased by 4% from its value in 2020

(a) Has the annual service charge band changed for Asha's apartment?
Show your working clearly.

(3)

Pam bought a boat.

In each year after Pam bought the boat, the value of the boat depreciated by 15%

(b) Work out the total percentage by which the value of the boat had depreciated by the end of the second year after Pam bought the boat.

..... %

(3)

(Total for Question 6 is 6 marks)

Question 8

3 marks | Compound Interest & Depreciation

8 Jane bought a new car for $18 000
The car depreciates in value by 15% each year.

Work out the value of the car at the end of 4 years.
Give your answer correct to the nearest $

$.....

(Total for Question 8 is 3 marks)

4MA1/2H JUNE 2022

Question 9

3 marks | Compound Interest & Depreciation

9 Pasha invests 50 000 dollars in a savings account for 4 years.
He gets 1.3% per year compound interest.

Work out how much money Pasha will have in his savings account at the end of 4 years.
Give your answer correct to the nearest dollar.

..... dollars

(Total for Question 9 is 3 marks)

Question 8

3 marks | Compound Interest & Depreciation

8 Charlotte buys a painting for $680
The value of the painting increases by 4% each year.

Work out the value of the painting at the end of 3 years.
Give your answer correct to the nearest $

$.....

(Total for Question 8 is 3 marks)

4MA1/1HR MAY 2023

Question 9

3 marks | Compound Interest & Depreciation

9 Kazi buys a car for 700 000 taka.
The value of the car depreciates by 12% each year.

Work out the value of the car at the end of 3 years.
Give your answer correct to the nearest taka.

..... taka

(Total for Question 9 is 3 marks)

Question 13

3 marks | Compound Interest & Depreciation

13 Feruzi invests 80 000 Kenyan shillings (KES)
He invests the money for 3 years at x% compound interest each year.

At the end of 3 years, the total interest he receives is 6151.25 KES

Work out the value of x

$x =$ .....

(Total for Question 13 is 3 marks)

Question 7

3 marks | Compound Interest & Depreciation

7 Hermione buys a boat for $26 800
The value of the boat depreciates by 8% each year.

Work out the value of the boat at the end of 3 years.
Give your answer correct to the nearest dollar.

$.....

(Total for Question 7 is 3 marks)

Question 5

3 marks | Compound Interest & Depreciation

5 Slavomir invests 5200 euros in a savings account for 4 years.
He gets 2.5% per year compound interest.

Work out how much money Slavomir will have in the savings account at the end of 4 years.
Give your answer correct to the nearest euro.

..... euros

(Total for Question 5 is 3 marks)

4MA1/2H JUNE 2024

Question 9

3 marks | Compound Interest & Depreciation

9 Giovanni invests 4500 koruna in a savings account for 4 years.
He gets 2.4% per year compound interest.

Work out how much money Giovanni will have in the savings account at the end of 4 years.
Give your answer correct to the nearest koruna.

..... koruna

(Total for Question 9 is 3 marks)

Question 9

3 marks | Compound Interest & Depreciation

9 Nisha invests 20 000 euros for 3 years in a savings account.
She gets 3.5% per year compound interest.

Work out how much money Nisha will have in her savings account at the end of the 3 years.
Give your answer correct to the nearest euro.

..... euros

(Total for Question 9 is 3 marks)

4MA1/2H JUNE 2025

Question 7

3 marks | Compound Interest & Depreciation

7 Tim buys a bracelet for 4000 Swiss francs.
The value of the bracelet increases by 7% each year.

Work out the value of the bracelet at the end of 3 years.
Give your answer correct to the nearest Swiss franc.

..... Swiss francs

(Total for Question 7 is 3 marks)

Question 9

3 marks | Compound Interest & Depreciation

9 Tim buys a bracelet for 4000 Swiss francs.
The value of the bracelet increases by 7% each year.

Work out the value of the bracelet at the end of 3 years.
Give your answer correct to the nearest Swiss franc.

..... Swiss francs

(Total for Question 9 is 3 marks)

Question 11

5 marks | Compound Interest & Depreciation

11 Zhou invests some money for 2 years.
He invests \$2500 with Bank A and \$3000 with Bank B.

Bank A

Invests \$2500

amount of money invested	:	total amount of interest after 2 years	=	20 : 3

Bank B

Invests \$3000

4% per year compound interest for 2 years

Zhou receives more **interest** from Bank A than from Bank B.

How much more?

\$ .....

(Total for Question 11 is 5 marks)

Question 12

3 marks | Compound Interest & Depreciation

12 Osman buys a car for \$16 000

The car depreciates at a rate of 12% each year for the first 2 years.
In the third year, the car depreciates at a rate of x%

At the end of 3 years, the value of the car is \$11 461.12

Work out the value of x

(Total for Question 12 is 3 marks)

Question 12

3 marks | Compound Interest & Depreciation

12 Osman buys a car for \$16 000

The car depreciates at a rate of 12% each year for the first 2 years.
In the third year, the car depreciates at a rate of x%

At the end of 3 years, the value of the car is \$11 461.12

Work out the value of x

(Total for Question 12 is 3 marks)

4MA1/1H JUNE 2025

Question 13

3 marks | Compound Interest & Depreciation

13 Charlotte bought an apartment for $750 000

In the first year, the value of the apartment decreased by 4%
In the second year, the value of the apartment decreased by 6.5%

In the third year, the value of the apartment increased by x%

At the end of the third year, the value of Charlotte's apartment was $698 445

Work out the value of x

$x =$ .....

(Total for Question 13 is 3 marks)

Question 15

3 marks | Compound Interest & Depreciation

15 Fred buys a painting.

The value of the painting increases by 12% during the first year.
The value of the painting then decreases by 15% during the second year.

Work out the overall percentage decrease in the value of the painting during this two-year period.

.....%

(Total for Question 15 is 3 marks)

Question 5

6 marks | Compound Interest & Depreciation

5 Otis sells ice creams.

On Friday, Otis sells 75 ice creams.
On Saturday, Otis sells 87 ice creams.

(a) Work out the percentage increase in the number of ice creams Otis sells from Friday to Saturday.

.....%
(3)

Claudia buys an ice cream machine for 960 Swiss francs.

The value of the ice cream machine depreciates by 20% each year.

(b) Work out the value of the ice cream machine at the end of 3 years.

..... Swiss francs
(3)

(Total for Question 5 is 6 marks)

Question 6

6 marks | Compound Interest & Depreciation

6 Otis sells ice creams.

On Friday, Otis sells 75 ice creams.
On Saturday, Otis sells 87 ice creams.

(a) Work out the percentage increase in the number of ice creams Otis sells from Friday to Saturday.

.....%
(3)

Claudia buys an ice cream machine for 960 Swiss francs.

The value of the ice cream machine depreciates by 20% each year.

(b) Work out the value of the ice cream machine at the end of 3 years.

..... Swiss francs
(3)

(Total for Question 6 is 6 marks)

Question 12

3 marks | Compound Interest & Depreciation

12 The value of a house

- decreased by 5% from the end of 2021 to the end of 2022
- increased by 20% from the end of 2022 to the end of 2023
- increased by 6.5% from the end of 2023 to the end of 2024

Calculate the percentage by which the value of the house increased from the end of 2021 to the end of 2024

.....%

(Total for Question 12 is 3 marks)

Question 10

3 marks | Compound Interest & Depreciation

10 Arwa invests 200 000 yen in a savings account for 3 years.
She gets 1.4% per year compound interest.

Work out how much money Arwa will have in her savings account at the end of 3 years.
Give your answer correct to the nearest yen.

..... yen

(Total for Question 10 is 3 marks)

4MA1/2H JUNE 2026

Question 10

4 marks | Compound Interest & Depreciation

10 Johan owns a car.

The current value of the car is 32 000 euros.
The value of the car will now depreciate by 15% per year.

Lena is going to save up and buy Johan's car in 3 years' time.
She has already saved 2516 euros.

She will save an equal amount of money each month for the next 3 years.

Work out how much money Lena needs to save each month.

..... euros

(Total for Question 10 is 4 marks)

4MA1/1H JUNE 2026

Question 14

3 marks | Compound Interest & Depreciation

14 In September, the sales in a shop increased by 20%
In October, the sales in the same shop decreased by x%

Over these two months, the sales in the shop decreased by 10%

Work out the value of x

$x =$ .....

(Total for Question 14 is 3 marks)

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TOPIC

Reverse Percentages

Every past-paper question on this topic, 2020 to 2026.

Question 7

3 marks | Reverse Percentages

7 In a sale, the normal price of a hat is reduced by 15%
The sale price of the hat is 20.40 euros.

Work out the normal price of the hat.

..... euros

(Total for Question 7 is 3 marks)

Question 8

7 marks | Reverse Percentages

8 The table shows the cost, in euros, of Brigitte's car insurance in each of the years 2016, 2017 and 2018

Year	**2016**	**2017**	**2018**
Cost of insurance (euros)	500	545	592

Brigitte says,

"The percentage increase in the cost of my car insurance from 2017 to 2018 is more than the percentage increase in the cost of my car insurance from 2016 to 2017"

(a) Is Brigitte correct?
You must show how you get your answer.

(4)

Henri wants to insure his car.

He gets a discount of 15% off the normal price.
Henri pays 952 euros for his car insurance after the discount.

(b) Work out the discount that Henri gets.

..... euros

(3)

(Total for Question 8 is 7 marks)

Question 5

6 marks | Reverse Percentages

5 In 2017, the population of a village was 7500
In 2019, the population of the village was 8265

(a) Work out the percentage increase in the population of the village from 2017 to 2019

.....%

(3)

In a sale, normal prices are reduced by 30%
The sale price of a T-shirt was 31.50 euros.

(b) Work out the normal price of the T-shirt.

..... euros

(3)

(Total for Question 5 is 6 marks)

4MA1/1H MAY/NOVEMBER 2020

Question 9

3 marks | Reverse Percentages

9 In a sale, normal prices are reduced by 20%

A bag costs 1080 rupees in the sale.

Work out the normal price of the bag.

..... rupees

(Total for Question 9 is 3 marks)

Question 10

5 marks | Reverse Percentages

10 Alex makes 80 cakes to sell.
He makes chocolate cakes, lemon cakes and fruit cakes where

$$\text{number of chocolate cakes} : \text{number of lemon cakes} : \text{number of fruit cakes} = 3 : 2 : 5$$

Alex sells

all of the chocolate cakes

$\frac{3}{4}$ of the lemon cakes

$\frac{7}{8}$ of the fruit cakes

The profit he makes on each cake he sells is shown in the table.

Type of cake	Profit per cake he sells
chocolate	£2.00
lemon	£1.70
fruit	£2.40

Work out the total profit that Alex makes from the cakes he sells.

£.....

(Total for Question 10 is 5 marks)

Question 3

6 marks | Reverse Percentages

3 Gladys buys a table for $465 to sell in her shop.

She sells the table for $520

(a) Work out the percentage profit that Gladys makes from the sale of the table.
Give your answer correct to 3 significant figures.

.....%

(3)

Gladys has a sale in her shop.

She decreases all the normal prices by 12%
The normal price of an armchair was $550

(b) Work out the sale price of the armchair.

$.....

(3)

(Total for Question 3 is 6 marks)

Question 6

3 marks | Reverse Percentages

6 On Wednesday, the price of 1 litre of petrol was £1.26
The price of petrol on Wednesday was 5% more than the price of petrol on the previous Monday.

Calculate the price of 30 litres of petrol on the previous Monday.

£.....

(Total for Question 6 is 3 marks)

Question 6

4 marks | Reverse Percentages

6 Mariana sells bags of bird food.

The bags that Mariana sold last week each contained 12 kg of seeds.

The bags that she is going to sell next week will each contain a mixture of nuts and seeds where for each bag

$$\text{weight of nuts} : \text{weight of seeds} = 4 : 5$$

The total weight of the nuts and the seeds in each bag will be 19.35 kg

The weight of seeds in each bag that Mariana sells next week will be less than the weight of seeds in each bag that Mariana sold last week.

Work out this decrease as a percentage of the weight of seeds in each bag that Mariana sold last week.
Give your answer correct to one decimal place.

..... %

(Total for Question 6 is 4 marks)

Question 6

3 marks | Reverse Percentages

6 Victor buys 12 bottles of apple juice for a total cost of $21
Victor sells all 12 bottles at $2.45 each bottle.

Work out Victor's percentage profit.

.....%

(Total for Question 6 is 3 marks)

Question 2

7 marks | Reverse Percentages

2 Mary saves for a holiday each year.

In 2020 she saved a total of \$720
In 2021, each month she saved \$78

The total amount Mary saved in 2021 was P% more than the total she saved in 2020

(a) Work out the value of P

.....

(4)

Roberto is going to go on holiday.

He has two coupons that will save him money on his holiday.

Coupon A	**Coupon B**
18% off the cost of the accommodation	12.5% off the total cost of the accommodation **and** the flights

For Roberto's holiday
the cost of the accommodation is \$1600
the cost of the flights is \$800

Roberto can only use one of the coupons.
He wants to save as much money as he can.

(b) Which of the two coupons, **A** or **B**, should he use?
Show your working clearly.

(3)

(Total for Question 2 is 7 marks)

Question 4

5 marks | Reverse Percentages

4 Sarah makes and sells mugs.

One day she makes 150 mugs.
Her total cost for making these mugs is £1140

Of these mugs

$\frac{2}{5}$ are small mugs

32% are medium mugs

and the rest are large mugs

Here is Sarah's price list for selling each mug.

MUGS	
Small	**£8.50**
Medium	**£11.20**
Large	**£14.20**

Sarah sells all 150 mugs.

Work out her percentage profit.
Give your answer correct to the nearest whole number.

.....%

(Total for Question 4 is 5 marks)

Question 8

5 marks | Reverse Percentages

8 The table gives information about the average house price in England in 2018 and in 2019

Year	**2017**	**2018**	**2019**
Average house price (£)		228 314	231 776

(a) Work out the percentage increase in the average house price from 2018 to 2019
Give your answer correct to one decimal place.

..... %

(2)

The average house price in 2019 was 7.7% greater than the average house price in 2017

(b) Work out the average house price in 2017
Give your answer correct to 3 significant figures.

£ .....

(3)

(Total for Question 8 is 5 marks)

4MA1/2HR JUNE 2022

Question 8

3 marks | Reverse Percentages

8 A cinema increased the cost of an adult ticket by 12%

After the increase, the cost of an adult ticket was £18.20

Work out the cost of an adult ticket before the increase.

£.....

(Total for Question 8 is 3 marks)

Question 3

4 marks | Reverse Percentages

3 Nanette buys 60 notebooks for a total cost of 780 dirhams.

Nanette sells 70% of the notebooks for 22 dirhams each.
She sells the remaining notebooks for 19 dirhams each.

Work out Nanette's percentage profit.
Give your answer correct to 3 significant figures.

.....%

(Total for Question 3 is 4 marks)

Question 6

7 marks | Reverse Percentages

6 In his previous job, Pierre was paid 400 euros in total for working a 5-day week.

In his new job, Pierre is paid 14 euros per hour.
In his new job, Pierre works for 7 hours each day for a 5-day week.

(a) Work out the percentage increase in the amount that Pierre is paid for a 5-day week.

..... %

(4)

Marie changes her job.

Her salary decreases by 6%
Her new salary is 23 030 euros.

(b) Work out Marie's salary before she changes her job.

..... euros

(3)

(Total for Question 6 is 7 marks)

Question 3

4 marks | Reverse Percentages

3 Joshua buys a car for $12 500

He sells the car to Nina.

Nina pays

- a deposit of $1500
- followed by 36 monthly payments of $450

Work out Joshua's percentage profit.

.....%

(Total for Question 3 is 4 marks)

Question 6

4 marks | Reverse Percentages

6 Juan wants to buy a ticket to fly from Madrid to Berlin.

He finds two different types of ticket he can buy in a sale, ticket **A** and ticket **B**

ticket **A**	ticket **B**
$\frac{1}{6}$ off normal price	20% off normal price

The sale price of ticket **A** is 140 euros.
The sale price of ticket **B** is 136 euros.

Work out the difference between the normal price of ticket **A** and the normal price of ticket **B**

..... euros

(Total for Question 6 is 4 marks)

Question 3

5 marks | Reverse Percentages

3 Norberto sells white loaves of bread and brown loaves of bread.

He sells a total of 200 loaves such that

the number of white loaves sold : the number of brown loaves sold = 3 : 2

Norberto sells the white loaves for £1.50 each.
He sells the brown loaves for £1.75 each.

40% of the price of a white loaf is profit.
60% of the price of a brown loaf is profit.

Work out Norberto's total profit when he sells all 200 loaves.

£.....

(Total for Question 3 is 5 marks)

Question 4

3 marks | Reverse Percentages

4 Ava records the number of kilometres she drives each month.

In April, Ava drove 943 kilometres.
This is 15% more than the number of kilometres she drove in March.

Work out the number of kilometres Ava drove in March.

..... kilometres

(Total for Question 4 is 3 marks)

4MA1/2HR JUNE 2024

Question 8

3 marks | Reverse Percentages

8 In a sale, all normal prices are reduced by 17%

The sale price of a fridge is 6225 rupees.

Work out the normal price of the fridge.

..... rupees

(Total for Question 8 is 3 marks)

Question 14

5 marks | Reverse Percentages

14 The combined savings of Abel and Bahira are 15 435 dinars.

The savings of Bahira are 45% more than the savings of Abel.

The savings of Bahira are $\frac{3}{2}$ times the savings of Chanda.

Work out the savings of Chanda.

..... dinars

(Total for Question 14 is 5 marks)

Question 4

5 marks | Reverse Percentages

4 N is a number.
17% of N is 357

(a) Work out the value of N

$N =$ .....

(2)

In 2019, the population of a village was 650
In 2020, the population of the village was 806

(b) Work out the percentage increase in the population.

..... %

(3)

(Total for Question 4 is 5 marks)

Question 2

6 marks | Reverse Percentages

2 Anna makes cups.
Each cup costs 6 Swiss francs to make.

Anna puts the cups into boxes to sell.
Each box contains 4 cups.

Anna sells 80 boxes of cups for a total of 2160 Swiss francs.

(a) Work out the percentage profit Anna makes.
Show your working clearly.

.....%
(4)

The height of each cup is 9 cm, correct to the nearest cm

(b) Write down the lower bound of the height.

..... cm
(1)

The weight of each cup is 120 g, correct to the nearest 10 g

(c) Write down the upper bound of the weight.

..... g
(1)

(Total for Question 2 is 6 marks)

Question 3

3 marks | Reverse Percentages

3 Bernice bought a car for $8000
She sold the car for $5600

Work out Bernice's percentage loss when she sold the car.

.....%

(Total for Question 3 is 3 marks)

Question 4

5 marks | Reverse Percentages

4 Joshua is going to cover a floor with tiles for a customer.
The area of the floor is 45 m^2

Joshua buys one box of tiles for each 1.5 m^2 of floor area.
Each box of tiles costs £64

Joshua also buys 5 bags of tile adhesive.
Each bag of tile adhesive costs £12

Joshua charges the customer £3000

Work out his percentage profit.
Give your answer correct to one decimal place.

..... %

(Total for Question 4 is 5 marks)

Question 5

3 marks | Reverse Percentages

5 In a sale, normal prices are reduced by 28%
The sale price of a watch is 198 euros.

Work out the normal price of the watch.

..... euros

(Total for Question 5 is 3 marks)

Question 5

5 marks | Reverse Percentages

5 Joshua is going to cover a floor with tiles for a customer.
The area of the floor is $45\,m^2$

Joshua buys one box of tiles for each $1.5\,m^2$ of floor area.
Each box of tiles costs £64

Joshua also buys 5 bags of tile adhesive.
Each bag of tile adhesive costs £12

Joshua charges the customer £3000

Work out his percentage profit.
Give your answer correct to one decimal place.

.....%

(Total for Question 5 is 5 marks)

Question 8

3 marks | Reverse Percentages

8 In a sale, normal prices are reduced by 15%

The sale price of a dishwasher is 612 Swiss francs.

Work out the normal price of the dishwasher.

..... Swiss francs

(Total for Question 8 is 3 marks)

Question 9

3 marks | Reverse Percentages

9 In a sale, normal prices are reduced by 15%

The sale price of a dishwasher is 612 Swiss francs.

Work out the normal price of the dishwasher.

..... Swiss francs

(Total for Question 9 is 3 marks)

Question 8

4 marks | Reverse Percentages

8 Shop A and shop B have offers for buying the same type of chair.

Shop A	Shop B
25% off the normal price	$\frac{2}{9}$ off the normal price
Sale price 240 euros	Sale price 245 euros

The normal price of the chair in shop A is more than the normal price of the chair in shop B

How much more?
Show your working clearly.

..... euros

(Total for Question 8 is 4 marks)

4MA1/2H JUNE 2026

Question 4

3 marks | Reverse Percentages

4 Sara sells water bottles.

In July, she sold 450 water bottles.
In August, she sold 612 water bottles.

Work out the percentage increase in the number of water bottles she sold from July to August.

.....%

(Total for Question 4 is 3 marks)

Question 8

3 marks | Reverse Percentages

8 A golf club increases the cost of membership by 17%
After the increase, the cost of membership is 3276 zloty.

Work out the cost of membership before the increase.

..... zloty

(Total for Question 8 is 3 marks)

4MA1/2HR JUNE 2026

Question 8

3 marks | Reverse Percentages

8 Lauren's salary increased by 4%
After the increase, her salary was 36 400 euros.

Work out Lauren's salary before the increase.

..... euros

(Total for Question 8 is 3 marks)

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TOPIC

Rounding, Estimation & Bounds

Every past-paper question on this topic, 2020 to 2026.

4WM1/01 SPECIMEN

Question 1

1 marks | Rounding, Estimation & Bounds

1 The weight of a cake is 2.75 kg, correct to 2 decimal places.

Write down the lower bound of the weight of the cake.

..... kg

(Total for Question 1 is 1 mark)

Question 15

4 marks | Rounding, Estimation & Bounds

15 Martin and Lucia went on two different car journeys.

For Martin's journey

distance = 80 km correct to the nearest 5 km
time = 2.7 hours correct to 1 decimal place

For Lucia's journey

distance = 33 km correct to 2 significant figures
time = 1 hour correct to the nearest 0.1 hour

Martin says,

"My average speed could have been greater than Lucia's average speed."

By considering bounds, show that Martin is correct.
Show your working clearly.

(Total for Question 15 is 4 marks)

Question 11

4 marks | Rounding, Estimation & Bounds

11 The weight of a cat is 4.3 kg correct to 2 significant figures.

(a) Write down the upper bound of the weight of the cat.

..... kg

(1)

(b) Write down the lower bound of the weight of the cat.

..... kg

(1)

$G = e - f$

e = 17 correct to the nearest integer
f = 9.4 correct to one decimal place

(c) Work out the upper bound for the value of G.

.....

(2)

(Total for Question 11 is 4 marks)

Question 16

3 marks | Rounding, Estimation & Bounds

16 $P = \dfrac{2a - c}{d}$

$a = 58.4$ correct to 3 significant figures.
$c = 20$ correct to 2 significant figures.
$d = 3.6$ correct to 2 significant figures.

Work out the upper bound for the value of P.
Show your working clearly.
Give your answer correct to 2 decimal places.

.....

(Total for Question 16 is 3 marks)

Question 17

4 marks | Rounding, Estimation & Bounds

17 A metal block has a mass of 5 kg, correct to the nearest 50 grams.
The block has a volume of $(1.84 \times 10^{-3})\,m^3$, correct to 3 significant figures.

Work out the upper bound for the density of the block.
Give your answer in kg/m^3 correct to 1 decimal place.
Show your working clearly.

..... kg/m^3

(Total for Question 17 is 4 marks)

Question 19

3 marks | Rounding, Estimation & Bounds

19 The diagram shows rectangle $ABCD$ with rectangle $EFGH$ cut out to form the shaded region.

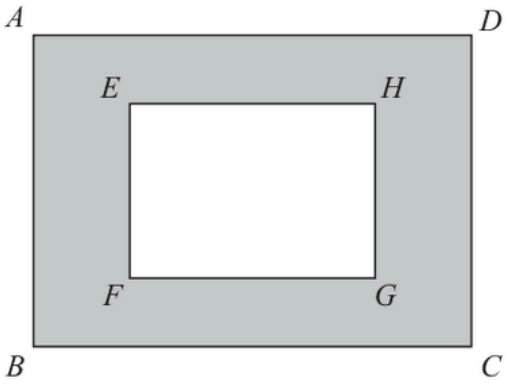


Diagram **NOT** accurately drawn

$AD = 8.3$ cm correct to one decimal place
$DC = 7.2$ cm correct to one decimal place
$EH = 6.2$ cm correct to one decimal place
$HG = 5.3$ cm correct to one decimal place

Work out the upper bound of the area of the shaded region.
Show your working clearly.

..... cm^2

(Total for Question 19 is 3 marks)

Question 15

3 marks | Rounding, Estimation & Bounds

15

$$a = \frac{v - u}{t}$$

$v = 9.6$ correct to 1 decimal place
$u = 3.8$ correct to 1 decimal place
$t = 1.84$ correct to 2 decimal places

Calculate the upper bound for the value of a.
Give your answer as a decimal correct to 2 decimal places.
Show your working clearly.

(Total for Question 15 is 3 marks)

Question 19

3 marks | Rounding, Estimation & Bounds

19 $k = \dfrac{t}{a - h}$

$t = 14$ correct to 2 significant figures
$a = 7.8$ correct to 2 significant figures
$h = 3.4$ correct to 2 significant figures

Work out the lower bound for the value of k.
Show your working clearly.

(Total for Question 19 is 3 marks)

Question 20

3 marks | Rounding, Estimation & Bounds

20 $P = \dfrac{t - w}{y}$

t = 9.7 correct to 1 decimal place

w = 5.9 correct to 1 decimal place

y = 3 correct to 1 significant figure

Calculate the upper bound for the value of P.
Show your working clearly.

(Total for Question 20 is 3 marks)

Question 13

3 marks | Rounding, Estimation & Bounds

13 Here is a triangle XYZ.

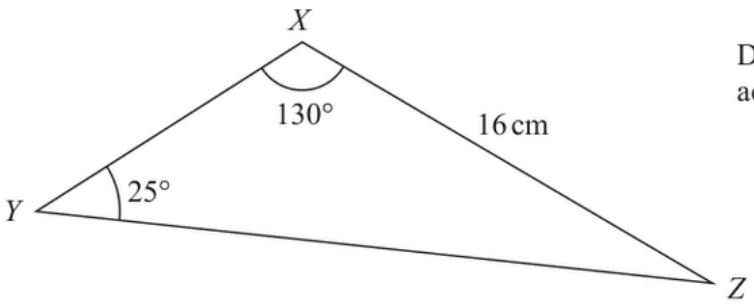


Diagram **NOT** accurately drawn

The length XZ and the angles YXZ and XYZ are each given correct to 2 significant figures.

Calculate the upper bound for the length YZ.
Give your answer correct to one decimal place.
Show your working clearly.

..... cm

(Total for Question 13 is 3 marks)

Question 4

2 marks | Rounding, Estimation & Bounds

4 Each side of a regular octagon has a length of 18 mm, correct to the nearest 0.5 mm

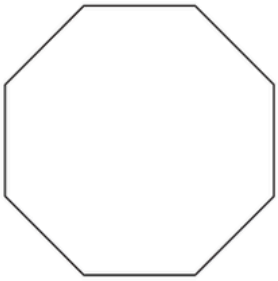


Diagram **NOT** accurately drawn

(a) Write down the lower bound of the length of each side of the octagon.

..... mm

(1)

(b) Write down the upper bound of the length of each side of the octagon.

..... mm

(1)

(Total for Question 4 is 2 marks)

Question 18

3 marks | Rounding, Estimation & Bounds

18 $A = w - \dfrac{x^2}{y}$

$w = 3.45$ correct to 2 decimal places.
$x = 1.9$ correct to 1 decimal place.
$y = 5$ correct to the nearest whole number.

Work out the lower bound of the value of A
Show your working clearly.

(Total for Question 18 is 3 marks)

Question 22

4 marks | Rounding, Estimation & Bounds

22 The diagram shows triangle ABC

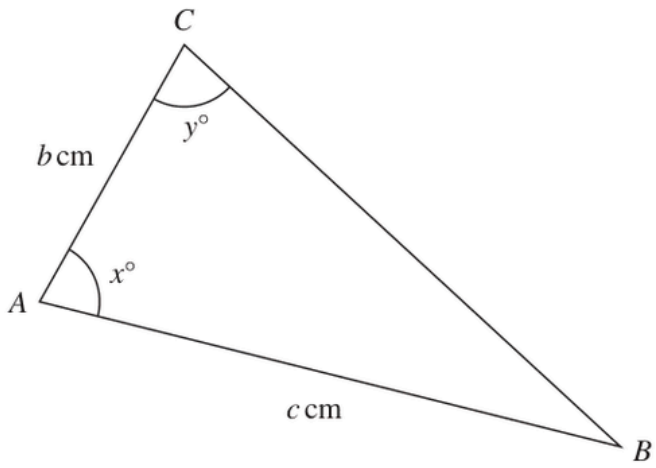


Diagram **NOT** accurately drawn

$c = 11.5$ correct to one decimal place
$x = 80$ correct to the nearest whole number
$y = 75$ correct to the nearest whole number

Calculate the upper bound for the value of b
Show your working clearly.
Give your answer correct to 3 significant figures.

(Total for Question 22 is 4 marks)

Question 18

3 marks | Rounding, Estimation & Bounds

18 $X = \dfrac{2a - b}{f}$

$a = 7.5$ correct to 1 decimal place.
$b = 3.42$ correct to 2 decimal places.
$f = 2$ correct to the nearest whole number.

Work out the upper bound of the value of X
Show your working clearly.

(Total for Question 18 is 3 marks)

Question 18

4 marks | Rounding, Estimation & Bounds

18 Kaidan and Sonja went on two different car journeys.

For Kaidan's journey
distance = 80 km correct to the nearest 5 km
time = 2.7 hours correct to 1 decimal place

For Sonja's journey
distance = 33 km correct to 2 significant figures
time = 1 hour correct to the nearest 0.1 hour

Kaidan says,
"My average speed could have been greater than Sonja's average speed."

By considering bounds, show that Kaidan is correct.
Show your working clearly.

(Total for Question 18 is 4 marks)

Question 18

4 marks | Rounding, Estimation & Bounds

18 Diego builds a fence using fence panels.

The total length of the fence is 50 metres, correct to the nearest 5 metres.
The length of each fence panel is 1.3 metres, correct to the nearest 10 cm.

The cost of each fence panel is £8.65

Diego may only buy complete fence panels.
Diego only pays for the number of panels he needs to build the fence.

Work out the greatest difference in the possible amounts that Diego could pay to build the fence.
Show your working clearly.

£.....

(Total for Question 18 is 4 marks)

Question 25

4 marks | Rounding, Estimation & Bounds

25 A solid sphere has a radius of 2.8 centimetres, correct to 1 decimal place.
The sphere has a mass of $M\pi$ grams, where $M = 260$ correct to 2 significant figures.

Work out the upper bound for the density of the sphere.
Give your answer in g/cm^3 correct to 2 decimal places.
Show your working clearly.

..... g/cm^3

(Total for Question 25 is 4 marks)

Question 17

3 marks | Rounding, Estimation & Bounds

17 $P = a(c + y)$

$a =$ 8.3 correct to 2 significant figures
$c =$ 2 correct to 1 significant figure
$y =$ 15 correct to the nearest 5

Work out the upper bound for the value of P
Show your working clearly.

(Total for Question 17 is 3 marks)

Question 19

3 marks | Rounding, Estimation & Bounds

19 $G = \dfrac{c}{2f - 3h}$

$c = 8$ correct to the nearest whole number
$f = 6.62$ correct to 2 decimal places
$h = 1.2$ correct to 1 decimal place

Work out the lower bound for the value of G
Give your answer correct to 3 decimal places.
Show your working clearly.

(Total for Question 19 is 3 marks)

Question 19

3 marks | Rounding, Estimation & Bounds

19 Aviv goes on a cycle journey.

For the cycle journey

average speed = 19 km/h correct to the nearest whole number

time = 1.5 hours correct to one decimal place

Work out the upper bound for the distance Aviv travels.
Give your answer correct to 3 significant figures.

..... km

(Total for Question 19 is 3 marks)

Question 2

2 marks | Rounding, Estimation & Bounds

2 The length of a table is measured as 1.4 metres correct to one decimal place.

(a) Write down the upper bound of the length of the table.

..... metres

(1)

(b) Write down the lower bound of the length of the table.

..... metres

(1)

(Total for Question 2 is 2 marks)

Question 21

3 marks | Rounding, Estimation & Bounds

21 $T = \dfrac{x^2 + y^2}{w}$

$x = 28.4$ correct to 1 decimal place.

$y = 17$ correct to 2 significant figures.

$w = 90$ correct to the nearest 5

Calculate the upper bound for the value of T

Give your answer correct to 3 significant figures.
Show your working clearly.

(Total for Question 21 is 3 marks)

Question 1

2 marks | Rounding, Estimation & Bounds

1 The length of a ship is 142.8 m, correct to 1 decimal place.

(i) Write down the lower bound of the length of the ship.

..... m

(1)

(ii) Write down the upper bound of the length of the ship.

..... m

(1)

(Total for Question 1 is 2 marks)

Question 2

2 marks | Rounding, Estimation & Bounds

2 The length of a ship is 142.8 m, correct to 1 decimal place.

(i) Write down the lower bound of the length of the ship.

..... m

(1)

(ii) Write down the upper bound of the length of the ship.

..... m

(1)

(Total for Question 2 is 2 marks)

Question 2

4 marks | Rounding, Estimation & Bounds

2 The height of a tree is 17.8 metres correct to one decimal place.

(a) Write down the lower bound for the height of the tree.

..... metres

(1)

The weight of an apple is 145 grams correct to the nearest 5 grams.

(b) Write down the upper bound for the weight of the apple.

..... grams

(1)

$$A = \frac{4.766 \times 815}{0.399}$$

(c) By rounding each number to one significant figure, work out an estimate for the value of A
Show your working clearly.

.....

(2)

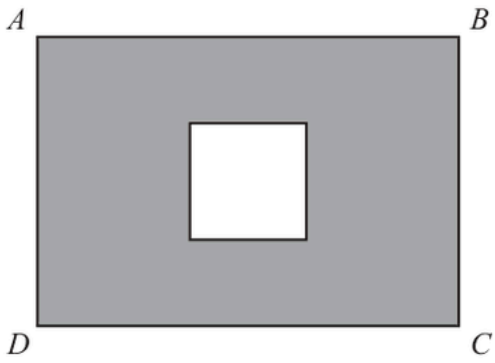
(Total for Question 2 is 4 marks)

Question 22

4 marks | Rounding, Estimation & Bounds

22 The diagram shows a square inside rectangle $ABCD$

Diagram **NOT** accurately drawn



The total area of the region shown shaded in the diagram is $X\text{cm}^2$

$AB = 11.5\text{ cm}$ correct to the nearest 0.5 cm
$BC = 9.2\text{ cm}$ correct to 2 significant figures
side of square $= 4.1\text{ cm}$ correct to 2 significant figures

By considering bounds, work out the value of X to a suitable degree of accuracy.
Show your working clearly.

$X =$ .....

(Total for Question 22 is 4 marks)

Question 2

2 marks | Rounding, Estimation & Bounds

2 By rounding each number to one significant figure, work out an estimate for the value of

$$\frac{2.11^2 \times 58.9}{\sqrt{8.859}}$$

Show your working clearly.

(Total for Question 2 is 2 marks)

Question 2

2 marks | Rounding, Estimation & Bounds

2 By rounding each number to one significant figure, work out an estimate for the value of

$$\frac{2.11^2 \times 58.9}{\sqrt{8.859}}$$

Show your working clearly.

(Total for Question 2 is 2 marks)

Question 6

2 marks | Rounding, Estimation & Bounds

6 The weight of a bag of apples is 475 g correct to the nearest g

(a) Write down the lower bound of the weight.

..... g

(1)

The height of a box is 120 cm correct to the nearest 10 cm

(b) Write down the upper bound for the height.

..... cm

(1)

(Total for Question 6 is 2 marks)

Question 7

2 marks | Rounding, Estimation & Bounds

7 The weight of a bag of apples is 475 g correct to the nearest g

(a) Write down the lower bound of the weight.

..... g

(1)

The height of a box is 120 cm correct to the nearest 10 cm

(b) Write down the upper bound for the height.

..... cm

(1)

(Total for Question 7 is 2 marks)

Question 24

5 marks | Rounding, Estimation & Bounds

24 $D = \dfrac{n}{p - q}$

$n = 10.3$ correct to 1 decimal place
$p = 7.24$ correct to 2 decimal places
$q = 4.39$ correct to 2 decimal places

By considering bounds, work out the value of D to a suitable degree of accuracy.
Show your working clearly.

(Total for Question 24 is 5 marks)

Question 4

2 marks | Rounding, Estimation & Bounds

4 The weight of a giraffe is 1178 kg, correct to the nearest kg

(i) Write down the lower bound of the weight of the giraffe.

..... kg

(1)

(ii) Write down the upper bound of the weight of the giraffe.

..... kg

(1)

(Total for Question 4 is 2 marks)

Question 18

5 marks | Rounding, Estimation & Bounds

18 The final velocity, v m/s, of an object is given by

$$v = 2\left(\frac{s}{t}\right) - u$$

where

$s = 100$ correct to the nearest integer
$t = 1.68$ correct to 2 decimal places
$u = 0.5$ correct to 1 decimal place

By considering bounds, work out the value of v to a suitable degree of accuracy.
Show your working clearly.

.....

(Total for Question 18 is 5 marks)

Question 20

5 marks | Rounding, Estimation & Bounds

20 The final velocity, v m/s, of an object is given by

$$v = 2\left(\frac{s}{t}\right) - u$$

where

$s = 100$ correct to the nearest integer
$t = 1.68$ correct to 2 decimal places
$u = 0.5$ correct to 1 decimal place

By considering bounds, work out the value of v to a suitable degree of accuracy.
Show your working clearly.

.....

(Total for Question 20 is 5 marks)

4MA1/2HR JUNE 2026

Question 21

3 marks | Rounding, Estimation & Bounds

21 $p = \dfrac{d-e}{f}$

$d = 6.6$ correct to 1 decimal place
$e = 2.8$ correct to 1 decimal place
$f = 0.47$ correct to 2 decimal places

Calculate the lower bound for the value of p
Give your answer correct to 3 significant figures.
Show your working clearly.

.....

(Total for Question 21 is 3 marks)

TOPIC

Powers & Roots

Every past-paper question on this topic, 2020 to 2026.

EP SPECIMEN

Question 33

3 marks | Powers & Roots

33 Find the value of

(a) 5^0

.....

(1)

(b) $8^{2/3}$

.....

(1)

(c) $16^{-1/2}$

.....

(1)

(Total for Question 33 is 3 marks)

EP SPECIMEN

Question 34

2 marks | Powers & Roots

34 Write $\frac{3^5 \times 3^{-2}}{3^4}$ as a single power of 3

.....

(2)

(Total for Question 34 is 2 marks)

EP SPECIMEN

Question 35

3 marks | Powers & Roots

35 $2^n = 8^4 \div 4^3$

Find the value of n.

$n =$ .....

(3)

(Total for Question 35 is 3 marks)

Question 3

5 marks | Powers & Roots

3 $20^{70} \times 20^{8} = 20^{n}$

(a) Find the value of n

$n =$ .....

(1)

$36^{80} \div 36^{5} = 36^{m}$

(b) Find the value of m

$m =$ .....

(1)

$\left(52^{4}\right)^{16} = 52^{p}$

(c) Find the value of p

$p =$ .....

(1)

In a race, Dani ran a distance of 100 metres, correct to the nearest metre.

(d) Write down the lower bound for the distance.

..... metres

(1)

Dani ran this race in a time of 16.3 seconds, correct to one decimal place.

(e) Write down the upper bound for the time.

..... seconds

(1)

(Total for Question 3 is 5 marks)

TOPIC

Standard Form

Every past-paper question on this topic, 2020 to 2026.

4WM2/01 SPECIMEN

Question 9

2 marks | Standard Form

9 (a) Write 0.000 089 in standard form.

.....

(1)

(b) Write 8.34×10^4 as an ordinary number.

.....

(1)

(Total for Question 9 is 2 marks)

Question 6

3 marks | Standard Form

6 (a) Write 7.8×10^{-4} as an ordinary number.

.....

(1)

(b) Work out $\dfrac{5.6 \times 10^4 + 7 \times 10^3}{2.8 \times 10^{-3}}$

Give your answer in standard form.

.....

(2)

(Total for Question 6 is 3 marks)

Question 10

3 marks | Standard Form

10 The table shows information about the surface area of each of the world's oceans.

Ocean	Surface area in square kilometres
Pacific	1.56×10^8
Indian	6.86×10^7
Southern	2.03×10^7
Arctic	1.41×10^7
Atlantic	1.06×10^8

(a) Work out the difference, in square kilometres, between the surface area of the Atlantic Ocean and the surface area of the Indian Ocean.
Give your answer in standard form.

..... square kilometres
(2)

The surface area of the Pacific Ocean is k times the surface area of the Arctic Ocean.

(b) Work out the value of k.
Give your answer correct to the nearest whole number.

$k =$ .....
(1)

(Total for Question 10 is 3 marks)

Question 5

4 marks | Standard Form

5 (a) Write 5.7×10^{-3} as an ordinary number.

.....

(1)

(b) Write 800 000 in standard form.

.....

(1)

(c) Work out $\dfrac{3 \times 10^5 - 2.7 \times 10^4}{6 \times 10^{-2}}$

.....

(2)

(Total for Question 5 is 4 marks)

Question 6

2 marks | Standard Form

6 (a) Write 2 840 000 000 in standard form.

.....

(1)

(b) Write 2.5×10^{-4} as an ordinary number.

.....

(1)

(Total for Question 6 is 2 marks)

Question 6

4 marks | Standard Form

6 (a) Write down the value of y^0

.....

(1)

(b) Work out $\dfrac{9.6 \times 10^{141} + 6.4 \times 10^{140}}{3.2 \times 10^{16}}$

Give your answer in standard form.

.....

(3)

(Total for Question 6 is 4 marks)

Question 8

3 marks | Standard Form

8 The table gives the length of the coastline, in kilometres, of each of five oceans.

Ocean	Length of coastline (km)
Arctic	4.539×10^4
Atlantic	1.119×10^5
Pacific	1.357×10^5
Indian	6.653×10^4
Southern	1.797×10^4

(a) Which ocean has the greatest length of coastline?

.....

(1)

(b) Calculate the difference between the length of the Atlantic Ocean's coastline and the length of the Southern Ocean's coastline.
Give your answer in standard form.

..... km

(2)

(Total for Question 8 is 3 marks)

Question 8

4 marks | Standard Form

8 The table shows the populations of five countries.

Country	Population
China	1.4×10^9
Germany	8.2×10^7
Sweden	9.9×10^6
Fiji	9.1×10^5
Malta	4.3×10^5

(a) Work out the difference between the population of China and the population of Germany.
Give your answer in standard form.

.....

(2)

Given that

$$\text{population of Fiji} = \frac{1}{k} \times \text{population of Sweden}$$

(b) work out the value of k.
Give your answer correct to the nearest whole number.

$k =$ .....

(2)

(Total for Question 8 is 4 marks)

Question 9

5 marks | Standard Form

9 A rainwater tank contains 2.4×10^7 raindrops.
The rainwater tank also contains 1.75×10^6 bacteria.

(a) Work out the number of bacteria per raindrop in the tank.
Give your answer in standard form correct to 2 significant figures.

.....

(3)

A drop of rainwater contains 5.01×10^{21} atoms.

In a drop of rainwater the number of atoms is 3 times the number of molecules.

(b) Work out the number of molecules in the rainwater tank.
Give your answer in standard form correct to one significant figure.

..... molecules

(2)

(Total for Question 9 is 5 marks)

Question 8

2 marks | Standard Form

8 $a = 4.2 \times 10^{-24}$ $b = 3 \times 10^{145}$

Work out the value of $a \times b$
Give your answer in standard form.

(Total for Question 8 is 2 marks)

Question 8

4 marks | Standard Form

8 (a) Write 5×10^4 as an ordinary number.

.....

(1)

(b) Write 0.000 06 in standard form.

.....

(1)

(c) Work out $(4 \times 10^{512}) \div (1.6 \times 10^{700})$
Give your answer in standard form.

.....

(2)

(Total for Question 8 is 4 marks)

Question 12

3 marks | Standard Form

12 $a = 6 \times 10^{40}$

Work out the value of a^3
Give your answer in standard form.

(Total for Question 12 is 3 marks)

Question 8

2 marks | Standard Form

8 (a) Write 0.000 089 in standard form.

.....

(1)

(b) Write 8.34×10^4 as an ordinary number.

.....

(1)

(Total for Question 8 is 2 marks)

Question 9

4 marks | Standard Form

9 The table gives information about the population, correct to 2 significant figures, of each of five cities in 2018

City	Population (2018)
Ahmedabad	7.7×10^6
Barcelona	5.5×10^6
Chicago	8.8×10^6
Lagos	1.3×10^7
Tokyo	3.7×10^7

(a) Write 8.8×10^6 as an ordinary number.

.....

(1)

(b) Which of these cities had the least population in 2018?

.....

(1)

(c) Work out the difference between the population of Tokyo and the population of Ahmedabad in 2018
Give your answer in standard form correct to 2 significant figures.

.....

(2)

(Total for Question 9 is 4 marks)

Question 6

2 marks | Standard Form

6 (a) Write $76\,000\,000$ in standard form.

.....

(1)

(b) Write 5.4×10^{-4} as an ordinary number.

.....

(1)

(Total for Question 6 is 2 marks)

Question 8

3 marks | Standard Form

8 (a) Write 5.6×10^{-3} as an ordinary number.

.....

(1)

(b) Work out $\dfrac{6 \times 10^{3}}{2.1 \times 10^{-4} + 9 \times 10^{-5}}$

Give your answer in standard form.

.....

(2)

(Total for Question 8 is 3 marks)

Question 15

6 marks | Standard Form

15 (a) $\sqrt{2} \div \dfrac{8^3}{16^{\frac{3}{2}}} = 2^n$

Work out the value of n
Show your working clearly.

$n =$ .....

(3)

(b) Find 4% of 4.5×10^{157}
Give your answer in standard form.

.....

(3)

(Total for Question 15 is 6 marks)

Question 9

4 marks | Standard Form

9 (a) Write 5.87×10^{-4} as an ordinary number.

.....

(1)

(b) Write 84 000 000 in standard form.

.....

(1)

The number of neurons in a human brain is 8.5×10^{10}
The number of neurons in a monkey brain is 1.47×10^{9}

The number of neurons in a human brain is K × the number of neurons in a monkey brain.

(c) Work out the value of K
Give your answer correct to one decimal place.

$K =$ .....

(2)

(Total for Question 9 is 4 marks)

Question 9

4 marks | Standard Form

9 (a) Write 6.04×10^5 as an ordinary number.

.....

(1)

(b) Write 0.000 07 in standard form.

.....

(1)

(c) Work out $\dfrac{7.6 \times 10^{10}}{4 \times 10^5 - 2 \times 10^4}$

Give your answer in standard form.

.....

(2)

(Total for Question 9 is 4 marks)

Question 9

3 marks | Standard Form

9 The table gives the amount of rice produced by each of two countries in 2020

Country	Amount of rice (tonnes)
Indonesia	3.5×10^7
Argentina	8.2×10^5

(a) Write 3.5×10^7 as an ordinary number.

.....

(1)

In 2020, Japan produced 6 780 000 more tonnes of rice than Argentina.

(b) Work out the amount of rice Japan produced in 2020
Give your answer in standard form.

..... tonnes

(2)

(Total for Question 9 is 3 marks)

Question 9

3 marks | Standard Form

9 (a) Write 8.4×10^{-5} as an ordinary number.

.....

(1)

(b) Work out $\left(6.5 \times 10^{-40}\right) \times \left(8 \times 10^{185}\right)$
Give your answer in standard form.

.....

(2)

(Total for Question 9 is 3 marks)

Question 6

3 marks | Standard Form

6 (a) Write $82\,000\,000$ in standard form.

.....

(1)

(b) Write 5.8×10^{-6} as an ordinary number.

.....

(1)

(c) Write 160×10^{300} in standard form.

.....

(1)

(Total for Question 6 is 3 marks)

Question 8

4 marks | Standard Form

8 (a) Write 520 million in standard form.

.....

(1)

(b) Write 8.79×10^{-5} as an ordinary number.

.....

(1)

(c) Work out $(5 \times 10^{42}) \times (7 \times 10^{-180})$
Give your answer in standard form.

.....

(2)

(Total for Question 8 is 4 marks)

Question 12

3 marks | Standard Form

12 (a) Write 8.6×10^{-5} as an ordinary number.

.....

(1)

(b) Work out $(3 \times 10^{143}) \div (6 \times 10^{137})$

Give your answer in standard form.

.....

(2)

(Total for Question 12 is 3 marks)

Question 13

3 marks | Standard Form

13 The distance from Earth to Andromeda Galaxy is 1.6×10^{11} astronomical units.

- 1 astronomical unit $= 1.5 \times 10^{8}$ km
- 1 light year $= 9.5 \times 10^{12}$ km

Work out the distance, in light years, from Earth to Andromeda Galaxy.
Give your answer in standard form, correct to 2 significant figures.

..... light years

(Total for Question 13 is 3 marks)

Question 14

2 marks | Standard Form

14 Work out $6.7 \times 10^{135} + 3 \times 10^{134}$

Give your answer in standard form.

(Total for Question 14 is 2 marks)

Question 8

3 marks | Standard Form

8 (a) Write 5.76×10^4 as an ordinary number.

.....

(1)

(b) Work out $\dfrac{3 \times 10^5 + 8 \times 10^3}{4 \times 10^{-2}}$

Give your answer in standard form.

.....

(2)

(Total for Question 8 is 3 marks)

Question 9

3 marks | Standard Form

9 (a) Write 5.76×10^4 as an ordinary number.

.....

(1)

(b) Work out $\dfrac{3 \times 10^5 + 8 \times 10^3}{4 \times 10^{-2}}$

Give your answer in standard form.

.....

(2)

(Total for Question 9 is 3 marks)

Question 13

2 marks | Standard Form

13 Work out $\left(9 \times 10^{80}\right)^3$

Give your answer in standard form.

(Total for Question 13 is 2 marks)

Question 7

3 marks | Standard Form

7 (a) Write 4×10^{-5} as an ordinary number.

.....

(1)

(b) Work out $(6 \times 10^{158}) \times (2 \times 10^{72})$
Give your answer in standard form.

.....

(2)

(Total for Question 7 is 3 marks)

4MA1/1H JUNE 2026

Question 9

3 marks | Standard Form

9 (a) Write 0.0651 in standard form.

.....

(1)

(b) Work out $\left(4 \times 10^{56}\right) \times \left(8 \times 10^{74}\right)$

Give your answer in standard form.

.....

(2)

(Total for Question 9 is 3 marks)

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TOPIC

Surds

Every past-paper question on this topic, 2020 to 2026.

Question 17

4 marks | Surds

17 Express $\dfrac{3+\sqrt{8}}{\left(\sqrt{2}-1\right)^2}$ in the form $p+\sqrt{q}$ where p and q are integers.

Show clearly each stage of your working.

.....

(Total for Question 17 is 4 marks)

Question 20

3 marks | Surds

20 The area of a rectangle is $18\,\text{cm}^2$

The length of the rectangle is $\left(\sqrt{7}+1\right)$ cm.

Without using a calculator and showing each stage of your working,

find the width of the rectangle.
Give your answer in the form $a\sqrt{b}+c$ where a, b and c are integers.

..... cm

(Total for Question 20 is 3 marks)

Question 19

3 marks | Surds

19 Without using a calculator, rationalise the denominator of $\frac{6}{3-\sqrt{7}}$

Simplify your answer.
You must show each stage of your working.

(Total for Question 19 is 3 marks)

Question 18

3 marks | Surds

18 Given that $(8 - \sqrt{x})(5 + \sqrt{x}) = y\sqrt{x} + 21$ where x is a prime number and y is an integer,

find the value of x and the value of y.
Show each stage of your working clearly.

$x =$ .....

$y =$ .....

(Total for Question 18 is 3 marks)

Question 17

3 marks | Surds

17 Express $\frac{8}{\sqrt{5}-1}$ in the form $\sqrt{a}+b$ where a and b are integers.

Show each stage of your working clearly.

(Total for Question 17 is 3 marks)

Question 16

3 marks | Surds

16 Without using a calculator, show that $\frac{12}{\sqrt{2}-1} - \left(\sqrt{2}\right)^5 = 2\sqrt{32} + 12$

Show your working clearly.

(Total for Question 16 is 3 marks)

Question 21

4 marks | Surds

21 Express $\dfrac{3+\sqrt{8}}{\left(\sqrt{2}-1\right)^2}$ in the form $p+\sqrt{q}$ where p and q are integers.

Show each stage of your working clearly.

(Total for Question 21 is 4 marks)

Question 23

4 marks | Surds

23 The diagram shows a cuboid with a square cross section.

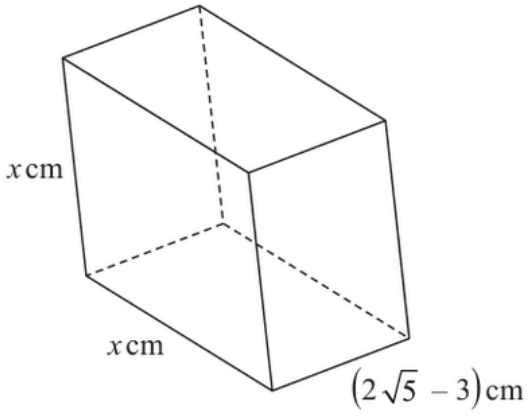


Diagram **NOT** accurately drawn

The volume of the cuboid is $(13 + 6\sqrt{5})\text{cm}^3$

Without using a calculator, find the value of x
Give your answer in the form $a + \sqrt{b}$ where a and b are integers.
Show your working clearly.

$x =$ .....

(Total for Question 23 is 4 marks)

Question 16

4 marks | Surds

16 $\sqrt{96} = 2\sqrt{k}$

(a) Find the value of k

$k =$ .....

(1)

(b) Show that $\dfrac{8}{3-\sqrt{5}}$ can be written in the form $a+\sqrt{b}$ where a and b are integers.

Show each stage of your working.

(3)

(Total for Question 16 is 4 marks)

Question 17

4 marks | Surds

17 $(\sqrt{3})^5 = k\sqrt{3}$ where k is an integer.

(a) Find the value of k

$k =$ .....

(1)

(b) Show that $\dfrac{21}{3-\sqrt{2}}$ can be written in the form $c + \sqrt{d}$

where c and d are integers.
Show each stage of your working clearly.

(3)

(Total for Question 17 is 4 marks)

Question 16

3 marks | Surds

16 Show that $\dfrac{2\sqrt{7}+2}{\sqrt{7}-3}$ can be written in the form $a-\sqrt{b}$ where a and b are integers.

Show your working clearly.

(Total for Question 16 is 3 marks)

Question 16

6 marks | Surds

16 (a) Solve $x^2 - \left(2\sqrt{3}\right)x - 13 = 0$

Give your solutions in the form $\sqrt{a} \pm b$ where a and b are integers.
Show your working clearly.

.....

(3)

(b) Show that $\dfrac{\sqrt{20}}{\sqrt{5}+2}$ can be written in the form $c - \sqrt{d}$ where c and d are integers.

(3)

(Total for Question 16 is 6 marks)

4MA1/1H JUNE 2026

Question 17

3 marks | Surds

17 Show that $\left(4-\sqrt{20}\right)\left(5-2\sqrt{5}\right)$ can be written in the form $a-\sqrt{b}$

where a and b are integers.

(Total for Question 17 is 3 marks)

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TOPIC

Using a Calculator

Every past-paper question on this topic, 2020 to 2026.

EP SPECIMEN

Question 1

2 marks | Using a Calculator

1 Work out $\dfrac{5.7^2 - \sqrt{30.25}}{1.8 \times 0.65}$

Write down all the figures on your calculator display.

.....

(2)

(Total for Question 1 is 2 marks)

EP SPECIMEN

Question 2

3 marks | Using a Calculator

2 (a) Work out $4.3^3 - \frac{1}{0.16}$

Write down all the figures on your calculator display.

.....

(2)

(b) Give your answer to part (a) correct to 3 significant figures.

.....

(1)

(Total for Question 2 is 3 marks)

EP SPECIMEN

Question 3

2 marks | Using a Calculator

3 Work out $\dfrac{8.4 \times \tan 35°}{\cos 62°}$

Give your answer correct to 3 significant figures.

.....

(2)

(Total for Question 3 is 2 marks)

EP SPECIMEN

Question 4

3 marks | Using a Calculator

4 Work out $\dfrac{3.7 \times 10^5 + 2.9 \times 10^4}{8.1 \times 10^{-3}}$

Give your answer in standard form correct to 3 significant figures.

.....

(3)

(Total for Question 4 is 3 marks)

EP SPECIMEN

Question 5

2 marks | Using a Calculator

5 $p = 2.6 \quad q = -1.8$

Work out the value of $\dfrac{p^2 - 3q}{\sqrt{(p + q^2)}}$

Give your answer correct to 3 decimal places.

.....

(2)

(Total for Question 5 is 2 marks)

EP SPECIMEN

Question 6

2 marks | Using a Calculator

6 Work out the value of $4.8^{-0.5} + 1.7^3$

Give your answer correct to 4 significant figures.

.....

(2)

(Total for Question 6 is 2 marks)

EP SPECIMEN

Question 7

3 marks | Using a Calculator

7 Here is a calculation: $\dfrac{19.6 \times 0.48}{4.1}$

(a) By rounding each number to 1 significant figure, work out an estimate for the calculation.

.....

(2)

(b) Use your calculator to work out the calculation. Give your answer correct to 3 significant figures.

.....

(1)

(Total for Question 7 is 3 marks)

TOPIC

Ratio Toolkit

Every past-paper question on this topic, 2020 to 2026.

Question 10

5 marks | Ratio Toolkit

10 Payel makes 300 celebration cards so that

$$\text{number of birthday cards} : \text{number of anniversary cards} : \text{number of congratulations cards} = 7 : 5 : 3$$

$\frac{2}{5}$ of the birthday cards have numbers on them.

36% of the anniversary cards have numbers on them.
None of the congratulations cards have numbers on them.

Work out what fraction of the 300 cards have numbers on them.
Give your answer in its simplest form.

.....

(Total for Question 10 is 5 marks)

4MA1/1HR JANUARY 2020

Question 1

3 marks | Ratio Toolkit

1 Brendon, Asha and Julie share some money in the ratios 3 : 2 : 6
The **total** amount of money that Asha and Julie receive is $36

Work out the amount of money that Brendon receives.

$.....

(Total for Question 1 is 3 marks)

Question 5

6 marks | Ratio Toolkit

5 120 children go on an activity holiday.
The ratio of the number of girls to the number of boys is 3 : 5

On Sunday, all the children either go sailing or go climbing.

$\frac{16}{25}$ of the boys go climbing.

Twice as many girls go sailing as go climbing.

Work out how many children go sailing on Sunday.

(Total for Question 5 is 6 marks)

Question 12

4 marks | Ratio Toolkit

12 Astrid wants to buy some oil.
She can buy the oil from either Dane Oil or Arctic Oil.

Here is information about the price that each company will charge Astrid.

Dane Oil	Arctic Oil
(4.2×10^5) litres for 2 500 000 Krone	(8.6×10^5) litres for 770 000 Dollars

Astrid wants to get the better value for money for the oil.

1 Dollar = 6.57 Krone

From which company should she buy her oil, Dane Oil or Arctic Oil?
You must show your working.

(Total for Question 12 is 4 marks)

Question 1

4 marks | Ratio Toolkit

1 Pieter owns a currency conversion shop.

Last Monday, Pieter changed a total of 20 160 rand into a number of different currencies.

He changed $\frac{3}{10}$ of the 20 160 rand into euros.

He changed the rest of the rands into dollars, rupees and francs in the ratios 9 : 5 : 2

Pieter changed more rands into dollars than he changed into francs.

Work out how many more.

..... rand

(Total for Question 1 is 4 marks)

Question 4

3 marks | Ratio Toolkit

4 On a farm there are chickens, ducks and pigs.

The ratio of the number of chickens to the number of ducks is 7 : 2
The ratio of the number of ducks to the number of pigs is 5 : 9
There are 36 pigs on the farm.

Work out the number of chickens on the farm.

(Total for Question 4 is 3 marks)

4MA1/1H JANUARY 2022

Question 2

3 marks | Ratio Toolkit

2 Danil, Gabriel and Hadley share some money in the ratios 3 : 5 : 9
The difference between the amount of money that Gabriel receives and the amount of money that Hadley receives is 196 euros.

Work out the amount of money that Danil receives.

..... euros

(Total for Question 2 is 3 marks)

4MA1/1H MAY 2023

Question 1

3 marks | Ratio Toolkit

1 Last season, the number of goals scored by Arjun, by Simon and by Kath for their football team were in the ratios $2:5:8$

Simon scored 12 more goals than Arjun.

Work out the number of goals scored by Kath.

(Total for Question 1 is 3 marks)

Question 5

4 marks | Ratio Toolkit

5 Nancy has some coins with a total value of 85 pence.
She has only 2 pence coins and 5 pence coins.
The ratio

$$\text{number of 2 pence coins} : \text{number of 5 pence coins} = 1 : 3$$

Nancy has more 5 pence coins than 2 pence coins.

How many more?

(Total for Question 5 is 4 marks)

Question 5

3 marks | Ratio Toolkit

5 Avril bakes a cake.

She uses flour, butter and sugar such that

weight of flour : weight of butter = 6 : 5
weight of butter : weight of sugar = 3 : 2

Avril uses 120 grams of sugar.

Work out the weight of flour Avril uses.

..... grams

(Total for Question 5 is 3 marks)

4MA1/2H JUNE 2025

Question 6

4 marks | Ratio Toolkit

6 Pau, Sam and Tia share £240 in the ratios 3 : 4 : 5

Sam and Tia each give £10 of their share to Pau.

Work out the ratios of the amounts of money that Pau, Sam and Tia now have.
Give your answer in its simplest form.

..... : ..... : .....

(Total for Question 6 is 4 marks)

Question 7

4 marks | Ratio Toolkit

7 Pau, Sam and Tia share £240 in the ratios 3 : 4 : 5

Sam and Tia each give £10 of their share to Pau.

Work out the ratios of the amounts of money that Pau, Sam and Tia now have.
Give your answer in its simplest form.

..... : ..... : .....

(Total for Question 7 is 4 marks)

Question 6

4 marks | Ratio Toolkit

6 Eli and Peta share \$275 in the ratio 2 : 3

Eli gives $\frac{3}{11}$ of his share to charity.

Peta gives 0.32 of her share to charity.

Work out the total amount that Eli and Peta give to charity.

\$.....

(Total for Question 6 is 4 marks)

4MA1/2HR JUNE 2026

Question 5

5 marks | Ratio Toolkit

5 Sarah and Dej each give some money to charity **A** and to charity **B**

Sarah shares \$400 between charity **A** and charity **B** in the ratio 2 : 3

Dej shares \$375 between the two charities.
He gives twice as much money to charity **B** as he gives to charity **A**

Dej gives more money to charity **B** than Sarah gives to charity **B**

How much more?

\$.....

(Total for Question 5 is 5 marks)

TOPIC

Standard & Compound Units

Every past-paper question on this topic, 2020 to 2026.

Question 5

3 marks | Standard & Compound Units

5 A plane flies from New York City to Los Angeles.

The plane flies a distance of 3980 kilometres in 5 hours 24 minutes.

Work out the average speed of the plane.
Give your answer in kilometres per hour correct to the nearest whole number.

..... kilometres per hour

(Total for Question 5 is 3 marks)

Question 7

4 marks | Standard & Compound Units

7 A cylinder is placed on the ground.

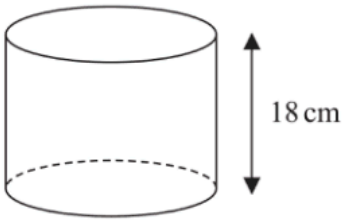


Diagram **NOT** accurately drawn

The height of the cylinder is 18 cm

The force exerted by the cylinder on the ground is 72 newtons.
The pressure on the ground due to the cylinder is 1.4 newtons/cm^2

$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

Work out the volume of the cylinder.
Give your answer correct to 3 significant figures.

..... cm^3

(Total for Question 7 is 4 marks)

Question 8

3 marks | Standard & Compound Units

(Total for Question 7 is 4 marks)

8 Change a speed of 81 kilometres per hour to a speed in metres per second.

..... metres per second

(Total for Question 8 is 3 marks)

Question 2

2 marks | Standard & Compound Units

2 Change 32.4 m^3 into cm^3

..... cm^3

(Total for Question 2 is 2 marks)

Question 5

3 marks | Standard & Compound Units

5 A plane takes 3 hours 36 minutes to fly from the Cayman Islands to New York.
The plane flies a distance of 2470 km.

Work out the average speed of the plane in km/h.
Give your answer correct to the nearest whole number.

..... km/h

(Total for Question 5 is 3 marks)

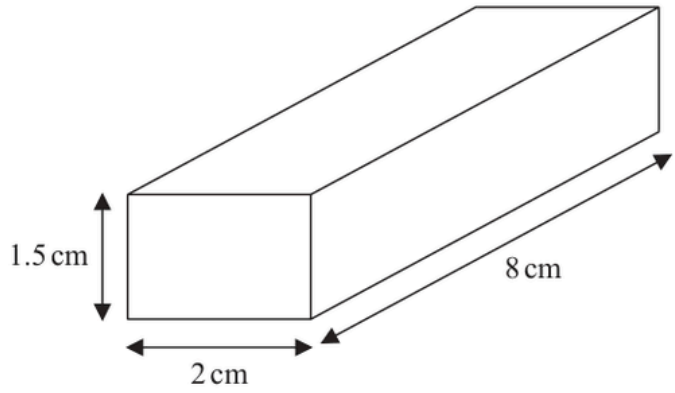
Question 9

5 marks | Standard & Compound Units

9 Pablo made a solid gold statue.

He melted down some gold blocks and used the gold to make the statue.
Each block of gold was a cuboid, as shown below.

Diagram **NOT** accurately drawn



The mass of the statue is 5.73 kg.
The density of gold is 19.32 g/cm^3

Work out the least number of gold blocks Pablo melted down in order to make the statue.
Show your working clearly.

(Total for Question 9 is 5 marks)

Question 9

2 marks | Standard & Compound Units

9 The density of gold is 19.3 g/cm^3
A gold bar has volume 150 cm^3

Work out the mass of the gold bar.

..... g

(Total for Question 9 is 2 marks)

Question 9

3 marks | Standard & Compound Units

9 The diagram shows a box in the shape of a cuboid.

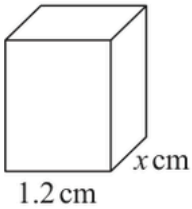


Diagram **NOT** accurately drawn

The box is put on a table.
The face of the box in contact with the table has length 1.2 metres and width x metres.

The force exerted by the box on the table is 27 newtons.
The pressure on the table due to the box is 30 newtons/m^2

$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

Work out the value of x.

$x =$ .....

(Total for Question 9 is 3 marks)

Question 10

3 marks | Standard & Compound Units

10 Change a speed of 50 metres per second to a speed in kilometres per hour.

..... kilometres per hour

(Total for Question 10 is 3 marks)

Question 13

4 marks | Standard & Compound Units

13 The diagram shows a solid cube.
The cube is placed on a table so that the whole of one face of the cube is in contact with the table.

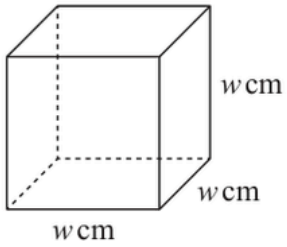


Diagram **NOT** accurately drawn

The cube exerts a force of 56 newtons on the table.
The pressure on the table due to the cube is 0.14 newtons/cm^2

$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

Work out the volume of the cube.

..... cm^3

(Total for Question 13 is 4 marks)

Question 6

3 marks | Standard & Compound Units

6 A rocket travelled 100 km at an average speed of 28 440 km/h.

Work out how long it took the rocket to travel the 100 km.
Give your answer in seconds, correct to the nearest second.

..... seconds

(Total for Question 6 is 3 marks)

Question 7

4 marks | Standard & Compound Units

7 Pedro drove from Toulouse to Montpellier in 2 hours 42 minutes.
He drove at an average speed of 90 km/hour.

Janine drove from Toulouse to Montpellier along the same route as Pedro.
The journey took her 3 hours.

Work out Janine's average speed for the journey.

..... km/hour

(Total for Question 7 is 4 marks)

Question 9

3 marks | Standard & Compound Units

9 A box is put on a horizontal table.

The face of the box in contact with the table is a square of side 1.5 metres.
The pressure on the table due to the box is 34.8 newtons/m^2

Work out the force exerted by the box on the table.

$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

..... newtons

(Total for Question 9 is 3 marks)

4MA1/2H JANUARY 2021

Question 1

3 marks | Standard & Compound Units

1 A train takes 6 hours 39 minutes to travel from New Delhi to Kanpur.
The train travels a distance of 429 km.

Work out the average speed of the train.
Give your answer in km/h correct to one decimal place.

..... km/h

(Total for Question 1 is 3 marks)

Question 4

3 marks | Standard & Compound Units

4 A train journey from Paris to Amsterdam took 3 hours 24 minutes.
The total distance the train travelled was 433.5 km.

Work out the average speed of the train.
Give your answer in kilometres per hour.

..... km/h

(Total for Question 4 is 3 marks)

4MA1/1H MAY 2021

Question 1

3 marks | Standard & Compound Units

1 A plane flew from Madrid to Dubai.

The distance the plane flew was 5658 km.
The flight time was 8 hours 12 minutes.

Work out the average speed of the plane.

..... km/h

(Total for Question 1 is 3 marks)

Question 10

5 marks | Standard & Compound Units

10 A solid aluminium cylinder has radius 10 cm and height h cm.

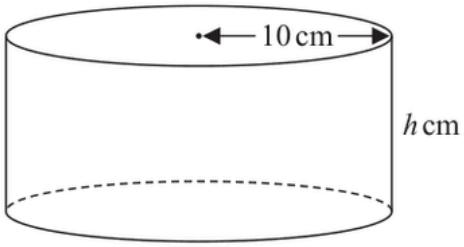


Diagram **NOT** accurately drawn

The mass of the cylinder is 5.4 kg.
The density of aluminium is 0.0027 kg/cm^3

Calculate the value of h.
Give your answer correct to one decimal place.

$h =$ .....

(Total for Question 10 is 5 marks)

Question 7

4 marks | Standard & Compound Units

7 Milly went on a car journey.
She travelled from Anesey to Breigh to Clando and then to Duckbridge.

For Anesey to Breigh, Milly drove the 245 km in 2.5 hours.
For Breigh to Clando, Milly drove the 220 km at an average speed of 80 km/h
For Clando to Duckbridge, Milly drove at an average speed of 72 km/h in 50 minutes.

Work out Milly's average speed, in km/h, for the journey from Anesey to Duckbridge.
Give your answer correct to one decimal place.

..... km/h

(Total for Question 7 is 4 marks)

Question 21

6 marks | Standard & Compound Units

21 The diagram shows a solid made from a cylinder and a hemisphere.
The cylinder and the hemisphere are both made from the same metal.

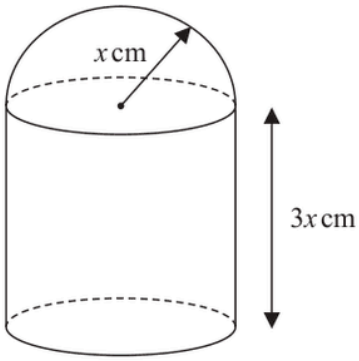


Diagram **NOT** accurately drawn

The plane face of the hemisphere coincides with the upper plane face of the cylinder.

The radius of the cylinder and the radius of the hemisphere are both x cm.
The height of the cylinder is $3x$ cm.

The total surface area of the solid is 81π cm^2
The mass of the solid is 840 grams.

The following table gives the density of each of four metals.

Metal	Density (g/cm^3)
Aluminium	2.7
Nickel	8.9
Gold	19.3
Silver	10.5

The metal used to make the solid is one of the metals in the table.

Determine the metal used to make the solid.
Show your working clearly.

(Total for Question 21 is 6 marks)

Question 3

3 marks | Standard & Compound Units

3 An aeroplane travelled from New York City to Los Angeles.

The aeroplane travelled a distance of 3980 kilometres in 5 hours 24 minutes.

Work out the average speed of the aeroplane.
Give your answer in kilometres per hour correct to the nearest whole number.

..... kilometres per hour

(Total for Question 3 is 3 marks)

Question 7

4 marks | Standard & Compound Units

7 A cylinder is placed on the ground.

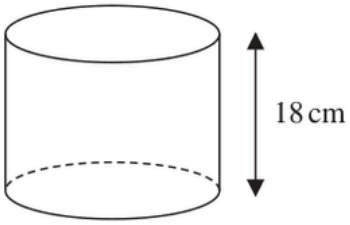


Diagram **NOT** accurately drawn

The height of the cylinder is 18 cm.

The force exerted by the cylinder on the ground is 72 newtons.
The pressure on the ground due to the cylinder is 1.4 newtons/cm^2

$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

Work out the volume of the cylinder.
Give your answer correct to 3 significant figures.

..... cm^3

(Total for Question 7 is 4 marks)

Question 7

3 marks | Standard & Compound Units

7 The diagram shows a solid cylinder made from iron.

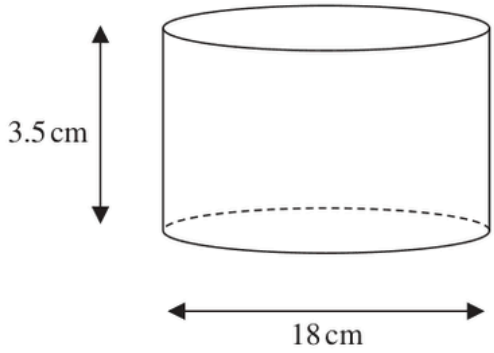


Diagram **NOT** accurately drawn

The cylinder has diameter 18 cm and height 3.5 cm
The mass of the cylinder is 7.04 kg

Work out the density of the iron.
Give your answer in g/cm^3 correct to 2 significant figures.

..... g/cm^3

(Total for Question 7 is 3 marks)

Question 7

3 marks | Standard & Compound Units

7 Change a speed of 81 kilometres per hour to a speed in metres per second.

..... metres per second

(Total for Question 7 is 3 marks)

Question 3

3 marks | Standard & Compound Units

3 Anjali travels on the Eurostar train from Paris to Amsterdam.

The distance the train travels between Paris and Amsterdam is 515 km.
The time taken by the train to travel between Paris and Amsterdam is 3 hours 18 minutes.

Work out the average speed of the train.
Give your answer in km/h correct to the nearest whole number.

..... km/h

(Total for Question 3 is 3 marks)

Question 9

3 marks | Standard & Compound Units

9 Change a speed of 27 kilometres per hour to a speed in metres per second.

..... m/s

(Total for Question 9 is 3 marks)

Question 11

3 marks | Standard & Compound Units

11 The diagram shows a block of iron in the shape of a cuboid.

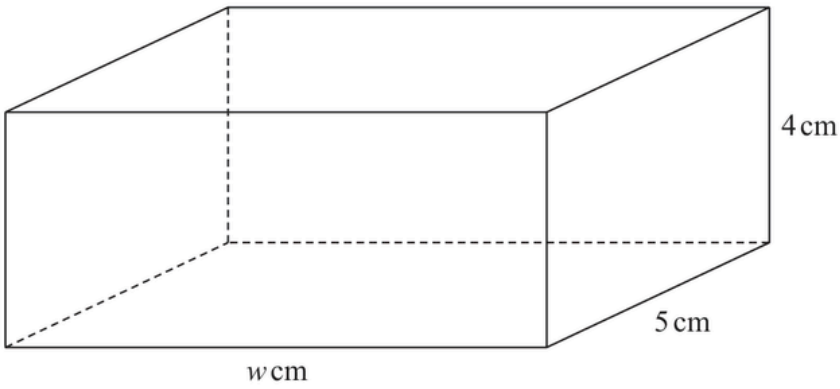


Diagram **NOT** accurately drawn

The block has length w cm, width 5 cm and height 4 cm

The density of iron is 7.8 g/cm^3
The mass of the block is 1950 g

Work out the value of w

$w =$ .....

(Total for Question 11 is 3 marks)

4MA1/2H JUNE 2024

Question 3

3 marks | Standard & Compound Units

3 A plane takes 9 hours 36 minutes to fly from New Delhi to Perth.

The plane flies at an average speed of 820 km/h.

Work out the total distance the plane flies.

..... km

(Total for Question 3 is 3 marks)

Question 6

3 marks | Standard & Compound Units

6 Change a speed of w metres per second to a speed in kilometres per hour.
Give your answer in terms of w in its simplest form.

..... kilometres per hour

(Total for Question 6 is 3 marks)

Question 6

4 marks | Standard & Compound Units

6 The diagram shows a solid wooden cylinder.

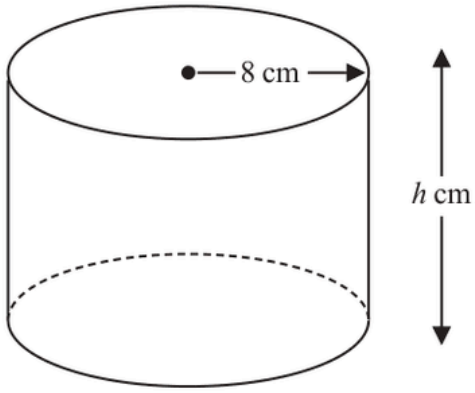


Diagram **NOT** accurately drawn

The cylinder has radius 8 cm and height h cm.
The volume of the cylinder is 1208 cm^3

(a) Work out the value of h
Give your answer correct to the nearest whole number.

$h =$ .....

(2)

The density of the wood is 1.25 g/cm^3

(b) Work out the mass of the cylinder.
Give your answer in kilograms.

..... kilograms

(2)

(Total for Question 6 is 4 marks)

Question 8

3 marks | Standard & Compound Units

8 A cylinder is placed on a table.

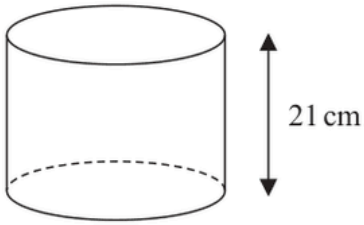


Diagram **NOT** accurately drawn

The volume of the cylinder is $1575\,cm^3$
The force exerted by the cylinder on the table is 84 newtons.

$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

Work out the pressure on the table due to the cylinder.

..... newtons/cm^2

(Total for Question 8 is 3 marks)

Question 6

3 marks | Standard & Compound Units

6 The diagram shows a block in the shape of a cuboid.

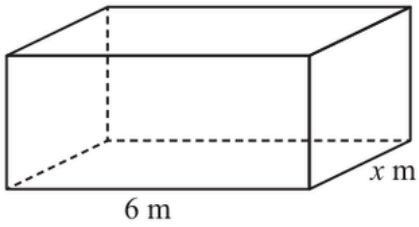


Diagram **NOT** accurately drawn

The block has a horizontal base with length 6 m and width x m

The block is placed on a table so that the whole of its horizontal base is in contact with the table.

The block exerts a force of 702 newtons on the table.
The pressure on the table due to the block is 65 newtons/m²

Work out the value of x

$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

$x =$ .....

(Total for Question 6 is 3 marks)

Question 7

3 marks | Standard & Compound Units

7 Change a speed of $50x$ metres per second to a speed in kilometres per hour.

..... km/h

(Total for Question 7 is 3 marks)

Question 7

2 marks | Standard & Compound Units

7 The mass of a silver coin is 48.3 g
The density of silver is 10.5 g/cm^3

Work out the volume of the silver coin.

..... cm^3

(Total for Question 7 is 2 marks)

Question 7

3 marks | Standard & Compound Units

7 Change a speed of 40 metres per second to a speed in kilometres per hour.
Show your working clearly.

..... kilometres per hour

(Total for Question 7 is 3 marks)

Question 10

5 marks | Standard & Compound Units

10 The diagram shows a rectangular sheet of metal.

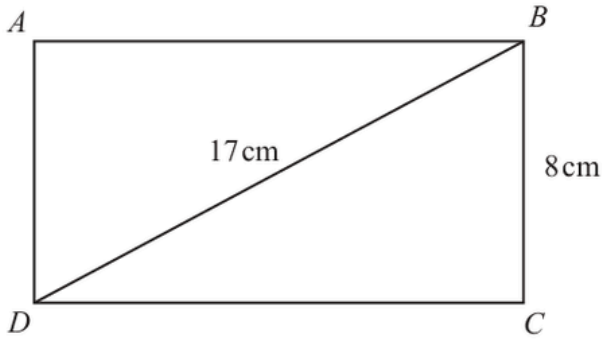


Diagram **NOT** accurately drawn

$BC = 8$ cm $DB = 17$ cm

The sheet of metal lies flat on a table.
The force exerted by the sheet of metal on the table is 150 newtons.

Work out the pressure on the table due to the sheet of metal.
Show your working clearly.

$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

..... newtons/cm^2

(Total for Question 10 is 5 marks)

Question 10

3 marks | Standard & Compound Units

10 A parcel in the shape of a cube is placed on a table so that the whole of one face of the parcel is in contact with the table.

The parcel has sides of length 7 cm

The pressure on the table due to the parcel is 62 newtons/cm^2

$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

Work out the force exerted by the parcel on the table.

..... newtons

(Total for Question 10 is 3 marks)

Question 26

6 marks | Standard & Compound Units

26 A solid cone is joined to a solid hemisphere to make the solid shown below.

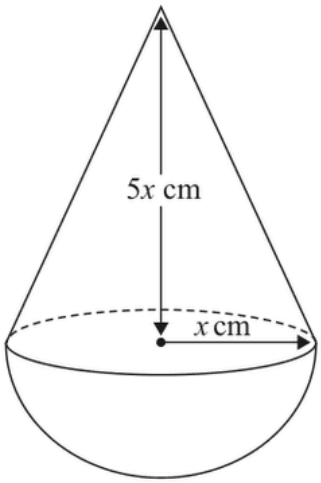


Diagram **NOT** accurately drawn

The cone is made from copper.
The density of copper is $9\,g/cm^3$

The hemisphere is made from a different metal.

The total mass of the solid is 4752π grams
The total volume of the solid is $504\pi\,cm^3$

Work out the density of the hemisphere.
Show your working clearly.

..... g/cm^3

(Total for Question 26 is 6 marks)

Question 4

4 marks | Standard & Compound Units

4 Henri competes in a race.

For the first part of the race Henri cycles 60 km at an average speed of 24 km/h
For the remaining part of the race Henri runs for 1 hour and 15 minutes at an average speed of 12 km/h

Work out Henri's average speed for the whole race.
Give your answer in km/h
Show your working clearly.

..... km/h

(Total for Question 4 is 4 marks)

Question 8

3 marks | Standard & Compound Units

8 Change a speed of 70 metres per second to a speed in kilometres per hour.
Show your working clearly.

..... km/h

(Total for Question 8 is 3 marks)

Question 8

3 marks | Standard & Compound Units

8 A block of wood has a mass of 480 kg
The wood has a density of 640 kg/m^3

Work out the volume of the block of wood.

..... m^3

(Total for Question 8 is 3 marks)

Question 9

3 marks | Standard & Compound Units

9 Change a speed of 198 kilometres per hour to a speed in metres per second.
Show your working clearly.

..... m/s

(Total for Question 9 is 3 marks)

Question 10

3 marks | Standard & Compound Units

10 The diagram shows a solid cylinder.

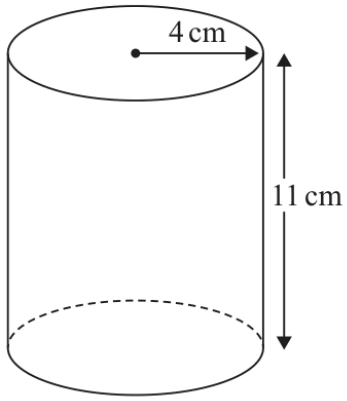


Diagram **NOT** accurately drawn

The cylinder has radius 4 cm and height 11 cm
The cylinder is made from wood with a density of 0.6 g/cm^3

Work out the mass of the cylinder.
Give your answer correct to 3 significant figures.

..... g

(Total for Question 10 is 3 marks)

TOPIC

Algebra Toolkit

Every past-paper question on this topic, 2020 to 2026.

EP SPECIMEN

Question 22

2 marks | Algebra Toolkit

22 (a) Simplify $5a + 3b - 2a + 7b$

.....

(1)

(b) Simplify $4x \times 3y$

.....

(1)

(Total for Question 22 is 2 marks)

EP SPECIMEN

Question 23

2 marks | Algebra Toolkit

23 Work out the value of $3p^2 - 2q$ when $p = -4$ and $q = 5$

.....

(2)

(Total for Question 23 is 2 marks)

EP SPECIMEN

Question 24

2 marks | Algebra Toolkit

24 $v = u + at$

Work out the value of v when $u = 12$, $a = -3.5$ and $t = 6$

$v =$ .....

(2)

(Total for Question 24 is 2 marks)

EP SPECIMEN

Question 25

2 marks | Algebra Toolkit

25 Pens cost 35p each. Pencils cost 18p each.

Write down an expression, in terms of x and y, for the total cost, in pence, of x pens and y pencils.

.....

(2)

(Total for Question 25 is 2 marks)

EP SPECIMEN

Question 26

2 marks | Algebra Toolkit

26 $T = \dfrac{a^2 + b}{2c}$

Work out the value of T when $a = -3$, $b = 7$ and $c = 0.5$

$T =$ .....

(2)

(Total for Question 26 is 2 marks)

EP SPECIMEN

Question 27

2 marks | Algebra Toolkit

27 Simplify $6x^2y - 2xy^2 + 3x^2y + 5xy^2$

.....

(2)

(Total for Question 27 is 2 marks)

EP SPECIMEN

Question 28

2 marks | Algebra Toolkit

28 A rectangle has length $(3x + 2)$ cm and width $(x - 1)$ cm.

Show that the perimeter, in cm, of the rectangle is $8x + 2$

.....

(2)

(Total for Question 28 is 2 marks)

EP SPECIMEN

Question 29

2 marks | Algebra Toolkit

29 Here are five expressions.

$3n \quad n+3 \quad n^3 \quad 3n^2 \quad -n$

When $n = -2$, which expression has the greatest value?
You must show your working.

.....

(2)

(Total for Question 29 is 2 marks)

TOPIC

Expanding Brackets

Every past-paper question on this topic, 2020 to 2026.

4MA1/1HR MAY/NOVEMBER 2020

Question 14

3 marks | Expanding Brackets

14 Expand and simplify $(4x + 1)(x - 3)(5x + 6)$

(Total for Question 14 is 3 marks)

Question 1

8 marks | Expanding Brackets

1 $w = 5y^2 - y^3$

(a) Work out the value of w when $y = -2$

$w =$ .....

(2)

(b) Factorise fully $8p^2 - 2p$

.....

(2)

(c) Expand $4t(3t - 2)$

.....

(2)

(d) Expand and simplify $(5x - 2)(x + 4)$

.....

(2)

(Total for Question 1 is 8 marks)

Question 12

6 marks | Expanding Brackets

12 (a) Express $\frac{4}{x-2} - \frac{3}{x+1}$ as a single fraction.

Give your answer in its simplest form.

.....

(3)

(b) Expand and simplify $2x(x-5)(x-3)$

.....

(3)

(Total for Question 12 is 6 marks)

Question 16

5 marks | Expanding Brackets

16 (a) Expand and simplify $(x + 4)(x - 2)(x + 1)$

.....

(3)

(b) Express $x^2 - 10x + 40$ in the form $(x + a)^2 + b$, where a and b are integers.

.....

(2)

(Total for Question 16 is 5 marks)

Question 13

3 marks | Expanding Brackets

13 Expand and simplify $4x(3x + 1)(2x - 3)$
Show your working clearly.

(Total for Question 13 is 3 marks)

4MA1/1H NOVEMBER 2021

Question 1

3 marks | Expanding Brackets

1 (a) Simplify $e^8 \div e^2$

.....

(1)

(b) Expand and simplify $(x - 3)(x + 1)$

.....

(2)

(Total for Question 1 is 3 marks)

Question 12

7 marks | Expanding Brackets

12 (a) Simplify $(64p^9q^{12})^{\frac{2}{3}}$

.....

(2)

(b) Write as a single fraction $\frac{2}{3x} + \frac{4}{5x} - \frac{9}{10x}$

Give your answer in its simplest form.

.....

(2)

(c) Expand and simplify $4x(x - 5)(2x + 3)$

Show your working clearly.

.....

(3)

(Total for Question 12 is 7 marks)

4MA1/2H JANUARY 2022

Question 1

4 marks | Expanding Brackets

1 (a) Expand and simplify $(y + 4)(2 - y)$

.....

(2)

(b) Factorise fully $15b^5c - 35b^3c^9$

.....

(2)

(Total for Question 1 is 4 marks)

Question 13

6 marks | Expanding Brackets

13 (a) Expand and simplify $5x(x + 2)(3x - 4)$

.....

(3)

(b) Simplify completely $\left(\frac{16w^8}{y^{20}}\right)^{-\frac{3}{4}}$

.....

(3)

(Total for Question 13 is 6 marks)

4MA1/1HR JUNE 2022

Question 16

6 marks | Expanding Brackets

16 (a) Expand and simplify $(3x - 1)(x + 2)(3x + 1)$

.....

(3)

(b) Simplify fully $\left(\frac{2x^5}{8xy^2}\right)^{-2}$

.....

(3)

(Total for Question 16 is 6 marks)

Question 1

4 marks | Expanding Brackets

1 $P = m^2 - 4c$

(a) Work out the value of P when $m = -5$ and $c = 3$

$P =$ .....

(2)

(b) Expand and simplify $(x + 5)(x - 7)$

.....

(2)

(Total for Question 1 is 4 marks)

Question 16

3 marks | Expanding Brackets

16 Expand and simplify $(2x + 3)(x - 5)(x + 4)$

(Total for Question 16 is 3 marks)

Question 14

6 marks | Expanding Brackets

14 (a) Expand and simplify $(3x+1)(2-x)(4+x)$

.....

(3)

(b) Simplify fully $\left(\frac{a^3b}{a^9b^5}\right)^{-\frac{1}{2}}$

.....

(3)

(Total for Question 14 is 6 marks)

Question 15

3 marks | Expanding Brackets

15 Write $3x(2x-1)(5x+4)$ in the form $ax^3 + bx^2 + cx$ where a, b and c are integers.

(Total for Question 15 is 3 marks)

Question 11

6 marks | Expanding Brackets

11 (a) Expand and simplify $5x(5x + 4)(2x - 3)$

.....

(3)

(b) Express $\frac{9}{4} + \frac{y - 7}{5y}$ as a single fraction in its simplest form.

.....

(3)

(Total for Question 11 is 6 marks)

4MA1/2H JUNE 2025

Question 12

3 marks | Expanding Brackets

12 Expand and simplify $3x(2x+5)(7x-4)$

(Total for Question 12 is 3 marks)

Question 13

5 marks | Expanding Brackets

13 (a) Factorise $4x^2 - 25y^2$

.....

(2)

(b) Show that $4x(x + 3)(2x - 5)$ can be written in the form $ax^3 + bx^2 + cx$ where a, b and c are integers to be found.

(3)

(Total for Question 13 is 5 marks)

Question 15

6 marks | Expanding Brackets

15 (a) Solve $3x^2 + 4x - 18 = 0$
Show your working clearly.
Give your solutions correct to 3 significant figures.

.....

(3)

(b) Expand and simplify $(2x - 3)(x + 4)(x - 1)$

.....

(3)

(Total for Question 15 is 6 marks)

Question 13

6 marks | Expanding Brackets

13 (a) Expand and simplify $7x(3x + 2)(2x - 5)$

.....

(3)

(b) Solve $\frac{9}{2y} + \frac{5}{7} = 5$

Show clear algebraic working.

$y =$ .....

(3)

(Total for Question 13 is 6 marks)

Question 14

6 marks | Expanding Brackets

14 (a) Expand and simplify $7x(3x + 2)(2x - 5)$

.....

(3)

(b) Solve $\frac{9}{2y} + \frac{5}{7} = 5$

Show clear algebraic working.

$y =$ .....

(3)

(Total for Question 14 is 6 marks)

4MA1/1H JUNE 2026

Question 12

6 marks | Expanding Brackets

12 $\dfrac{2^3}{8^x} = 64$

(a) Find the value of x
Show clear algebraic working.

$x =$ .....

(3)

(b) Expand and simplify $4t(t + 5)(2t - 3)$

.....

(3)

(Total for Question 12 is 6 marks)

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TOPIC

Factorising

Every past-paper question on this topic, 2020 to 2026.

Question 7

8 marks | Factorising

7 (a) Solve $5(4 - x) = 7 - 3x$
Show clear algebraic working.

$x =$ .....

(3)

(b) Factorise fully $16m^3g^3 + 24m^2g^5$

.....

(2)

(c) (i) Factorise $y^2 - 2y - 48$

.....

(2)

(ii) Hence, solve $y^2 - 2y - 48 = 0$

.....

(1)

(Total for Question 7 is 8 marks)

Question 9

5 marks | Factorising

9 (a) Simplify $(2x^3y^5)^4$

.....

(2)

(b) (i) Factorise $x^2 + 5x - 36$

.....

(2)

(ii) Hence, solve $x^2 + 5x - 36 = 0$

.....

(1)

(Total for Question 9 is 5 marks)

Question 9

5 marks | Factorising

9 (a) Factorise fully $25a^4c^7d + 45a^9c^3h$

.....

(2)

(b) Solve $(2x + 5)^2 = (2x + 3)(2x - 1)$

$x =$ .....

(3)

(Total for Question 9 is 5 marks)

Question 9

3 marks | Factorising

9 (i) Factorise $x^2 + 2x - 24$

.....

(2)

(ii) Hence solve $x^2 + 2x - 24 = 0$

.....

(1)

(Total for Question 9 is 3 marks)

Question 8

4 marks | Factorising

8 (a) Simplify $(3x^2y)^0$

.....

(1)

(b) (i) Factorise $x^2 - 5x - 36$

.....

(2)

(ii) Hence solve $x^2 - 5x - 36 = 0$

.....

(1)

(Total for Question 8 is 4 marks)

Question 9

5 marks | Factorising

9 (a) Simplify $x^4 \times x^5$

.....

(1)

(b) Simplify $(4y^2)^3$

.....

(2)

(c) Factorise $n^2 - 7n + 12$

.....

(2)

(Total for Question 9 is 5 marks)

Question 5

5 marks | Factorising

5 (a) Expand $3c^3(c + 4)$

.....

(2)

(b) (i) Factorise $x^2 + 8x - 9$

.....

(2)

(ii) Hence, solve $x^2 + 8x - 9 = 0$

.....

(1)

(Total for Question 5 is 5 marks)

Question 11

5 marks | Factorising

11 (a) Factorise $9x^2 - 4y^2$

.....

(2)

(b) Express $\frac{7}{8} - \frac{x+3}{4x}$ as a single fraction in its simplest form.

.....

(3)

(Total for Question 11 is 5 marks)

4MA1/2H JUNE 2022

Question 11

3 marks | Factorising

11 (i) Factorise $x^2 + 5x - 24$

.....

(2)

(ii) Hence, solve $x^2 + 5x - 24 = 0$

.....

(1)

(Total for Question 11 is 3 marks)

Question 6

8 marks | Factorising

6 (a) Simplify $(2c^4d^7)^3$

.....

(2)

(b) Find the value of $5y^0$ where $y > 0$

.....

(1)

(c) Factorise fully $16a^2b^3 + 20a^3b$

.....

(2)

(d) (i) Factorise $x^2 + 9x - 22$

.....

(2)

(ii) Hence solve $x^2 + 9x - 22 = 0$

.....

(1)

(Total for Question 6 is 8 marks)

Question 7

3 marks | Factorising

7 (a) Expand $4x(x - 5)$

.....

(1)

(b) Factorise $y^2 - 9y + 20$

.....

(2)

(Total for Question 7 is 3 marks)

Question 14

3 marks | Factorising

14 Factorise fully $50g^2 - 18$

(Total for Question 14 is 3 marks)

Question 11

3 marks | Factorising

11 (i) Factorise $x^2 + 9x - 22$

.....

(2)

(ii) Hence, solve $x^2 + 9x - 22 = 0$

.....

(1)

(Total for Question 11 is 3 marks)

Question 6

6 marks | Factorising

6 (a) Solve $x - 4 = \dfrac{3 + 2x}{6}$

Show clear algebraic working.

$x =$ .....

(3)

(b) (i) Factorise $y^2 - 11y + 30$

.....

(2)

(ii) Hence solve $y^2 - 11y + 30 = 0$

.....

(1)

(Total for Question 6 is 6 marks)

Question 7

6 marks | Factorising

7 (a) Solve $x - 4 = \frac{3 + 2x}{6}$

Show clear algebraic working.

$x =$ .....

(3)

(b) (i) Factorise $y^2 - 11y + 30$

.....

(2)

(ii) Hence solve $y^2 - 11y + 30 = 0$

.....

(1)

(Total for Question 7 is 6 marks)

Question 8

5 marks | Factorising

8 (a) Simplify $a^6 \times a^{10}$

.....

(1)

(b) Simplify $c^{30} \div c^{12}$

.....

(1)

(c) (i) Factorise $y^2 - 10y + 21$

.....

(2)

(ii) Hence, solve $y^2 - 10y + 21 = 0$

.....

(1)

(Total for Question 8 is 5 marks)

Question 9

7 marks | Factorising

9 (a) Simplify $\left(5k^3n^4\right)^2$

.....

(2)

(b) Factorise fully $12m^2y^4 + 18m^3y$

.....

(2)

(c) (i) Factorise $x^2 - 13x + 42$

.....

(2)

(ii) Hence, solve $x^2 - 13x + 42 = 0$

.....

(1)

(Total for Question 9 is 7 marks)

Question 7

3 marks | Factorising

7 (i) Factorise $x^2 + 2x - 48$

.....

(2)

(ii) Hence, solve $x^2 + 2x - 48 = 0$

.....

(1)

(Total for Question 7 is 3 marks)

Question 8

9 marks | Factorising

8 (a) Expand $5w(3w - 4w^2)$

.....

(2)

(b) Simplify fully $\left(4a^3c^5\right)^3$

.....

(2)

(c) Factorise fully $14m^3p^2 + 21m^2p^4$

.....

(2)

(d) (i) Factorise $x^2 - 10x + 24$

.....

(2)

(ii) Hence solve $x^2 - 10x + 24 = 0$

.....

(1)

(Total for Question 8 is 9 marks)

Question 10

7 marks | Factorising

10 (a) Simplify $(6m)^0$

.....

(1)

(b) Solve $5y + 20 < 7y + 1$

.....

(2)

(c) Factorise fully $15w^2x^5 + 25w^3x^2$

.....

(2)

(d) Simplify fully $\dfrac{36a^5c^7}{12a^2c^3}$

.....

(2)

(Total for Question 10 is 7 marks)

Question 8

2 marks | Factorising

8 Factorise $x^2 - 12x + 32$

.....

(Total for Question 8 is 2 marks)

Question 9

7 marks | Factorising

9 (a) Find the value of $7n^0$ where $n > 0$

.....

(1)

(b) Simplify fully $\left(2m^5p^4\right)^3$

.....

(2)

(c) Factorise fully $18c^5w^2 + 30cw^3$

.....

(2)

(d) Factorise $x^2 + 6x - 27$

.....

(2)

(Total for Question 9 is 7 marks)

Question 9

5 marks | Factorising

9 (a) Factorise $15g^4h - 20gh^3$

.....

(2)

(b) (i) Factorise $x^2 + 3x - 28$

.....

(2)

(ii) Hence, solve $x^2 + 3x - 28 = 0$

.....

(1)

(Total for Question 9 is 5 marks)

TOPIC

Algebraic Fractions

Every past-paper question on this topic, 2020 to 2026.

Question 12

5 marks | Algebraic Fractions

12 (a) Factorise $9x^2 - 4y^2$

.....

(2)

(b) Express $\frac{7}{8} - \frac{x+3}{4x}$ as a single fraction in its simplest form.

.....

(3)

(Total for Question 12 is 5 marks)

Question 21

3 marks | Algebraic Fractions

21 Express $\left(\frac{20}{x^2 - 36} - \frac{2}{x - 6}\right) \times \frac{1}{4 - x}$ as a single fraction in its simplest form.

Show clear algebraic working.

.....

Question 21

3 marks | Algebraic Fractions

21 $a = \dfrac{14}{3x - 7}$ $\quad x = \dfrac{7}{4y - 3}$

Express a in the form $\dfrac{py + q}{ry + s}$ where p, q, r and s are integers.

Give your answer in its simplest form.

$a =$ .....

(Total for Question 21 is 3 marks)

Question 24

4 marks | Algebraic Fractions

24 Express

$$\left(\frac{4}{2x-5}-\frac{3}{2x-3}\right)\div\frac{9x-4x^3}{6x^2-17x+5}$$

as a single fraction in its simplest form.

(Total for Question 24 is 4 marks)

Question 21

5 marks | Algebraic Fractions

21 Express

$$\frac{1}{3x-2} \times \frac{9x^2-4}{3x^2-13x-10} - \frac{7}{x-1}$$

as a single fraction in its simplest form.

(Total for Question 21 is 5 marks)

Question 18

5 marks | Algebraic Fractions

18 Solve the equation

$$\frac{5}{x+2} + \frac{3}{x^2+2x} = 2$$

Show clear algebraic working.

(Total for Question 18 is 5 marks)

Question 21

4 marks | Algebraic Fractions

21 Write $\dfrac{25x^2 - 64}{5x^2 - 13x - 6} \times \dfrac{x^2 - 8x + 15}{5x + 8} - (x - 7)$

as a single fraction in its simplest form.
Show clear algebraic working.

(Total for Question 21 is 4 marks)

Question 21

4 marks | Algebraic Fractions

21 Given that $x = \dfrac{5}{9y + 5}$ and that $y = \dfrac{5}{5a - 2}$

find an expression for x in terms of a.
Give your expression as a single fraction in its simplest form.

(Total for Question 21 is 4 marks)

Question 12

5 marks | Algebraic Fractions

12 (a) Expand and simplify $n(n-4)(3n+5)$

.....

(2)

(b) Express

$$\frac{3}{x}+\frac{x+2}{2x}+\frac{1}{4}$$

as a single fraction in its simplest form.

.....

(3)

(Total for Question 12 is 5 marks)

Question 19

3 marks | Algebraic Fractions

19 $a = \dfrac{14}{3x - 7}$ $x = \dfrac{7}{4y - 3}$

Express a in the form $\dfrac{py + q}{ry + s}$ where p, q, r and s are integers.

Give your answer in its simplest form.

$a =$ .....

(Total for Question 19 is 3 marks)

Question 23

3 marks | Algebraic Fractions

23 Express $\left(\frac{20}{x^2 - 36} - \frac{2}{x - 6}\right) \times \frac{1}{4 - x}$ as a single fraction in its simplest form.

(Total for Question 23 is 3 marks)

Question 23

4 marks | Algebraic Fractions

23 Simplify $\left(x^2 - 4\right) \div \left(\dfrac{4x^2 - 7x - 2}{x}\right) - 2x$

Give your answer in the form $\dfrac{ax^2}{bx + c}$ where a, b and c are integers.

(Total for Question 23 is 4 marks)

Question 11

3 marks | Algebraic Fractions

11 Express $\frac{3}{4}+\frac{5-x}{6x}$ as a single fraction in its simplest terms.

(Total for Question 11 is 3 marks)

Question 24

5 marks | Algebraic Fractions

24 Solve $\dfrac{45x^3 - 80x}{3x^2 + x - 4} \times \left(\dfrac{1}{3x - 4} + \dfrac{1}{x} \right) = \dfrac{4(x + 2)}{5x - 8}$

Show clear algebraic working.

$x =$ .....

(Total for Question 24 is 5 marks)

Question 12

5 marks | Algebraic Fractions

12 (a) Factorise fully $6y^2 - 5y - 4$

.....

(2)

(b) Express $\frac{2x+1}{4x} + \frac{7-5x}{3x}$ as a single fraction in its simplest form.

.....

(3)

(Total for Question 12 is 5 marks)

Question 20

3 marks | Algebraic Fractions

20 Given that $k = x - y$ and $x = \frac{1}{4y}$

express $\frac{5k}{x+2}$ in the form $\frac{a - by^2}{c + dy}$ where a, b, c and d are integers.

(Total for Question 20 is 3 marks)

4MA1/2HR JUNE 2024

Question 26

4 marks | Algebraic Fractions

26 Write $4 - \left[(3x - 5) \div \dfrac{3x^2 + x - 10}{4x - 1} \right]$ as a single fraction in its simplest form.

(Total for Question 26 is 4 marks)

4MA1/1H JUNE 2025

Question 12

3 marks | Algebraic Fractions

12 Express $\frac{5}{4} + \frac{x-3}{6x}$ as a single fraction in its simplest form.

(Total for Question 12 is 3 marks)

Question 19

3 marks | Algebraic Fractions

19 Simplify fully $\dfrac{3x^2 - 3y^2}{5x + 5y} \div \dfrac{xy^2 - x^2y}{10xy}$

Show clear algebraic working.

(Total for Question 19 is 3 marks)

Question 20

3 marks | Algebraic Fractions

20 Given that $k = m + n$ and $m = \frac{3}{4n}$

express $\frac{7k}{5 - m}$ in the form $\frac{a + bn^2}{cn - d}$ where a, b and c are integers and d is prime.

(Total for Question 20 is 3 marks)

Question 23

4 marks | Algebraic Fractions

23 $\dfrac{4x^2-4x-120}{5x^2-180} \div \dfrac{x^2+5x}{10x^2+60x} = p$ where p is an integer.

Find the value of p

Show clear algebraic working.

$p =$ .....

(Total for Question 23 is 4 marks)

Question 24

4 marks | Algebraic Fractions

24 Write $(2x-1)+\dfrac{2x^2-5x-12}{x^2-16}\times\dfrac{x^2+4x}{6x^2+11x+3}$ as a single fraction in its simplest form.

Show clear algebraic working.

(Total for Question 24 is 4 marks)

Question 23

3 marks | Algebraic Fractions

23 $a = \dfrac{2x + 5}{1 - x}$ $x = \dfrac{5 - 2y}{3y}$

Write a in the form $\dfrac{m + ny}{p(y - 1)}$ where m, n and p are integers.

Show your working clearly.

$a =$ .....

(Total for Question 23 is 3 marks)

Question 25

3 marks | Algebraic Fractions

25 $a = \dfrac{2x + 5}{1 - x}$ $x = \dfrac{5 - 2y}{3y}$

Write a in the form $\dfrac{m + ny}{p(y - 1)}$ where m, n and p are integers.

Show your working clearly.

$a =$ .....

(Total for Question 25 is 3 marks)

Question 28

4 marks | Algebraic Fractions

28 Solve $\dfrac{6x^3 + 5x^2 + x}{4x^2 - 1} \div \dfrac{15x^2 - x - 2}{8x - 4} = 2x$

Show clear algebraic working.

$x =$ .....

(Total for Question 28 is 4 marks)

4MA1/1HR JUNE 2026

Question 16

6 marks | Algebraic Fractions

16 (a) Express $\frac{5}{8} - \frac{x+2}{4x}$ as a single fraction in its simplest form.

.....

(3)

(b) Expand and simplify $3x(2x - 1)(x + 4)$

.....

(3)

(Total for Question 16 is 6 marks)

Question 18

3 marks | Algebraic Fractions

18 Simplify fully $\dfrac{4x^2 - 9}{2x^2 - 5x - 12}$

Show clear algebraic working.

.....

(Total for Question 18 is 3 marks)

Question 20

4 marks | Algebraic Fractions

20 Express $\left(\frac{5}{4x-7}-\frac{3}{3x-5}\right)\div\frac{9x^2-16}{6x^2-7x-5}$ as a single fraction in its simplest form.

Show clear algebraic working.

.....

(Total for Question 20 is 4 marks)

TOPIC

Algebraic Roots & Indices

Every past-paper question on this topic, 2020 to 2026.

Question 3

2 marks | Algebraic Roots & Indices

3 $\frac{2^k}{4^n} = 2^x$

Find an expression for x in terms of k and n

$x =$ .....

(Total for Question 3 is 2 marks)

Question 7

4 marks | Algebraic Roots & Indices

7 (a) Simplify $8 \times (4t)^0$

.....

(1)

$x^6 \div x^{-5} = x^p$

(b) Find the value of p

$p =$ .....

(1)

(c) Simplify fully $(2k^2m^4)^3$

.....

(2)

Question 13

6 marks | Algebraic Roots & Indices

13 (a) Expand and simplify $(3x-1)(x+2)(3x+1)$

.....

(3)

(b) Simplify fully $\left(\frac{2x^5}{8xy^2}\right)^{-2}$

.....

(3)

(Total for Question 13 is 6 marks)

Question 22

3 marks | Algebraic Roots & Indices

22 $\dfrac{16 \times (\sqrt{27})^{}}{6 \times 9^{2n+8}} = 3^x$

Express x in terms of n

Show your working clearly and simplify your expression.

$x =$ .....

4MA1/2H JANUARY 2020

Question 1

3 marks | Algebraic Roots & Indices

1 (a) Simplify $\dfrac{x^9}{x^2}$

.....

(1)

(b) Write $\dfrac{7^8 \times 7^4}{7^3}$ as a single power of 7

.....

(2)

(Total for Question 1 is 3 marks)

Question 17

6 marks | Algebraic Roots & Indices

17 (a) Show that $\left(6+2\sqrt{12}\right)^2 = 12\left(7+4\sqrt{3}\right)$

Show each stage of your working.

(3)

(b) Simplify fully $\left(\frac{27a^{12}}{t^{15}}\right)^{-\frac{2}{3}}$

.....

(3)

(Total for Question 17 is 6 marks)

Question 21

7 marks | Algebraic Roots & Indices

21 (a) Simplify fully $\dfrac{10x^2 + 23x + 12}{4x^2 - 9}$

.....

(3)

$2^{2y} \times 2^{3y+2} = \dfrac{8^{5y}}{4^n}$

(b) Find an expression for n in terms of y.
Show clear algebraic working and simplify your expression.

.....

(4)

(Total for Question 21 is 7 marks)

Question 21

5 marks | Algebraic Roots & Indices

21 Given that $M = \dfrac{18^{4n} \times 2^{3(n^2-6n)} \times 3^{2(1-4n)}}{12^2}$

find the values of n for which $M = 2$

(Total for Question 21 is 5 marks)

Question 4

4 marks | Algebraic Roots & Indices

4 (a) Simplify $(3k^2)^4$

.....

(2)

(b) Simplify $(21m^4n) \div (3n^{-5})$

.....

(2)

(Total for Question 4 is 4 marks)

Question 11

3 marks | Algebraic Roots & Indices

11 Simplify fully $\left(\frac{9t^4w^9}{18t^6w^{10}}\right)^{-2}$

(Total for Question 11 is 3 marks)

Question 12

9 marks | Algebraic Roots & Indices

12 (a) Simplify $(16e^{10}f^{6})^{\frac{1}{2}}$

.....

(2)

(b) Write $\frac{2x+1}{4}+\frac{x-2}{3}$ as a single fraction in its simplest form.

.....

(3)

Given that $4^{k+3}=16\times 2^{k}$

(c) find the value of k.
Show your working clearly.

$k =$ .....

(4)

(Total for Question 12 is 9 marks)

Question 19

7 marks | Algebraic Roots & Indices

19 (a) Simplify $8^2 \times \sqrt[3]{4^6}$

Give your answer in the form 2^a where a is an integer.

Show each stage of your working clearly.

.....

(3)

Given that $n^{\left(-\frac{4}{5}\right)} = \left(\frac{1}{2}\right)^4$ where $n > 0$

(b) find the value of n.

$n =$ .....

(4)

(Total for Question 19 is 7 marks)

Question 11

4 marks | Algebraic Roots & Indices

11 $\sqrt{2} \times 16 = 2^x$

(a) Find the value of x.
Show your working clearly.

$x =$ .....

(2)

$$\frac{(11^{-6})^5}{11^4} = 11^n$$

(b) Find the value of n.
Show your working clearly.

$n =$ .....

(2)

(Total for Question 11 is 4 marks)

Question 14

3 marks | Algebraic Roots & Indices

14 Simplify fully $\left(\frac{9x^4}{16y^{10}}\right)^{-\frac{1}{2}}$

(Total for Question 14 is 3 marks)

4MA1/2H NOVEMBER 2021

Question 1

4 marks | Algebraic Roots & Indices

1 (a) Write down the value of m, given that $3^4 \times 3^5 = 3^m$

$m =$ .....

(1)

(b) Write down the value of n, given that $(5^3)^7 = 5^n$

$n =$ .....

(1)

(c) Find the value of p, given that $\dfrac{7^8 \times 7^2}{7^p} = 7^6$

$p =$ .....

(2)

(Total for Question 1 is 4 marks)

Question 1

6 marks | Algebraic Roots & Indices

1 (a) Simplify $a^7 \times a^4$

.....

(1)

(b) Simplify $w^{15} \div w^3$

.....

(1)

(c) Simplify $(8x^5y^3)^2$

.....

(2)

(d) Make t the subject of $c = t^3 - 8v$

.....

(2)

(Total for Question 1 is 6 marks)

Question 6

4 marks | Algebraic Roots & Indices

6 (a) Write down the value of x^0

.....

(1)

Given that $2^{-3} \times 2^9 = 2^n$

(b) find the value of n

$n =$ .....

(1)

Given that $\dfrac{7^{206} \times 7^m}{7^{214}} = 7^{-3}$

(c) find the value of m

$m =$ .....

(2)

(Total for Question 6 is 4 marks)

Question 7

2 marks | Algebraic Roots & Indices

7 $\frac{2^k}{4^n} = 2^x$

Find an expression for x in terms of k and n

$x =$ .....

(Total for Question 7 is 2 marks)

Question 9

4 marks | Algebraic Roots & Indices

9 (a) Simplify $8 \times (4t)^0$

.....

(1)

$x^6 \div x^{-5} = x^p$

(b) Find the value of p

$p =$ .....

(1)

(c) Simplify fully $(2k^2m^4)^3$

.....

(2)

(Total for Question 9 is 4 marks)

Question 24

3 marks | Algebraic Roots & Indices

24

$$\frac{18 \times (\sqrt{27})}{6 \times 9^{2n+8}} = 3^x$$

Express x in terms of n
Show your working clearly and simplify your expression.

$x =$ .....

(Total for Question 24 is 3 marks)

Question 6

4 marks | Algebraic Roots & Indices

6 (a) Simplify $m^{10} \div m^3$

.....

(1)

$k^n \times k^4 = k^{12}$

(b) Write down the value of n

$n =$ .....

(1)

(c) Simplify $(3x^6y^8)^2$

.....

(2)

(Total for Question 6 is 4 marks)

4MA1/2HR JUNE 2023

Question 7

2 marks | Algebraic Roots & Indices

7 (a) Simplify $(4^{-2})^0$

.....

(1)

$3^{-14} \times 3^8 = 3^m$

(b) Find the value of m

$m =$ .....

(1)

(Total for Question 7 is 2 marks)

4MA1/2HR JUNE 2023

Question 11

2 marks | Algebraic Roots & Indices

11 Express $\left(\frac{m^6k^{10}}{25}\right)^{\frac{3}{2}}$ in the form $\frac{m^ak^b}{c}$ where a, b and c are integers to be found.

(Total for Question 11 is 2 marks)

Question 15

7 marks | Algebraic Roots & Indices

15 (a) Simplify fully $\left(32a^{15}\right)^{\frac{3}{5}}$

.....

(2)

(b) Express $\left(\frac{1}{10x}\right)^{-3}$ in the form px^n where p and n are integers.

.....

(2)

(c) Solve $\frac{1-2y}{3} = \frac{4}{5} - \frac{2y-1}{2}$

Show clear algebraic working.

$y =$ .....

(3)

(Total for Question 15 is 7 marks)

Question 24

5 marks | Algebraic Roots & Indices

24 Given that

$$2^n = 2^{x^2} \times 16^x \times 8$$

and

$$x > 0$$

find an expression for x in terms of n
State any restrictions on n

(Total for Question 24 is 5 marks)

Question 4

8 marks | Algebraic Roots & Indices

4 (a) Solve $\frac{2x+5}{6} = 2x - 5$

Show clear algebraic working.

$x =$ .....

(3)

(b) Simplify $h^{15} \div h^3$

.....

(1)

(c) Simplify fully $\left(2g^3k^5\right)^4$

.....

(2)

(d) Given that $\frac{y^5 \times y^n}{y^7} = y^{12}$

work out the value of n

$n =$ .....

(2)

(Total for Question 4 is 8 marks)

Question 12

4 marks | Algebraic Roots & Indices

12 $2^7 \times 4^5 = 4^x$

(a) Calculate the value of x

$x =$ .....

(2)

(b) Simplify fully $\left(125p^6y^{24}\right)^{\frac{2}{3}}$

.....

(2)

(Total for Question 12 is 4 marks)

Question 7

2 marks | Algebraic Roots & Indices

7 $\dfrac{3^{-2}\times 3^{5}}{3^{10}} = 3^{n}$

Find the value of n

$n =$ .....

(Total for Question 7 is 2 marks)

Question 10

4 marks | Algebraic Roots & Indices

10 (a) Simplify $(2p)^0$ where $p > 0$

.....

(1)

$y^9 \times y^{-3} = y^n$

(b) Find the value of n

$n =$ .....

(1)

(c) Simplify fully $(5a^4c^2)^3$

.....

(2)

(Total for Question 10 is 4 marks)

Question 17

4 marks | Algebraic Roots & Indices

17 (a) $\left(\sqrt[4]{k^{12}}\right)^5 = k^n$

Find the value of n

$n =$ .....

(1)

(b) Express $\dfrac{7}{2-\sqrt{3}}$ in the form $\sqrt{c} + d$ where c and d are integers.

Show your working clearly.

.....

(3)

(Total for Question 17 is 4 marks)

4MA1/2H JUNE 2024

Question 23

3 marks | Algebraic Roots & Indices

23 Simplify $\dfrac{30 \times 25^{2x+7}}{\sqrt{180} \times \left(\sqrt{5}\right)^{4x+9}}$

Give your answer in the form 5^w where w is an expression in terms of x
Show each stage of your working clearly.

(Total for Question 23 is 3 marks)

Question 14

3 marks | Algebraic Roots & Indices

14 Given that $\frac{3^{2n+3}}{3^4} = 3^3 \times 3^{1-2n}$

find the value of n
Show your working clearly.

$n =$ .....

(Total for Question 14 is 3 marks)

4MA1/1H JUNE 2025

Question 4

4 marks | Algebraic Roots & Indices

4 $x^5 \times x^7 = x^m$

(a) Find the value of m

$m =$ .....

(1)

$y^8 \div y^3 = y^n$

(b) Find the value of n

$n =$ .....

(1)

(c) Simplify fully $(5a^4r^2)^3$

.....

(2)

(Total for Question 4 is 4 marks)

Question 5

4 marks | Algebraic Roots & Indices

5 $x^5 \times x^7 = x^m$

(a) Find the value of m

$m =$ .....

(1)

$y^8 \div y^3 = y^n$

(b) Find the value of n

$n =$ .....

(1)

(c) Simplify fully $(5a^4r^2)^3$

.....

(2)

(Total for Question 5 is 4 marks)

Question 5

4 marks | Algebraic Roots & Indices

5 $3^8 \times 3^4 = 3^m$

(a) Find the value of m

$m =$ .....

(1)

$4^{12} \div 4^7 = 4^n$

(b) Find the value of n

$n =$ .....

(1)

$\left(6^2\right)^{10} = 6^p$

(c) Find the value of p

$p =$ .....

(1)

$5^r = 1$

(d) Write down the value of r

$r =$ .....

(1)

(Total for Question 5 is 4 marks)

Question 6

5 marks | Algebraic Roots & Indices

6 (a) Write down the value of 5^0

.....

(1)

$$\frac{5^9 \times 5^{-3}}{5^{-2}} = 5^k$$

(b) Find the value of k

$k =$ .....

(2)

(c) Simplify fully $\left(2d^4e^5\right)^3$

.....

(2)

(Total for Question 6 is 5 marks)

Question 9

3 marks | Algebraic Roots & Indices

9 $7^x = 1$

(a) Write down the value of x

$x =$ .....

(1)

$$\frac{8^{-4} \times 8^{11}}{8^{12}} = 8^n$$

(b) Work out the value of n

$n =$ .....

(2)

(Total for Question 9 is 3 marks)

4MA1/2H JUNE 2025

Question 15

3 marks | Algebraic Roots & Indices

15 Simplify fully $\left(\frac{2a^3}{10a^7c^2}\right)^{-3}$

(Total for Question 15 is 3 marks)

Question 16

3 marks | Algebraic Roots & Indices

16 Solve the equation $8^{3y+4} \times 4^{3y} = 2^{5y}$
Show your working clearly.

$y =$ .....

(Total for Question 16 is 3 marks)

Question 7

2 marks | Algebraic Roots & Indices

7 $\dfrac{8^{-2} \times 8^{9}}{8^{10}} = 8^{n}$

Work out the value of n

$n =$ .....

(Total for Question 7 is 2 marks)

Question 8

2 marks | Algebraic Roots & Indices

8 $\dfrac{8^{-2} \times 8^{9}}{8^{10}} = 8^{n}$

Work out the value of n

$n =$ .....

(Total for Question 8 is 2 marks)

Question 13

4 marks | Algebraic Roots & Indices

13 (a) Simplify fully $\left(\frac{125x^6}{y^{15}}\right)^3$

.....

(2)

Given that $4^n = \frac{4^m}{64^p}$

(b) Express n in terms of m and p

$n =$ .....

(2)

(Total for Question 13 is 4 marks)

Question 15

3 marks | Algebraic Roots & Indices

15 $\dfrac{16^{x-3} \times 8^{x+1}}{32^{x}} = 2^{n}$

Express n in terms of x
Give your answer in its simplest form.

$n =$ .....

(Total for Question 15 is 3 marks)

4MA1/1HR JUNE 2026

Question 3

2 marks | Algebraic Roots & Indices

3 (a) Simplify $e^7 \times e^3$

.....

(1)

(b) Simplify $g^5 \div g^2$

.....

(1)

(Total for Question 3 is 2 marks)

Question 6

2 marks | Algebraic Roots & Indices

6 Simplify $\left(4x^5y^6\right)^3$

.....

(Total for Question 6 is 2 marks)

Question 6

2 marks | Algebraic Roots & Indices

6 Simplify $\left(4x^5y^6\right)^3$

.....

(Total for Question 6 is 2 marks)

Question 12

6 marks | Algebraic Roots & Indices

12 $\dfrac{2^{\frac{x}{3}}}{8^x} = 64$

(a) Find the value of x
Show clear algebraic working.

$x =$ .....

(3)

(b) Expand and simplify $4t(t + 5)(2t - 3)$

.....

(3)

(Total for Question 12 is 6 marks)

Question 16

2 marks | Algebraic Roots & Indices

16 $\left(\frac{1}{\sqrt{a}}\right)^6 = a^n$

Work out the value of n

$n =$ .....

(Total for Question 16 is 2 marks)

4MA1/1HR JUNE 2026

Question 26

3 marks | Algebraic Roots & Indices

26

$$\frac{27^x \times 3^{n+6}}{9^{4-n}} = \frac{6^x}{2^x}$$

Express x in terms of n
Show your working clearly and simplify your expression.

$x =$ .....

(Total for Question 26 is 3 marks)

TOPIC

Linear Equations

Every past-paper question on this topic, 2020 to 2026.

Question 4

5 marks | Linear Equations

4 (a) Expand and simplify $(n - 6)(n + 4)$

.....

(2)

(b) Solve $2x - 3 = \frac{3x - 5}{4}$

Show clear algebraic working.

$x =$ .....

(3)

(Total for Question 4 is 5 marks)

Question 7

9 marks | Linear Equations

7 (a) Expand and simplify $(m - 8)(m + 5)$

.....

(2)

(b) Factorise fully $5y + 20y^2$

.....

(2)

(c) Simplify $(p^2 + 3)^0$

.....

(1)

(d) Solve $3(2x - 5) = \frac{9 - x}{2}$

Show clear algebraic working.

$x =$ .....

(4)

(Total for Question 7 is 9 marks)

Question 3

6 marks | Linear Equations

3 (a) Simplify $h^7 \times h^2$

.....

(1)

$G = c^2 - 4c$

(b) Find the value of G when $c = -5$

$G =$ .....

(2)

(c) Solve $\frac{5x - 3}{4} = 2x + 3$

Show clear algebraic working.

$x =$ .....

(3)

(Total for Question 3 is 6 marks)

Question 5

5 marks | Linear Equations

5 (a) Factorise fully $15y^4 + 20uy^3$

.....

(2)

(b) Solve $4 - 3x = \dfrac{5 - 8x}{4}$

Show clear algebraic working.

$x =$ .....

(3)

(Total for Question 5 is 5 marks)

Question 3

5 marks | Linear Equations

3 (a) Solve $4y + 5 > 12$

.....

(2)

(b) Solve $6x - 5 = \frac{4x - 7}{2}$

Show clear algebraic working.

$x =$ .....

(3)

(Total for Question 3 is 5 marks)

Question 5

5 marks | Linear Equations

5 (a) Expand and simplify $(n - 6)(n + 4)$

.....

(2)

(b) Solve $2x - 3 = \dfrac{3x - 5}{4}$

Show clear algebraic working.

$x =$ .....

(3)

(Total for Question 5 is 5 marks)

Question 6

8 marks | Linear Equations

6 (a) Solve $p = \dfrac{3p - 5}{10}$

Show clear algebraic working.

$p =$ .....

(3)

(b) Simplify a^0 where $a > 0$

.....

(1)

(c) Simplify fully $\dfrac{3xy^3}{6x^2y}$

.....

(2)

(d) Factorise fully $10c^3d^2 + 15cd^4$

.....

(2)

(Total for Question 6 is 8 marks)

Question 6

8 marks | Linear Equations

6 (a) Solve $\frac{2f}{3} = 4f - 17$

Show clear algebraic working.

$f =$ .....

(3)

(b) Simplify $(e + 12)^0$ where $e > 0$

.....

(1)

(c) Simplify fully $\frac{12a^4h^6}{4ah^2}$

.....

(2)

(d) Factorise fully $20x^5y + 12x^3y^4$

.....

(2)

(Total for Question 6 is 8 marks)

Question 6

5 marks | Linear Equations

6 (a) Expand and simplify $(m + 5)(m - 8)$

.....

(2)

(b) Solve $3n - 4 = \dfrac{5n + 6}{3}$

Show clear algebraic working.

$n =$ .....

(3)

(Total for Question 6 is 5 marks)

Question 3

6 marks | Linear Equations

3 (a) Simplify $\left(p^3\right)^5$

.....

(1)

(b) Expand and simplify $2n(4n+3)+n(n-4)$

.....

(2)

(c) Solve $\dfrac{2x+5}{3}=4-x$

Show clear algebraic working.

$x =$ .....

(3)

(Total for Question 3 is 6 marks)

Question 1

5 marks | Linear Equations

1 (a) Factorise fully $18c - 45cd$

.....

(2)

(b) Solve $\frac{5 - 2x}{6} = 3x - 4$

Show clear algebraic working.

$x =$ .....

(3)

(Total for Question 1 is 5 marks)

Question 12

6 marks | Linear Equations

12 (a) Solve $\frac{5a+8}{3} - \frac{2a+5}{4} = 23$

Show clear algebraic working.

$a =$ .....

(4)

(b) Express $\left(\frac{\sqrt{y}}{3}\right)^{-1}$ in the form cy^n where c and n are numbers to be found.

.....

(2)

(Total for Question 12 is 6 marks)

Question 15

6 marks | Linear Equations

15 (a) Solve $\frac{5a+8}{3} - \frac{2a+5}{4} = 23$

Show clear algebraic working.

$a =$ .....

(4)

(b) Express $\left(\frac{\sqrt{y}}{3}\right)^{-1}$ in the form cy^n where c and n are numbers to be found.

.....

(2)

(Total for Question 15 is 6 marks)

Question 4

8 marks | Linear Equations

4 (a) Solve $3(x + 2) = 1 - 5x$
Show clear algebraic working.

$x =$ .....
(3)

$P = c^2 - 5d$

(b) Work out the value of P when $c = -7$ and $d = 3$

$P =$ .....
(2)

(c) Simplify m^0

.....
(1)

(d) Simplify $(4r^2t)^3$

.....
(2)

(Total for Question 4 is 8 marks)

TOPIC

Forming & Solving Equations

Every past-paper question on this topic, 2020 to 2026.

Question 3

4 marks | Forming & Solving Equations

3 Three tins, A, B and C, each contain buttons.

Tin A contains x buttons.
Tin B contains 4 times the number of buttons that tin A contains.
Tin C contains 7 fewer buttons than tin A.

The total number of buttons in the three tins is 137

Work out the number of buttons in tin C.

(Total for Question 3 is 4 marks)

Question 2

4 marks | Forming & Solving Equations

2 Here are two rectangles, rectangle A and rectangle B.

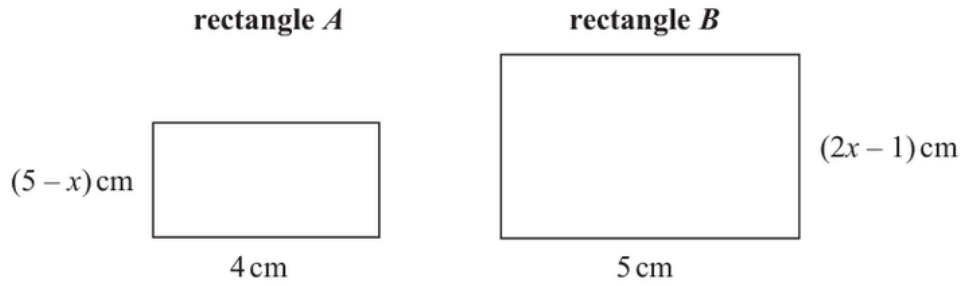


Diagram **NOT** accurately drawn

The area of rectangle B is twice the area of rectangle A.

Work out the value of x.
Show your working clearly.

$x =$ .....

(Total for Question 2 is 4 marks)

Question 5

5 marks | Forming & Solving Equations

5 Yasmin has some identical rectangular tiles.
Each tile is L cm by W cm.

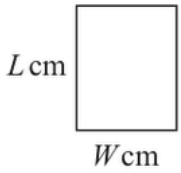


Diagram **NOT** accurately drawn

Using 9 of her tiles, Yasmin makes rectangle $ABCD$, shown in the diagram below.

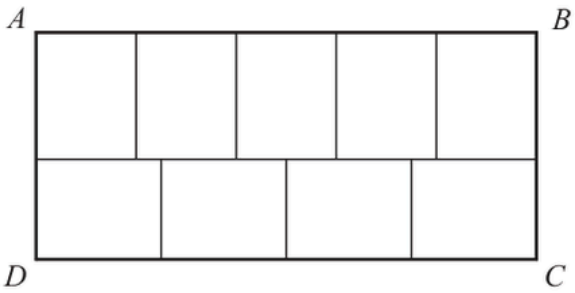


Diagram **NOT** accurately drawn

The area of $ABCD$ is $1620\,\text{cm}^2$

Work out the value of L and the value of W.

$L =$ ..... $W =$ .....

(Total for Question 5 is 5 marks)

Question 2

6 marks | Forming & Solving Equations

2 (a) Factorise fully $12pq - 18p$

.....

(2)

There are 56 metal bars in a box.
Each metal bar is gold or silver or zinc.

y metal bars are gold.
$(3y + 7)$ metal bars are silver.
$(2y - 5)$ metal bars are zinc.

(b) Work out the number of metal bars that are zinc.
Show clear algebraic working.

.....

(4)

(Total for Question 2 is 6 marks)

Question 6

3 marks | Forming & Solving Equations

$\left(6^2\right)^{10} = 6^p$

(c) Find the value of p

$p =$ .....

(1)

$5^r = 1$

(d) Write down the value of r

$r =$ .....

(1)

(Total for Question 5 is 4 marks)

6 The diagram shows triangle ABC

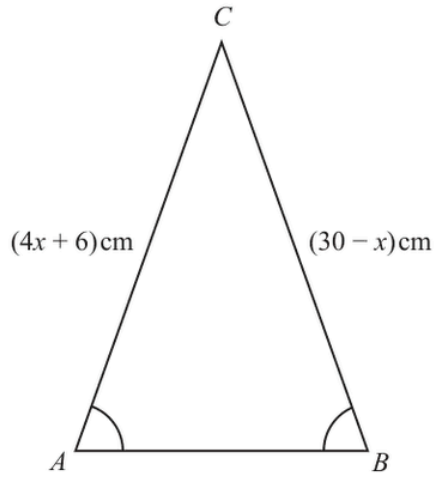


Diagram **NOT** accurately drawn

$CA = (4x + 6)$ cm $\quad CB = (30 - x)$ cm $\quad$ angle CAB = angle CBA

Work out the value of x

$x =$ .....

(Total for Question 6 is 3 marks)

Question 20

3 marks | Forming & Solving Equations

20 Here is a quadratic equation.

$$ax^2 + 4x + c = 0$$

The solutions of this equation are given by $x = \dfrac{-4 \pm 2\sqrt{39}}{10}$

Find the value of a and the value of c
Show your working clearly.

$a =$ .....

$c =$ .....

(Total for Question 20 is 3 marks)

TOPIC

Rearranging Formulae

Every past-paper question on this topic, 2020 to 2026.

Question 3

8 marks | Rearranging Formulae

3 (a) Make a the subject of $d = g + 2ac$

.....

(2)

(b) Factorise fully $9ef - 12f$

.....

(2)

(c) Expand and simplify $(x + 2)(x - 5)$

.....

(2)

(d) Simplify fully $\dfrac{n^4 \times n^7}{n^5}$

.....

(2)

(Total for Question 3 is 8 marks)

Question 16

4 marks | Rearranging Formulae

16 Make x the subject of $y = \sqrt{\dfrac{x+1}{x-4}}$

(Total for Question 16 is 4 marks)

Question 6

5 marks | Rearranging Formulae

6 (a) Make c the subject of $A = \frac{c}{y} - 5z$

.....

(2)

(b) Write down the value of g^0

.....

(1)

(c) Factorise $x^2 - 11x + 24$

.....

(2)

(Total for Question 6 is 5 marks)

Question 14

7 marks | Rearranging Formulae

14 (a) Solve $\frac{9a-7}{5} - \frac{3a-7}{4} = 4.55$

Show clear algebraic working.

$a =$ .....

(3)

(b) Make c the subject of the formula $p = \sqrt{\frac{ac+8}{3+c}}$

.....

(4)

(Total for Question 14 is 7 marks)

Question 5

6 marks | Rearranging Formulae

5 (a) Expand and simplify $3x(2x + 3) - x(3x + 5)$

.....

(2)

(b) Make t the subject of the formula $p = at - d$

.....

(2)

Given that $\frac{w^5 \times w^n}{w^3} = w^{10}$

(c) work out the value of n.

$n =$ .....

(2)

(Total for Question 5 is 6 marks)

Question 17

8 marks | Rearranging Formulae

17 (a) Factorise $6y^2 - y - 5$

.....

(2)

(b) Make f the subject of $w = \dfrac{2f + 3}{8 - f}$

.....

(3)

(c) Express $4x^2 - 8x + 7$ in the form $a(x + b)^2 + c$ where a, b and c are integers.

.....

(3)

(Total for Question 17 is 8 marks)

Question 15

4 marks | Rearranging Formulae

15 Make t the subject of $n^2 = \dfrac{4d + t^3}{t^3}$

(Total for Question 15 is 4 marks)

Question 14

7 marks | Rearranging Formulae

14 (a) Expand and simplify $(5 - x)(2x + 3)(x + 4)$
Show your working clearly.

.....

(3)

(b) Make c the subject of $g = \dfrac{c + 3}{4 + c} - 7$

.....

(4)

(Total for Question 14 is 7 marks)

Question 17

7 marks | Rearranging Formulae

17 (a) Expand and simplify $(x + 6)(3x - 2)(x + 6)$

.....

(3)

(b) Make e the subject of $w = \sqrt{\dfrac{e + g}{ef - d}}$

.....

(4)

(Total for Question 17 is 7 marks)

Question 17

4 marks | Rearranging Formulae

17 Make x the subject of $y = \sqrt[3]{\dfrac{6+5x}{x+4}}$

(Total for Question 17 is 4 marks)

Question 15

3 marks | Rearranging Formulae

15 Make n the subject of the formula $x = \dfrac{3p+n}{3n-4}$

(Total for Question 15 is 3 marks)

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Question 15

7 marks | Rearranging Formulae

15 (a) Make g the subject of $e = \sqrt{\dfrac{7g + 5}{11 + 2g}}$

.....

(4)

(b) Solve the inequality $3y^2 + 4y - 32 > 0$
Show your working clearly.

.....

(3)

(Total for Question 15 is 7 marks)

Question 12

7 marks | Rearranging Formulae

12 (a) Solve $\frac{3x+2}{5} - \frac{2x+1}{3} = x$

Show clear algebraic working.

$x =$ .....

(3)

(b) Make c the subject of the formula $f = \sqrt{\frac{a+bc}{c-d}}$

.....

(4)

(Total for Question 12 is 7 marks)

Question 14

4 marks | Rearranging Formulae

14 Make k the subject of $p = \dfrac{8k^2 + 5}{7 - 3k^2}$

(Total for Question 14 is 4 marks)

Question 16

4 marks | Rearranging Formulae

16 Make t the subject of the formula $c = \dfrac{t^2 + 3}{7 - 8t^2}$

(Total for Question 16 is 4 marks)

Question 17

4 marks | Rearranging Formulae

17 Make k the subject of $p = \dfrac{8k^2 + 5}{7 - 3k^2}$

(Total for Question 17 is 4 marks)

Question 19

4 marks | Rearranging Formulae

19 Make t the subject of the formula $c = \sqrt{7 - 8t^2}$

.....

(Total for Question 19 is 4 marks)

Question 18

4 marks | Rearranging Formulae

18 Make w the subject of the formula $p = \sqrt{\dfrac{7w + y}{cw + k}}$

(Total for Question 18 is 4 marks)

Question 18

4 marks | Rearranging Formulae

18 Make y the subject of $p = \sqrt{\dfrac{y + w}{3y - t}}$

(Total for Question 18 is 4 marks)

Question 18

4 marks | Rearranging Formulae

18 Make x the subject of the formula $a = \dfrac{3w - x^2}{x^2 + 6}$

.....

(Total for Question 18 is 4 marks)

Question 19

3 marks | Rearranging Formulae

19 Make x the subject of $y = \dfrac{3x+5}{4-2x}$

(Total for Question 19 is 3 marks)

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Question 20

3 marks | Rearranging Formulae

20 Make x the subject of $y = \dfrac{3x+5}{4-2x}$

.....

(Total for Question 20 is 3 marks)

TOPIC

Simultaneous Equations

Every past-paper question on this topic, 2020 to 2026.

Question 11

3 marks | Simultaneous Equations

11 Solve the simultaneous equations

$$7x + 3y = 3$$
$$3x - y = 7$$

Show clear algebraic working.

$x =$ .....

$y =$ .....

(Total for Question 11 is 3 marks)

Question 20

5 marks | Simultaneous Equations

20 Solve the simultaneous equations

$$x - 2y = 3$$
$$x^2 - y^2 + 2x = 10$$

Show clear algebraic working.

(Total for Question 20 is 5 marks)

Question 7

3 marks | Simultaneous Equations

7 Solve the simultaneous equations

$$3x + 5y = 6$$
$$7x - 5y = -11$$

Show clear algebraic working.

$x =$ .....

$y =$ .....

(Total for Question 7 is 3 marks)

Question 12

4 marks | Simultaneous Equations

12 Solve the simultaneous equations

$$7x - 2y = 34$$
$$3x + 5y = -3$$

Show clear algebraic working.

$x =$ .....

$y =$ .....

(Total for Question 12 is 4 marks)

Question 12

4 marks | Simultaneous Equations

12 Solve the simultaneous equations

$$7x + 2y = 5.5$$
$$3x - 5y = 17$$

Show clear algebraic working.

$x =$ .....

$y =$ .....

(Total for Question 12 is 4 marks)

Question 12

4 marks | Simultaneous Equations

12 Solve the simultaneous equations $2x + 7y = 17$
$5x + 3y = -1$

Show clear algebraic working.

$x =$ .....

$y =$ .....

(Total for Question 12 is 4 marks)

Question 17

5 marks | Simultaneous Equations

17 Solve the simultaneous equations

$$x - 6y = 5$$
$$xy - 2y^2 = 6$$

Show clear algebraic working.

(Total for Question 17 is 5 marks)

Question 19

5 marks | Simultaneous Equations

19 Solve the simultaneous equations

$$x^2 - 9y - x = 2y^2 - 12$$
$$x + 2y - 1 = 0$$

Show clear algebraic working.

(Total for Question 19 is 5 marks)

Question 8

3 marks | Simultaneous Equations

8 Solve the simultaneous equations

$$5a + 2c = 10$$
$$2a - 4c = 7$$

Show clear algebraic working.

$a =$ .....

$c =$ .....

(Total for Question 8 is 3 marks)

Question 19

5 marks | Simultaneous Equations

19 Solve the simultaneous equations

$$y = 3 - 2x$$
$$x^2 + y^2 = 18$$

Show clear algebraic working.

(Total for Question 19 is 5 marks)

Question 6

5 marks | Simultaneous Equations

6 Alison buys 5 apples and 3 pears for a total cost of $1.96
Greg buys 3 apples and 2 pears for a total cost of $1.22

Michael buys 10 apples and 10 pears.

Work out how much Michael pays for his 10 apples and 10 pears.
Show your working clearly.

$.....

(Total for Question 6 is 5 marks)

Question 10

3 marks | Simultaneous Equations

10 Solve the simultaneous equations

$$3x + 5y = 3.1$$
$$6x + 3y = 3.75$$

Show clear algebraic working.

$x =$ .....

$y =$ .....

(Total for Question 10 is 3 marks)

Question 19

5 marks | Simultaneous Equations

19 Solve the simultaneous equations

$$3x^2 + y^2 - xy = 5$$
$$y = 2x - 3$$

Show clear algebraic working.

(Total for Question 19 is 5 marks)

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Question 10

3 marks | Simultaneous Equations

10 Solve the simultaneous equations

$$7x + 3y = 3$$
$$3x - y = 7$$

Show clear algebraic working.

$x =$ .....

$y =$ .....

(Total for Question 10 is 3 marks)

Question 14

4 marks | Simultaneous Equations

14 Solve the simultaneous equations

$$3x - 5y = 25$$
$$4x + 3y = 14$$

Show clear algebraic working.

$x =$ .....

$y =$ .....

(Total for Question 14 is 4 marks)

Question 21

5 marks | Simultaneous Equations

21 Solve the simultaneous equations

$$x - 2y = 3$$
$$x^2 - y^2 + 2x = 10$$

Show clear algebraic working.

(Total for Question 21 is 5 marks)

Question 9

3 marks | Simultaneous Equations

9 Solve the simultaneous equations

$$2x + 9y = 14.5$$
$$7x + 3y = 8$$

Show clear algebraic working.

$x =$ .....

$y =$ .....

(Total for Question 9 is 3 marks)

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Question 21

5 marks | Simultaneous Equations

21 Solve the simultaneous equations

$$2x^2 + 3y^2 = 11$$
$$x = 3y - 1$$

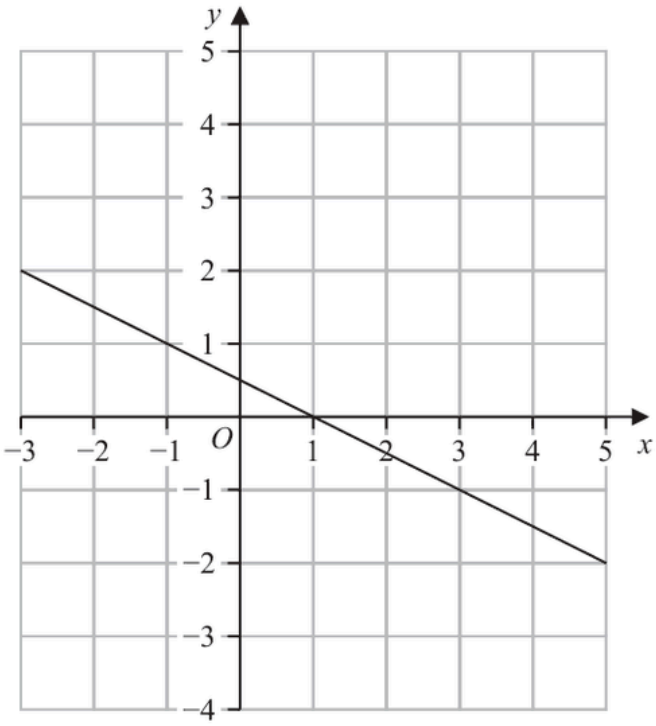
Show clear algebraic working.

(Total for Question 21 is 5 marks)

Question 14

3 marks | Simultaneous Equations

14 Here is the graph of the equation $2y + x = 1$ drawn on a grid.



By drawing another straight line on the grid, solve the simultaneous equations

$$y - x - 2 = 0$$
$$2y + x = 1$$

$x =$ .....

$y =$ .....

(Total for Question 14 is 3 marks)

Question 10

3 marks | Simultaneous Equations

10 Solve the simultaneous equations

$$6x + 4y = 1$$
$$3x + 5y = 8$$

Show clear algebraic working.

$x =$ .....

$y =$ .....

(Total for Question 10 is 3 marks)

Question 12

4 marks | Simultaneous Equations

12 Solve the simultaneous equations

$$4x + 3y = 9.6$$
$$6x + 5y = 16.8$$

Show clear algebraic working.

$x =$ .....

$y =$ .....

(Total for Question 12 is 4 marks)

Question 22

5 marks | Simultaneous Equations

22 Solve the simultaneous equations

$$x^2 + y^2 = y + 11$$
$$y = 3x - 1$$

Show clear algebraic working.

(Total for Question 22 is 5 marks)

Question 22

5 marks | Simultaneous Equations

22 Solve the simultaneous equations

$$x^2 + y^2 + y = 3$$

$$x + 2 = y$$

Show clear algebraic working.

(Total for Question 22 is 5 marks)

Question 3

3 marks | Simultaneous Equations

3 Solve the simultaneous equations

$$3x + 2y = 10$$
$$3x - 4y = 16$$

Show clear algebraic working.

$x =$ .....

$y =$ .....

(Total for Question 3 is 3 marks)

Question 3

3 marks | Simultaneous Equations

3 Solve the simultaneous equations

$$3x + 2y = 10$$
$$3x - 4y = 16$$

Show clear algebraic working.

$x =$ .....

$y =$ .....

(Total for Question 3 is 3 marks)

Question 8

3 marks | Simultaneous Equations

8 Solve the simultaneous equations

$$3x + 5y = 8$$
$$4x + y = -3.5$$

Show clear algebraic working.

$x =$ .....

$y =$ .....

(Total for Question 8 is 3 marks)

Question 10

3 marks | Simultaneous Equations

10 Solve the simultaneous equations

$$3x + 5y = 8$$
$$4x + y = -3.5$$

Show clear algebraic working.

$x =$ .....

$y =$ .....

(Total for Question 10 is 3 marks)

Question 22

5 marks | Simultaneous Equations

22 Solve the simultaneous equations

$$x^2 + 3y + y^2 = 7$$
$$y = x + 2$$

Show clear algebraic working.

(Total for Question 22 is 5 marks)

Question 22

5 marks | Simultaneous Equations

22 Solve the simultaneous equations

$$x^2 + y^2 = 41$$
$$2x + y = 3$$

Show clear algebraic working.

(Total for Question 22 is 5 marks)

Question 22

5 marks | Simultaneous Equations

22 Solve the simultaneous equations

$$y^2 + 5y + x^2 = 12$$

$$x = y + 5$$

Show clear algebraic working.

(Total for Question 22 is 5 marks)

Question 2

3 marks | Simultaneous Equations

2 Solve the simultaneous equations

$$5x + y = 11$$
$$3x - y = 9$$

Show clear algebraic working.

$x =$ .....

$y =$ .....

(Total for Question 2 is 3 marks)

Question 3

3 marks | Simultaneous Equations

3 Solve the simultaneous equations

$$5x + y = 11$$
$$3x - y = 9$$

Show clear algebraic working.

$x =$ .....

$y =$ .....

(Total for Question 3 is 3 marks)

Question 20

5 marks | Simultaneous Equations

20 Solve the simultaneous equations

$$x^2 + y^2 = 3xy - 11$$
$$y = x + 2$$

Show clear algebraic working.

(Total for Question 20 is 5 marks)

Question 10

3 marks | Simultaneous Equations

10 Solve the simultaneous equations

$$4x + 3y = 9$$
$$2x - 2y = -13$$

Show clear algebraic working.

$x =$ .....

$y =$ .....

(Total for Question 10 is 3 marks)

Question 12

3 marks | Simultaneous Equations

12 Solve the simultaneous equations

$$4x + 4y = 5$$
$$x + 2y = 1$$

Show clear algebraic working.

$x =$ .....

$y =$ .....

(Total for Question 12 is 3 marks)

Question 21

5 marks | Simultaneous Equations

21 Solve the simultaneous equations

$$y^2 = x^2 + 7$$
$$y = 3x - 5$$

Show clear algebraic working.

(Total for Question 21 is 5 marks)

Question 22

5 marks | Simultaneous Equations

22 Solve the simultaneous equations

$$y^2 = x^2 + 7$$
$$y = 3x - 5$$

Show clear algebraic working.

.....

(Total for Question 22 is 5 marks)

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Question 23

5 marks | Simultaneous Equations

23 The straight line **L** has equation $y = 3x - 2$

The curve **C** has equation $x^2 + y^2 - 2y = 12$

Find the coordinates of the points where **L** and **C** intersect.
Show clear algebraic working.

(..... , ...) and (..... , ...)

(Total for Question 23 is 5 marks)

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TOPIC

Inequalities (Solving & Graphing)

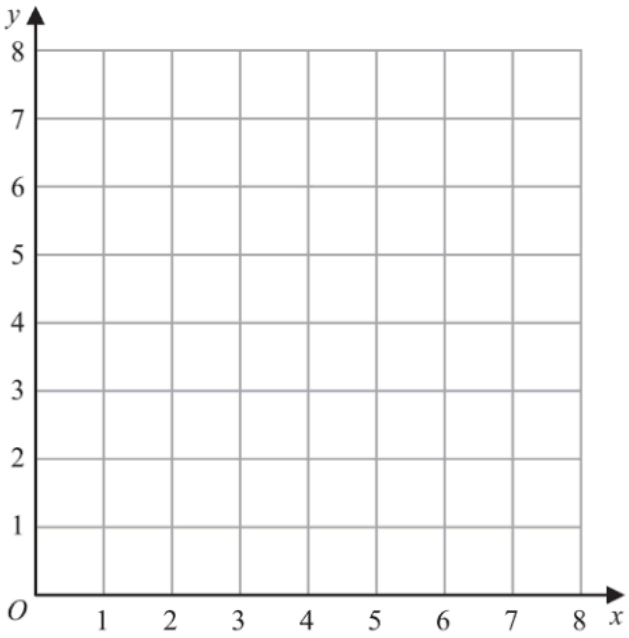
Every past-paper question on this topic, 2020 to 2026.

Question 5

4 marks | Inequalities (Solving & Graphing)

5 (a) On the grid, draw and label with its equation the straight line with equation

(i) $y = 1$ (ii) $x = 2$ (iii) $x + y = 7$



(3)

(b) Show, by shading on the grid, the region that satisfies **all three** of the inequalities

$y \geqslant 1$ $x \geqslant 2$ $x + y \leqslant 7$

Label the region **R**

(1)

(Total for Question 5 is 4 marks)

Question 18

3 marks | Inequalities (Solving & Graphing)

18 Solve the inequality $2y^2 - 7y - 30 \leqslant 0$
Show your working clearly.

.....

(Total for Question 18 is 3 marks)

Question 7

5 marks | Inequalities (Solving & Graphing)

7 (a) Solve the inequality $2x + 7 > 4$

.....

(2)

(b) Solve $x^2 - 3x - 40 = 0$
Show clear algebraic working.

.....

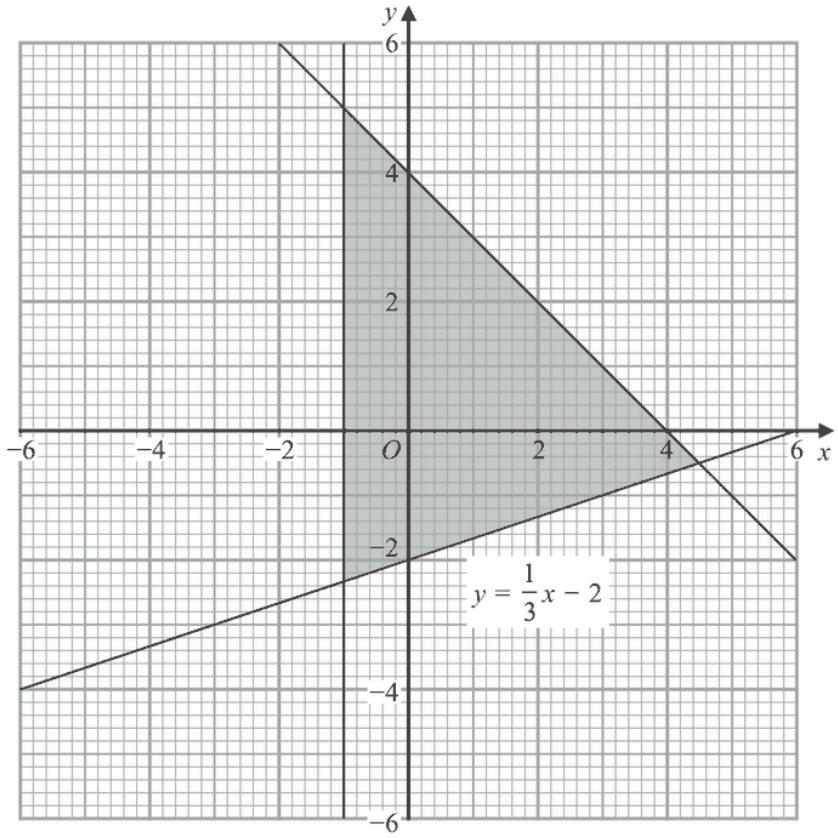
(3)

(Total for Question 7 is 5 marks)

Question 10

3 marks | Inequalities (Solving & Graphing)

10 The shaded region in the diagram is bounded by three lines.
The equation of one of the lines is given.



Write down the three inequalities that define the shaded region.

.....

.....

.....

(Total for Question 10 is 3 marks)

Question 11

4 marks | Inequalities (Solving & Graphing)

11 (a) Write down the integer values of x that satisfy the inequality $-2 < x \leqslant 4$

.....

(2)

The region **R**, shown shaded in the diagram, is bounded by three straight lines.

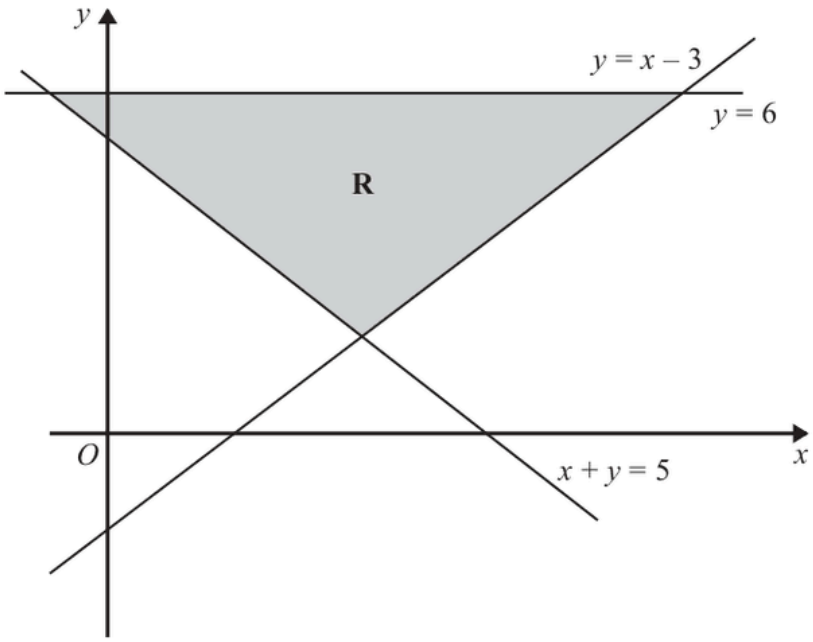


Diagram **NOT** accurately drawn

(b) Write down the three inequalities that define the region **R**.

.....

(2)

(Total for Question 11 is 4 marks)

Question 19

6 marks | Inequalities (Solving & Graphing)

19 (a) Solve $\frac{4-3x}{5} - \frac{3x-5}{2} = -3$

Show clear algebraic working.

$x =$ .....

(3)

(b) Solve the inequality $5y^2 - 17y \leqslant 40$

.....

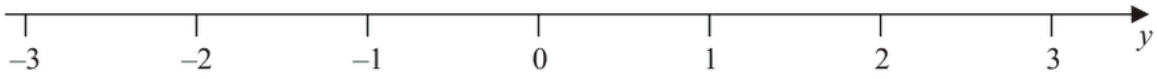
(3)

(Total for Question 19 is 6 marks)

Question 3

4 marks | Inequalities (Solving & Graphing)

3 (a) On the number line, show the inequality $-2 \leqslant y < 1$



(2)

n is an integer.

(b) Write down all the values of n that satisfy $-3.4 < n \leqslant 2$

.....

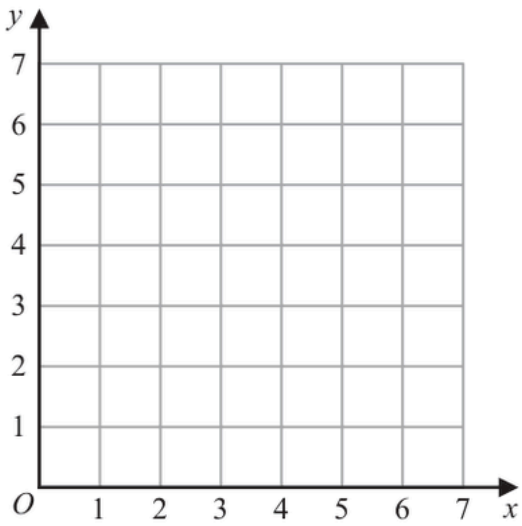
(2)

(Total for Question 3 is 4 marks)

Question 4

4 marks | Inequalities (Solving & Graphing)

4



(a) On the grid, draw and **label** the straight line with equation

(i) $x = 1.5$

(ii) $y = x$

(iii) $x + y = 6$

(3)

(b) Show, by shading on the grid, the region that satisfies **all three** of the inequalities

$x \geqslant 1.5$ $y \geqslant x$ $x + y \leqslant 6$

Label the region **R**.

(1)

(Total for Question 4 is 4 marks)

Question 5

7 marks | Inequalities (Solving & Graphing)

5 (a) Expand and simplify $4x(2x + 5) - 3x(2x - 3)$

.....

(2)

Given that $\dfrac{y^5 \times y^n}{y^6} = y^{13}$

(b) work out the value of n.

$n =$ .....

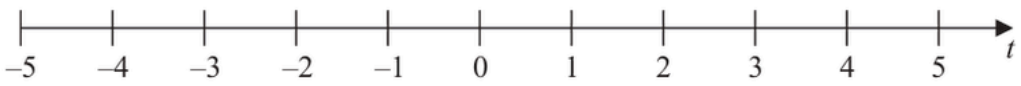
(2)

(c) (i) Solve the inequality $7t - 8 < 2t + 7$

.....

(2)

(ii) On the number line below, represent the solution set of the inequality solved in part (c)(i)



(1)

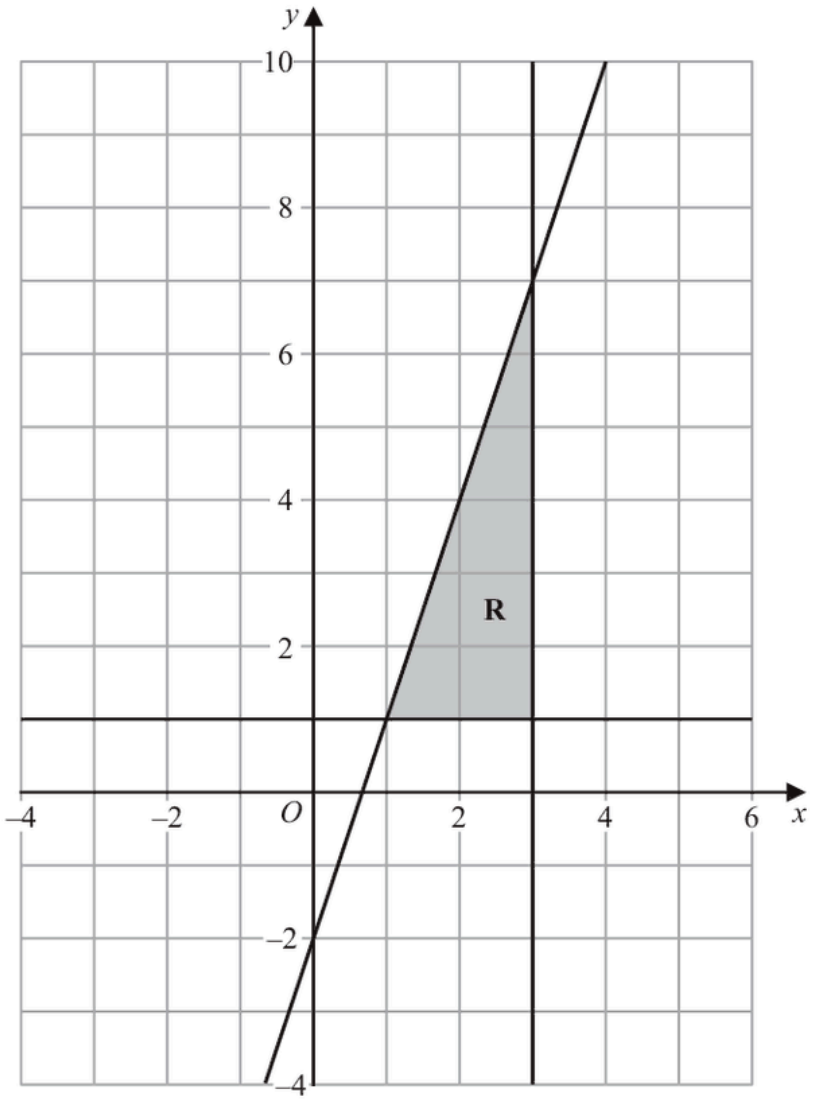
(Total for Question 5 is 7 marks)

Question 7

3 marks | Inequalities (Solving & Graphing)

7 The shaded region **R**, shown in the diagram below, is bounded by the straight line with equation $y = 3x - 2$ and by two other straight lines.

Write down the three inequalities that define region **R**.



(Total for Question 7 is 3 marks)

Question 7

4 marks | Inequalities (Solving & Graphing)

7 $-4 \leqslant 2y < 6$

y is an integer.

(a) Write down all the possible values of y.

.....

(2)

(b) Solve the inequality $7t - 3 \leqslant 2t + 31$

Show your working clearly.

.....

(2)

(Total for Question 7 is 4 marks)

Question 9

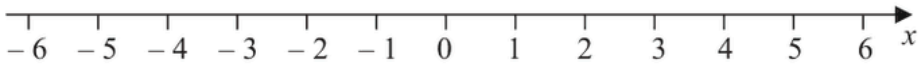
5 marks | Inequalities (Solving & Graphing)

9 (i) Solve the inequalities $-7 \leqslant 2x - 3 < 5$

.....

(3)

(ii) On the number line, represent the solution set to part (i)



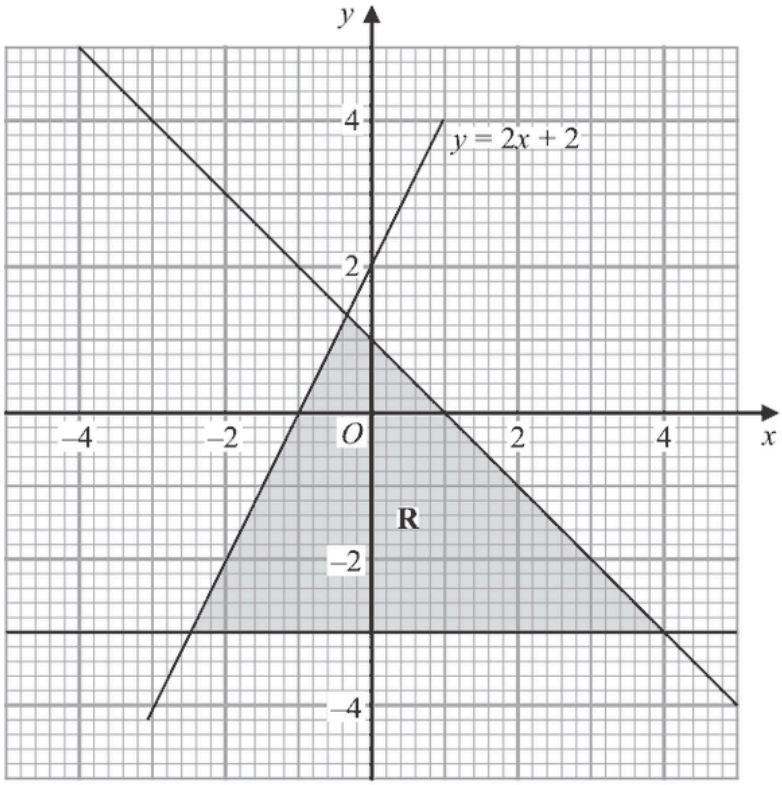
(2)

(Total for Question 9 is 5 marks)

Question 13

3 marks | Inequalities (Solving & Graphing)

13



The region **R**, shown shaded in the diagram, is bounded by three straight lines.

Write down the three inequalities that define **R**.

(Total for Question 13 is 3 marks)

Question 1

3 marks | Inequalities (Solving & Graphing)

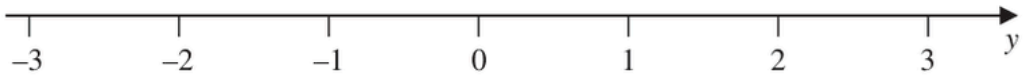
1 n is an integer.

(a) Write down all the values of n such that $-2 \leqslant n < 3$

.....

(2)

(b) On the number line, represent the inequality $y \leqslant 1$



(1)

(Total for Question 1 is 3 marks)

Question 6

5 marks | Inequalities (Solving & Graphing)

6 (a) Solve the inequality $5x - 7 \leqslant 2$

.....

(2)

(b) (i) Factorise $y^2 - 2y - 35$

.....

(2)

(ii) Hence, solve $y^2 - 2y - 35 = 0$

.....

(1)

(Total for Question 6 is 5 marks)

Question 7

5 marks | Inequalities (Solving & Graphing)

7 (a) Write down an equation of the straight line with gradient -3 and which passes through the point with coordinates $(0, 5)$

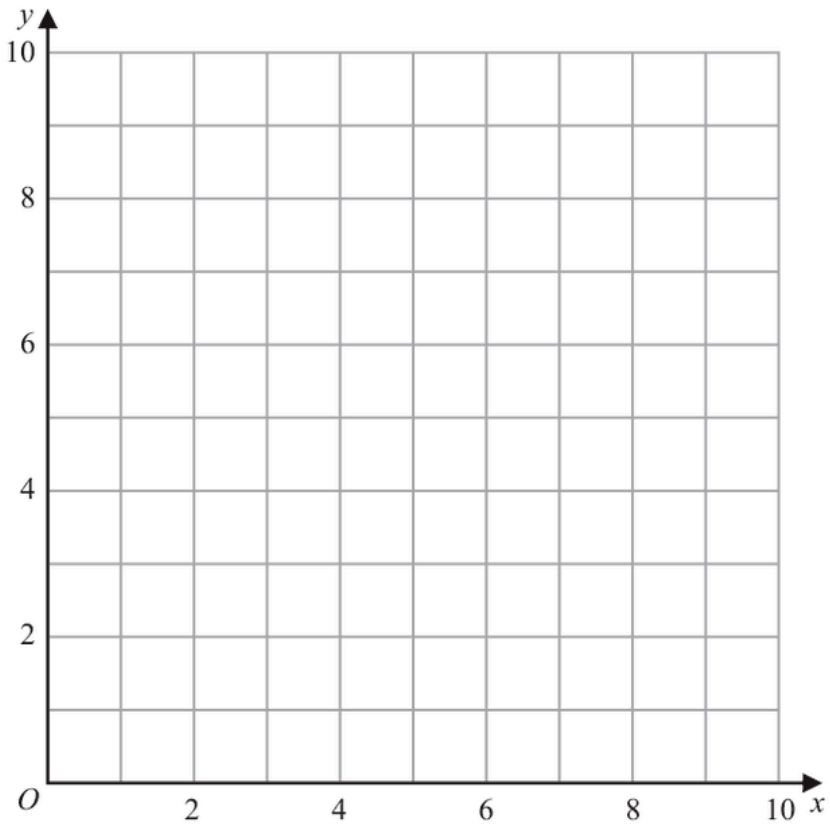
.....

(2)

(b) Show, by shading on the grid, the region defined by **all three** of the inequalities

$$x \leqslant 6 \qquad y \geqslant 2 \qquad y \leqslant x + 1$$

Label the region **R**



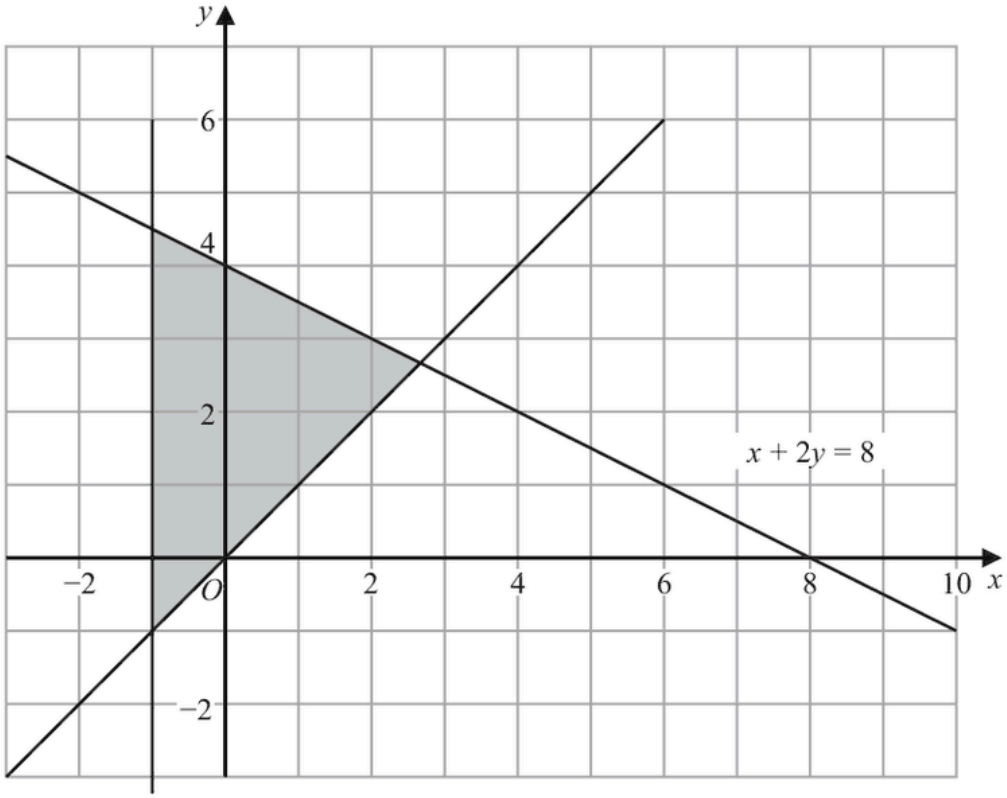
(3)

(Total for Question 7 is 5 marks)

Question 13

3 marks | Inequalities (Solving & Graphing)

13 The shaded region in the diagram is bounded by three lines.
The equation of one of the lines is given.



Write down three inequalities that define the shaded region.

(Total for Question 13 is 3 marks)

Question 22

5 marks | Inequalities (Solving & Graphing)

22 Here is a rectangle.

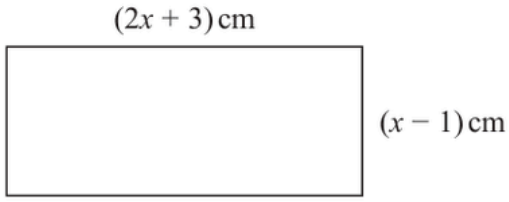


Diagram **NOT** accurately drawn

Given that the area of the rectangle is less than $75\,\text{cm}^2$

find the range of possible values of x

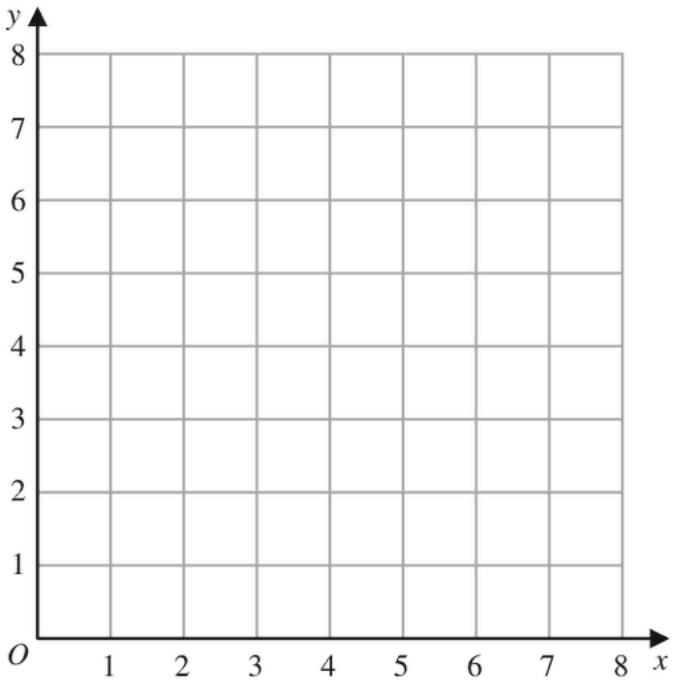
(Total for Question 22 is 5 marks)

Question 2

4 marks | Inequalities (Solving & Graphing)

2 (a) On the grid, draw and label with its equation the straight line with equation

(i) $y = 1$ (ii) $x = 2$ (iii) $x + y = 7$



(3)

(b) Show, by shading on the grid, the region that satisfies **all three** of the inequalities

$y \geqslant 1$ $x \geqslant 2$ $x + y \leqslant 7$

Label the region **R**.

(1)

(Total for Question 2 is 4 marks)

Question 9

2 marks | Inequalities (Solving & Graphing)

9 Solve the inequality $3 - 4x \leqslant 11$

(Total for Question 9 is 2 marks)

Question 15

7 marks | Inequalities (Solving & Graphing)

15 (a) Solve $\frac{4x+5}{3} - \frac{3-2x}{2} = 13$

Show clear algebraic working.

$x =$ .....

(4)

(b) Solve the inequality $2y^2 - 7y - 30 \leqslant 0$

Show your working clearly.

.....

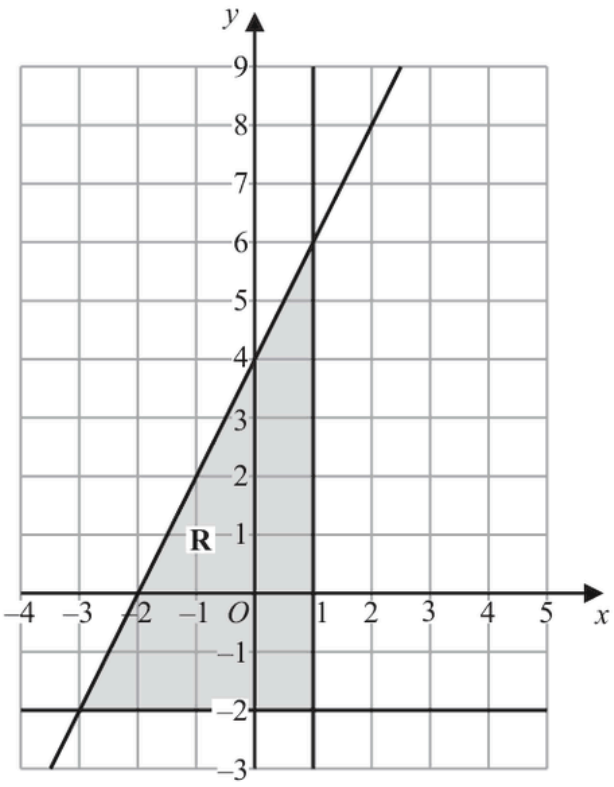
(3)

(Total for Question 15 is 7 marks)

Question 7

4 marks | Inequalities (Solving & Graphing)

7



The region **R**, shown shaded in the diagram, is bounded by three straight lines.

Find the inequalities that define **R**

(Total for Question 7 is 4 marks)

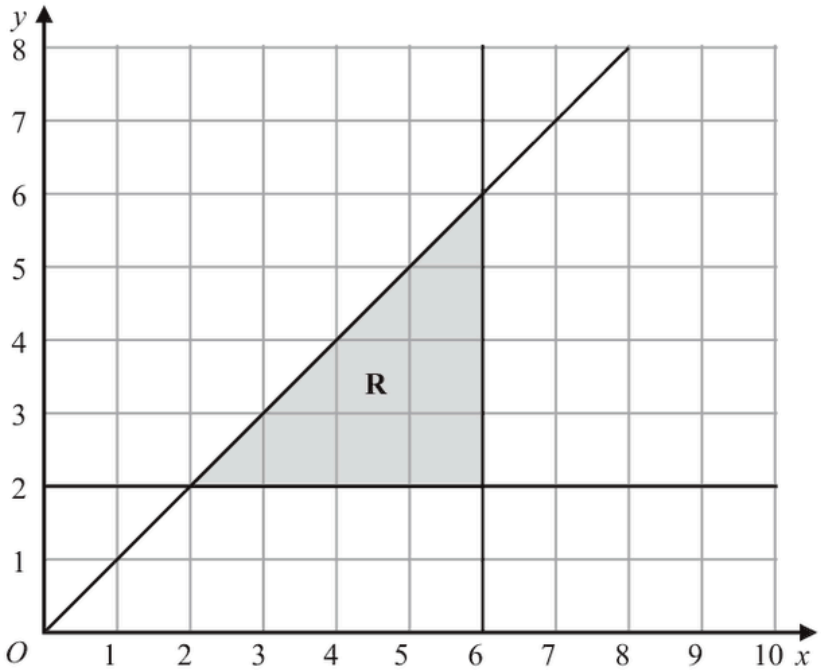
Question 8

5 marks | Inequalities (Solving & Graphing)

8 (a) Solve $9 - 4x > 17$

.....

(2)



(b) Write down the three inequalities that represent the shaded region **R**

.....

(3)

(Total for Question 8 is 5 marks)

Question 8

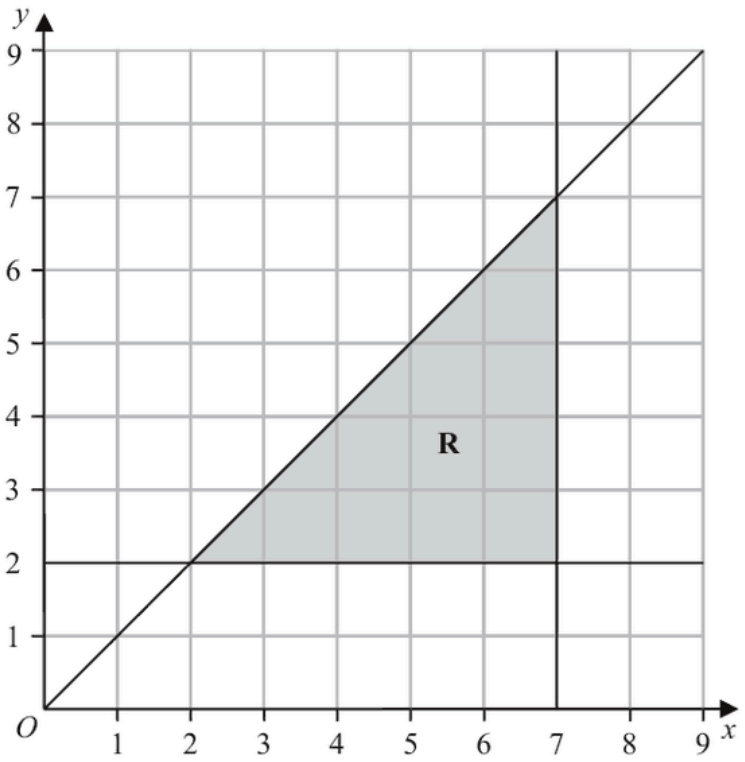
5 marks | Inequalities (Solving & Graphing)

8 (a) Solve the inequality $8x - 4 \geqslant 3x - 10$

.....

(2)

The region **R**, shown shaded in the diagram, is bounded by three straight lines.



(b) Write down the three inequalities that define the region **R**

.....

(3)

(Total for Question 8 is 5 marks)

Question 2

4 marks | Inequalities (Solving & Graphing)

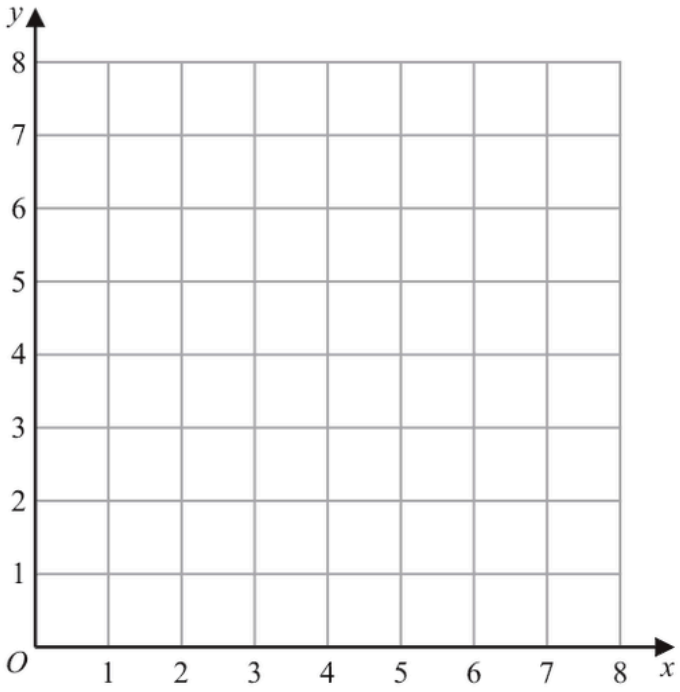
2 (a) On the grid, draw the straight line with equation

(i) $y = 2$

(ii) $x = 6$

(iii) $y = x + 1$

Label each line with its equation.



(3)

(b) Show, by shading on the grid, the region that satisfies all three of the inequalities

$y \geqslant 2$ $x \leqslant 6$ $y \leqslant x + 1$

Label the region **R**

(1)

(Total for Question 2 is 4 marks)

Question 7

9 marks | Inequalities (Solving & Graphing)

7 (a) Simplify $g^9 \div g^2$

.....

(1)

(b) Expand $5k^2(k^3 + 4)$

.....

(2)

(c) (i) Factorise $x^2 - 2x - 63$

.....

(2)

(ii) Hence, solve $x^2 - 2x - 63 = 0$

.....

(1)

(d) Solve the inequality $7 - 2y < 3y - 12$

.....

(3)

(Total for Question 7 is 9 marks)

Question 20

4 marks | Inequalities (Solving & Graphing)

20 Solve $6x^2 - 7x - 20 > 0$
Show clear algebraic working.

(Total for Question 20 is 4 marks)

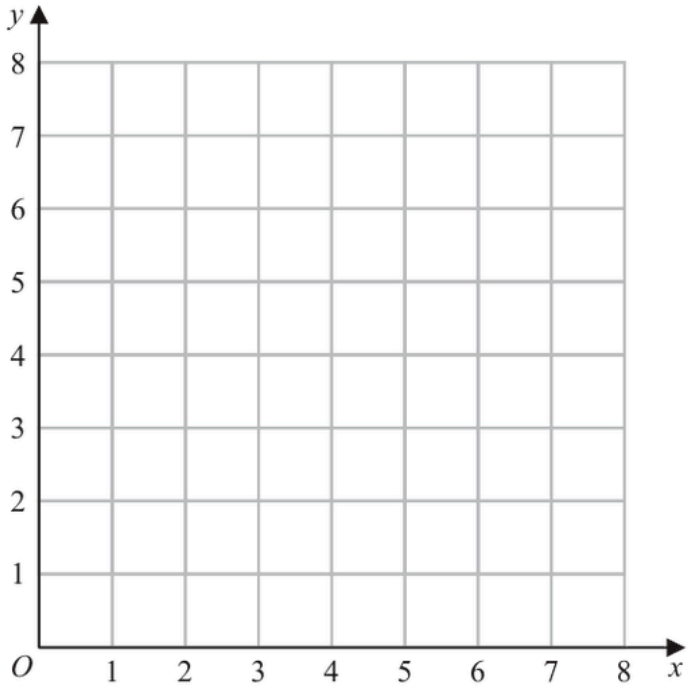
Question 7

4 marks | Inequalities (Solving & Graphing)

7 (a) On the grid, draw the straight line with equation

(i) $x = 3$ (ii) $y = 1$ (iii) $x + y = 7$

Label each line with its equation.



(3)

(b) Show, by shading on the grid, the region that satisfies all three of the inequalities

$x \geqslant 3$ $y \geqslant 1$ $x + y \leqslant 7$

Label the region **R**

(1)

(Total for Question 7 is 4 marks)

Question 8

6 marks | Inequalities (Solving & Graphing)

8 (a) (i) Factorise $x^2 + 5x - 24$

.....

(2)

(ii) Hence, solve $x^2 + 5x - 24 = 0$

.....

(1)

(b) Solve the inequality $3y + 5 > 7y - 10$

Show clear algebraic working.

.....

(3)

(Total for Question 8 is 6 marks)

Question 20

3 marks | Inequalities (Solving & Graphing)

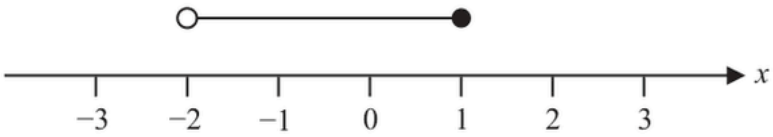
20 Solve the inequality $10x^2 + 11x - 21 < 0$
Show clear algebraic working.

(Total for Question 20 is 3 marks)

Question 6

4 marks | Inequalities (Solving & Graphing)

6



(a) Write down the inequality shown on the number line.

.....

(2)

(b) Solve the inequality $7a - 5 \leqslant 3a + 28$
Show clear algebraic working.

.....

(2)

(Total for Question 6 is 4 marks)

Question 9

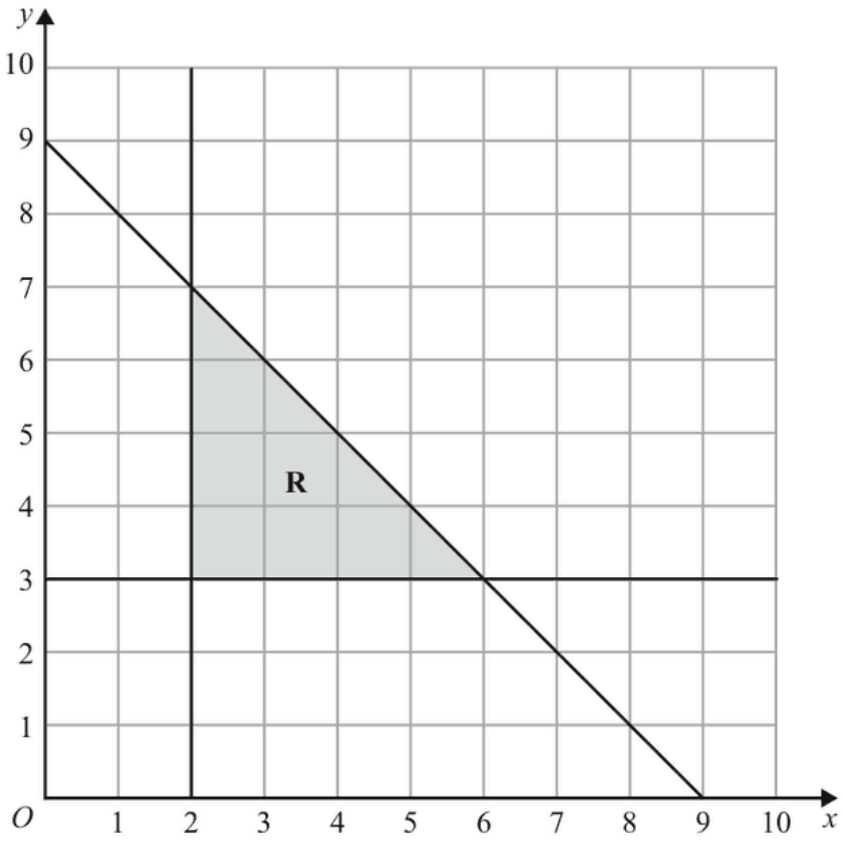
5 marks | Inequalities (Solving & Graphing)

9 (a) Solve the inequality $7 - 3t < 2t + 15$

.....

(2)

The region **R**, shown shaded in the diagram, is bounded by three straight lines.



(b) Write down three inequalities that define the region **R**

.....

(3)

(Total for Question 9 is 5 marks)

Question 9

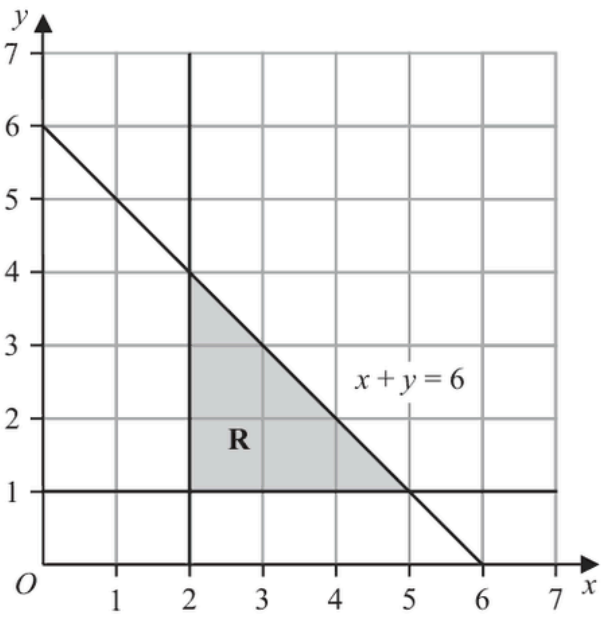
6 marks | Inequalities (Solving & Graphing)

9 (a) Solve the inequality $3x - 22 > 8x - 40$
Show clear algebraic working.

.....

(3)

The region **R**, shown shaded in the diagram, is bounded by three straight lines.



(b) Write down the three inequalities that define the region **R**

.....

(3)

(Total for Question 9 is 6 marks)

Question 11

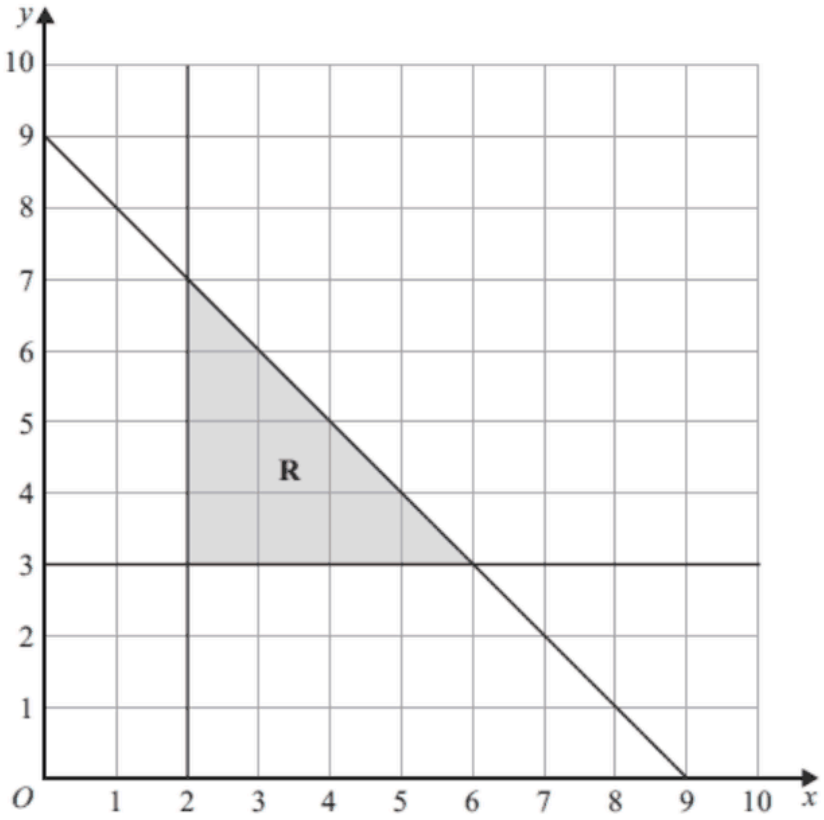
5 marks | Inequalities (Solving & Graphing)

11 (a) Solve the inequality $7 - 3t < 2t + 15$

.....

(2)

The region **R**, shown shaded in the diagram, is bounded by three straight lines.



(b) Write down three inequalities that define the region **R**

.....

.....

.....

(3)

(Total for Question 11 is 5 marks)

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Question 19

3 marks

Inequalities (Solving & Graphing)

19 Solve the inequality $4x^2 + 4x - 15 < 0$
Show clear algebraic working.

(Total for Question 19 is 3 marks)

Question 20

3 marks | Inequalities (Solving & Graphing)

20 Solve the inequality $2x^2 - 7x - 15 > 0$

Show clear algebraic working.

(Total for Question 20 is 3 marks)

Question 21

3 marks | Inequalities (Solving & Graphing)

21 Solve the inequality $2x^2 - 7x - 15 > 0$

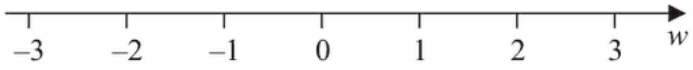
Show clear algebraic working.

(Total for Question 21 is 3 marks)

Question 10

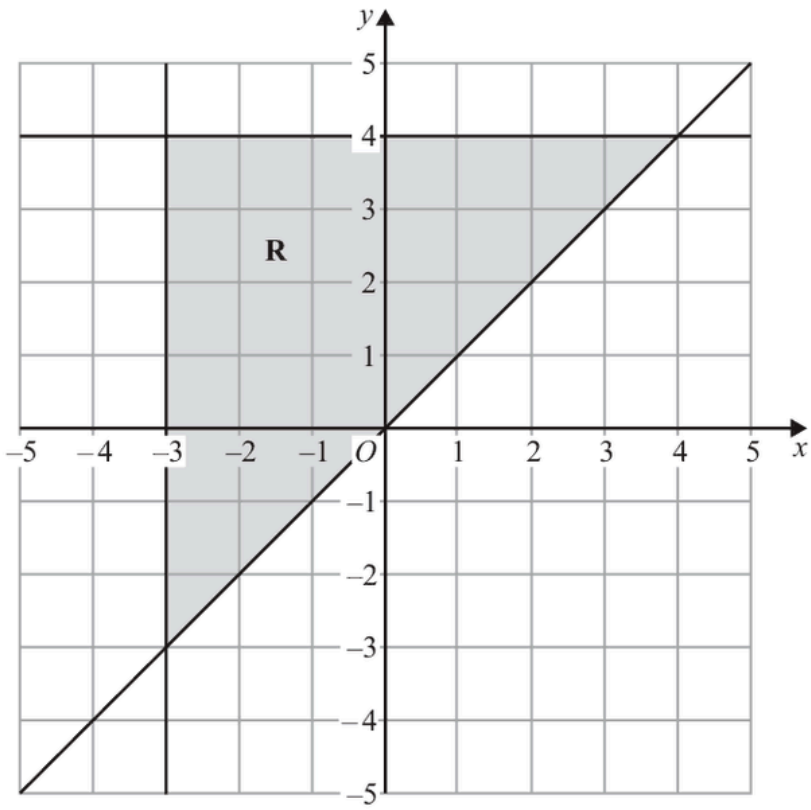
4 marks | Inequalities (Solving & Graphing)

10 (a) On the number line, represent the inequality $w < 1$



(1)

The region **R**, shown shaded in the diagram, is bounded by three straight lines.



(b) Write down the three inequalities that define the region **R**

.....

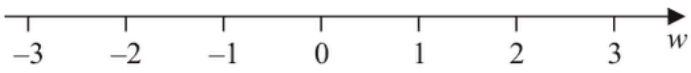
(3)

(Total for Question 10 is 4 marks)

Question 11

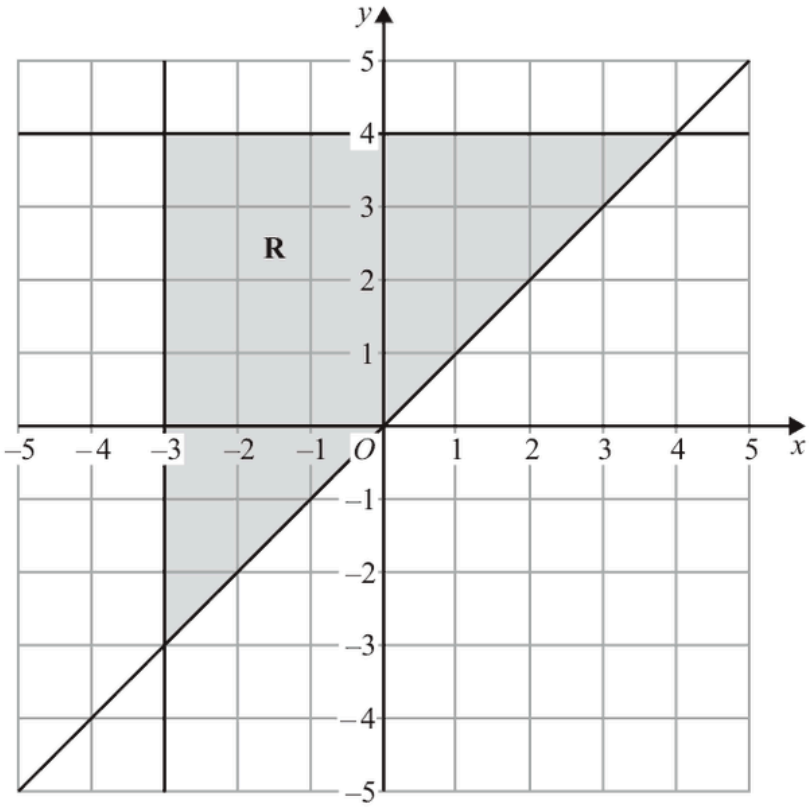
4 marks | Inequalities (Solving & Graphing)

11 (a) On the number line, represent the inequality $w < 1$



(1)

The region **R**, shown shaded in the diagram, is bounded by three straight lines.



(b) Write down the three inequalities that define the region **R**

.....

(3)

(Total for Question 11 is 4 marks)

Question 25

3 marks | Inequalities (Solving & Graphing)

25 Solve the inequality $2x^2 + x - 28 > 0$
Show clear algebraic working.

(Total for Question 25 is 3 marks)

Question 5

7 marks | Inequalities (Solving & Graphing)

5 (a) Expand $4e(2e - 3)$

.....

(1)

(b) Expand and simplify $(f + 3)(f - 6)$

.....

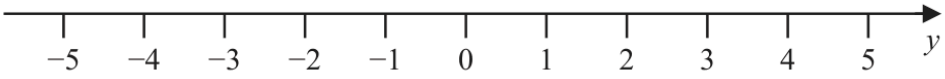
(2)

(c) Make x the subject of $t = ax - 2n$

.....

(2)

(d) On the number line, represent the inequality $-1 < y \leqslant 3$



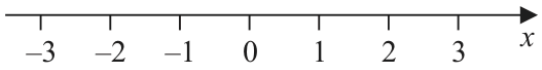
(2)

(Total for Question 5 is 7 marks)

Question 7

5 marks | Inequalities (Solving & Graphing)

7



(a) Represent the inequality $x < 1$ on the number line above.

(1)

$2 \leqslant y + 3 < 7$
y is an integer.

(b) Write down all the possible values of y

.....

(2)

(c) Solve the inequality $8 - 5w > -10$

.....

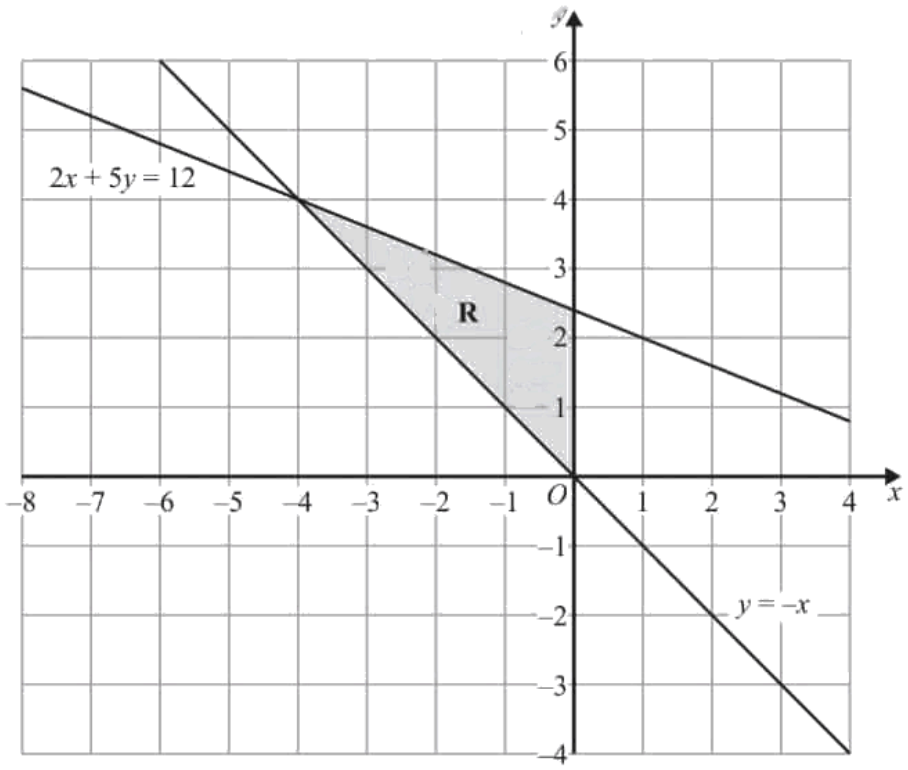
(2)

(Total for Question 7 is 5 marks)

Question 12

3 marks | Inequalities (Solving & Graphing)

12



The region **R**, shown shaded in the diagram, is bounded by the y-axis and the straight lines with equations

$$y = -x$$

$$2x + 5y = 12$$

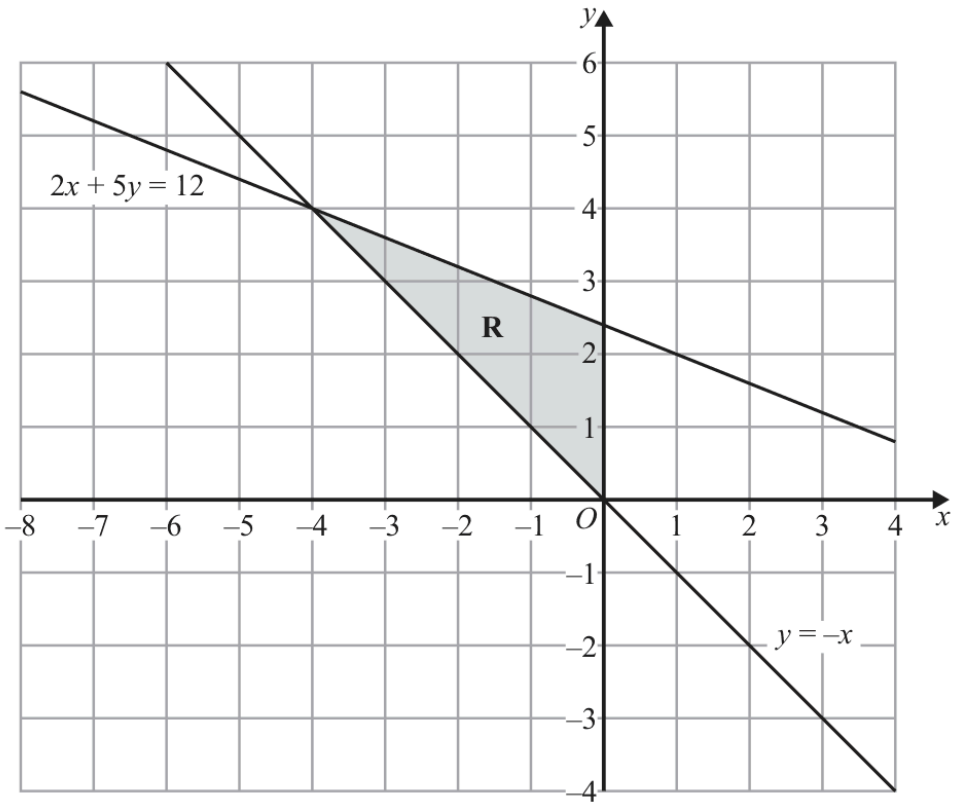
Write down the three inequalities that define **R**

(Total for Question 12 is 3 marks)

Question 12

3 marks | Inequalities (Solving & Graphing)

12



The region **R**, shown shaded in the diagram, is bounded by the y-axis and the straight lines with equations

$$y = -x$$

$$2x + 5y = 12$$

Write down the three inequalities that define **R**

.....

.....

.....

(Total for Question 12 is 3 marks)

TOPIC

Completing the Square

Every past-paper question on this topic, 2020 to 2026.

Question 20

4 marks | Completing the Square

20 Find the values of a, b and c so that

$$7 + 12x - 2x^2$$

is written as $a - b(x - c)^2$

$a =$ .....

$b =$ .....

$c =$ .....

(Total for Question 20 is 4 marks)

Question 23

3 marks | Completing the Square

23 Express $7 - 12x - 2x^2$ in the form $a + b(x + c)^2$ where a, b and c are integers.

(Total for Question 23 is 3 marks)

Question 22

4 marks | Completing the Square

22 The curve **S** has equation $y = f(x)$ where $f(x) = x^2$
The curve **T** has equation $y = g(x)$ where $g(x) = 2x^2 - 12x + 13$

By writing $g(x)$ in the form $a(x - b)^2 - c$, where a, b and c are constants,
describe fully a series of transformations that map the curve **S** onto the curve **T**.

(Total for Question 22 is 4 marks)

Question 19

3 marks | Completing the Square

19 Given that $\left(\sqrt[3]{\frac{1}{x}}\right)^4 = x^m$

(a) find the value of m

$m =$ .....

(1)

Given that a, b and c are integers,

(b) express $3x^2 + 12x + 19$ in the form $a(x + b)^2 + c$

.....

(2)

(Total for Question 19 is 3 marks)

Question 20

4 marks | Completing the Square

20 (a) Express $7 + 12x - 3x^2$ in the form $a + b(x + c)^2$ where a, b and c are integers.

.....

(3)

C is the curve with equation $y = 7 + 12x - 3x^2$
The point A is the maximum point on **C**

(b) Use your answer to part (a) to write down the coordinates of A

(..... , ...)

(1)

(Total for Question 20 is 4 marks)

Question 23

5 marks | Completing the Square

23 (a) Express $2x^2 - 12x + 3$ in the form $a(x + b)^2 + c$ where a, b and c are integers.

.....

(3)

The curve **C** has equation $y = 2(x + 4)^2 - 12(x + 4) + 3$

The point M is the minimum point on **C**

(b) Find the coordinates of M

(..... , ...)

(2)

(Total for Question 23 is 5 marks)

4MA1/1H JUNE 2022

Question 24

4 marks | Completing the Square

24 Express each of a, b and c in terms of q so that

$$q + 12x - qx^2$$

can be written as $a - b(x - c)^2$

$a =$ .....

$b =$ .....

$c =$ .....

(Total for Question 24 is 4 marks)

Question 19

3 marks | Completing the Square

19 Express $3x^2 - 6x + 5$ in the form $a(x - b)^2 + c$

(Total for Question 19 is 3 marks)

Question 20

5 marks | Completing the Square

20 (a) Express $2x^2 - 11x + 9$ in the form $a(x - b)^2 - c$ where a, b and c are numbers to be found.

.....

(3)

The curve **C** has equation $y = 2(x - 3)^2 - 11(x - 3) + 9$

The point P is the minimum point on **C**

(b) Find the coordinates of P

(..... , ...)

(2)

(Total for Question 20 is 5 marks)

Question 25

4 marks | Completing the Square

25 $f(x) = 17 - 3x^2 + 12x$

Write $f(x)$ in the form $a - b(x - c)^2$ where a, b and c are constants.

$f(x) =$ .....

(Total for Question 25 is 4 marks)

Question 18

4 marks | Completing the Square

18 (a) Express $2x^2 - 12x + 23$ in the form $a(x - b)^2 + c$ where a, b and c are integers.
Show clear algebraic working.

.....

(3)

(b) Hence, state the least value of $2x^2 - 12x + 23$

.....

(1)

(Total for Question 18 is 4 marks)

Question 25

6 marks | Completing the Square

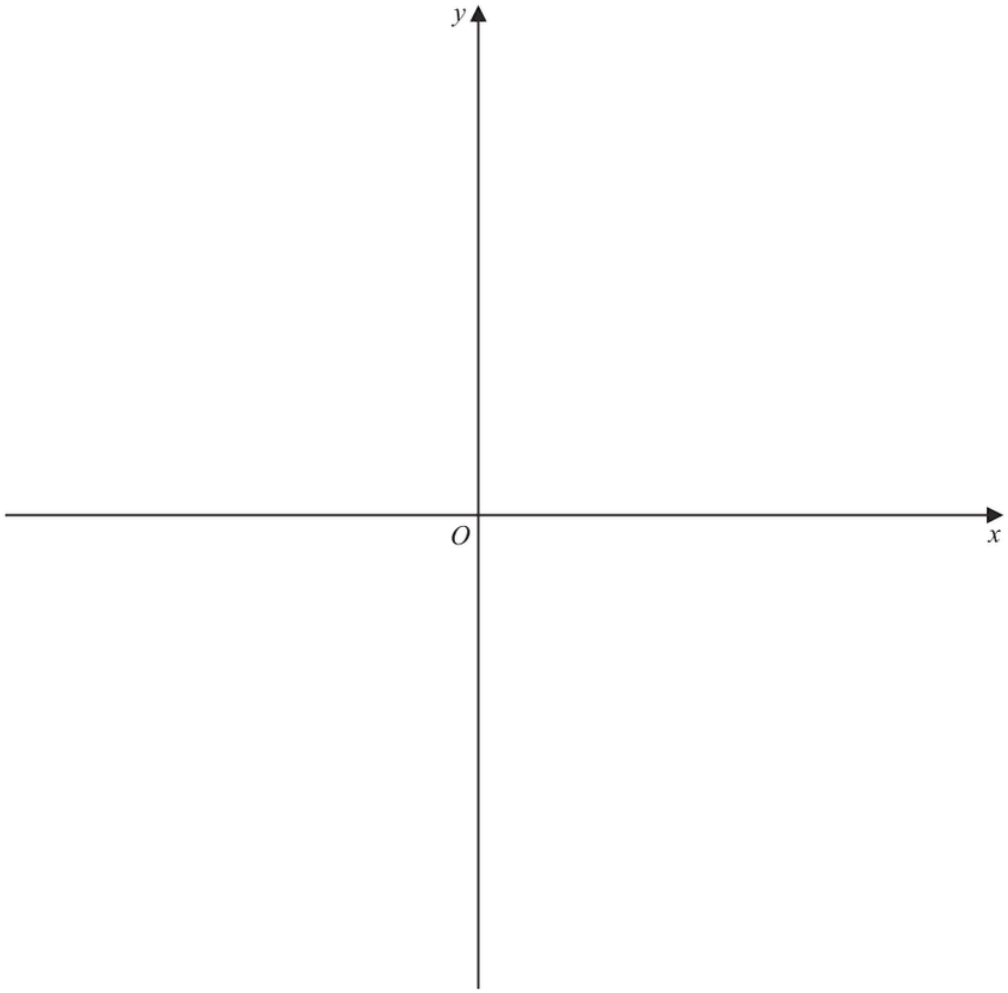
25 (a) Write $28+24x-6x^2$ in the form $a-b(x-c)^2$ where a, b and c are integers.

.....

(3)

(b) On the axes below, sketch the graph of $y=28+24x-6x^2$

Show clearly the coordinates of the turning point and the coordinates of the point of intersection of the graph with the y-axis.



(3)

(Total for Question 25 is 6 marks)

Question 25

5 marks | Completing the Square

25 (a) Express $8 - 12x - 4x^2$ in the form $a - b(x + c)^2$
where a, b and c are constants.

.....

(3)

(b) Hence solve $8 - 12x - 4x^2 = 0$
Show your working clearly.
Give your solutions in surd form.

.....

(2)

(Total for Question 25 is 5 marks)

Question 21

3 marks | Completing the Square

21 Express $5x^2 - 20x + 23$ in the form $a(x - b)^2 + c$ where a, b and c are integers.

(Total for Question 21 is 3 marks)

Question 22

2 marks | Completing the Square

22 $9x^2 - 12x + q$ can be written in the form $(px - r)^2$ where p, q and r are integers.

Find the value of q

$q =$ .....

(Total for Question 22 is 2 marks)

Question 24

3 marks | Completing the Square

24 Express $5x^2 - 20x + 23$ in the form $a(x - b)^2 + c$ where a, b and c are integers.

(Total for Question 24 is 3 marks)

Question 24

5 marks | Completing the Square

24 (a) Express $10 - 24x - 3x^2$ in the form $a - b(x + c)^2$ where a, b and c are integers.

.....

(3)

T is the curve with equation $y = 10 - 24(x - 1) - 3(x - 1)^2$
The point P is the maximum point on **T**

(b) Use your answer to part (a) to find the coordinates of P

(..... , ...)

(1)

(c) Write down the equation for the line of symmetry of **T**

.....

(1)

(Total for Question 24 is 5 marks)

Question 24

3 marks | Completing the Square

24 Express $22 - 3x^2 + 30x$ in the form $a - b(x - c)^2$ where a, b and c are integers.

.....

(Total for Question 24 is 3 marks)

TOPIC

Quadratic Formula

Every past-paper question on this topic, 2020 to 2026.

EP SPECIMEN

Question 30

3 marks | Quadratic Formula

30 Solve $2x^2 - 5x - 4 = 0$

Show your working clearly.
Give your solutions correct to 3 significant figures.

.....

(3)

(Total for Question 30 is 3 marks)

EP SPECIMEN

Question 31

3 marks | Quadratic Formula

31 Solve $x^2 + 6x + 2 = 0$

Give your solutions in the form $a \pm \sqrt{b}$ where a and b are integers.

.....

(3)

(Total for Question 31 is 3 marks)

EP SPECIMEN

Question 32

5 marks | Quadratic Formula

32 A rectangle has length $(x + 3)$ cm and width $(x - 1)$ cm.
The area of the rectangle is 20 cm^2.

(a) Show that $x^2 + 2x - 23 = 0$

.....

(2)

(b) Work out the length of the rectangle.
Give your answer correct to 3 significant figures.

..... cm

(3)

(Total for Question 32 is 5 marks)

TOPIC

Quadratic Equations

Every past-paper question on this topic, 2020 to 2026.

Question 6

3 marks | Quadratic Equations

6 Solve $x^2 - 5x - 36 = 0$
Show clear algebraic working.

(Total for Question 6 is 3 marks)

Question 9

3 marks | Quadratic Equations

9 Solve $x^2 - 21x + 20 = 0$
Show your working clearly.

(Total for Question 9 is 3 marks)

4WM1/01 MAY 2025

Question 15

3 marks | Quadratic Equations

15 Solve the equation $5x^2 + 9x - 17 = 0$
Show your working clearly.
Give your solutions correct to 3 significant figures.

(Total for Question 15 is 3 marks)

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TOPIC

Algebraic Proof

Every past-paper question on this topic, 2020 to 2026.

Question 13

4 marks | Algebraic Proof

13 (a) Use algebra to show that $0.5\dot{7}\dot{2} = \frac{63}{110}$

(2)

Given that y is a prime number,

(b) express $\frac{3}{2-\sqrt{y}}$ in the form $\frac{a+b\sqrt{y}}{c-y}$ where a, b and c are integers.

.....

(2)

(Total for Question 13 is 4 marks)

Question 17

3 marks | Algebraic Proof

17 Prove that the difference between two consecutive square numbers is always an odd number.
Show clear algebraic working.

(Total for Question 17 is 3 marks)

Question 25

3 marks | Algebraic Proof

25 N is a multiple of 5

$A = N + 1$
$B = N - 1$

Prove, using algebra, that $A^2 - B^2$ is always a multiple of 20

(Total for Question 25 is 3 marks)

Question 15

5 marks | Algebraic Proof

15 (a) Use algebra to show that $4.\dot{5}\dot{7} = 4\frac{19}{33}$

(2)

(b) Show that $\frac{2}{6-3\sqrt{2}}$ can be written in the form $\frac{a+\sqrt{a}}{b}$

where a and b are integers.

Show your working clearly.

(3)

(Total for Question 15 is 5 marks)

Question 15

4 marks | Algebraic Proof

15 Prove algebraically that the product of any two odd numbers is always an odd number.

(Total for Question 15 is 4 marks)

4MA1/1H MAY 2021

Question 17

3 marks | Algebraic Proof

17 Using algebra, prove that, given any 3 consecutive even numbers, the difference between the square of the largest number and the square of the smallest number is always 8 times the middle number.

(Total for Question 17 is 3 marks)

Question 19

6 marks | Algebraic Proof

19 *ABCED* is a five-sided shape.

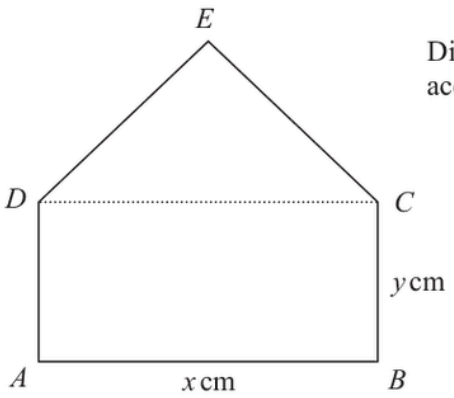


Diagram **NOT** accurately drawn

ABCD is a rectangle.
CED is an equilateral triangle.

$AB = x$ cm $BC = y$ cm

The perimeter of *ABCED* is 100 cm.
The area of *ABCED* is R cm^2

(a) Show that $R = \frac{x}{4}\left(200 - \left[6 - \sqrt{3}\right]x\right)$

(3)

(b) (i) Find the value of x for which R has its maximum value.

Give your answer in the form $\frac{p}{q - \sqrt{3}}$ where p and q are integers.

$x =$ .....

(2)

(ii) Explain why the maximum value of R is given by this value of x.

.....

(1)

(Total for Question 19 is 6 marks)

Question 13

3 marks | Algebraic Proof

13 $a = \sqrt{8} + 4$

$b = \sqrt{8} - 4$

$(a - b)(a + b)$ can be written in the form $y\sqrt{4y}$

Find the value of y
Show your working clearly.

$y =$ .....

(Total for Question 13 is 3 marks)

Question 15

3 marks | Algebraic Proof

15 Using algebra, prove that, given any 3 consecutive whole numbers, the sum of the square of the smallest number and the square of the largest number is always 2 more than twice the square of the middle number.

(Total for Question 15 is 3 marks)

Question 17

3 marks | Algebraic Proof

17 Show that $\dfrac{\sqrt{12}}{\sqrt{3}+2}$

can be written in the form $a+\sqrt{b}$ where a and b are integers.

(Total for Question 17 is 3 marks)

Question 18

3 marks | Algebraic Proof

18 Prove that when the sum of the squares of any two consecutive odd numbers is divided by 8, the remainder is always 2
Show clear algebraic working.

(Total for Question 18 is 3 marks)

Question 17

2 marks | Algebraic Proof

17 Use algebra to show that $0.3\dot{4}\dot{5} = \frac{19}{55}$

(Total for Question 17 is 2 marks)

4MA1/2H JUNE 2023

Question 1

3 marks | Algebraic Proof

1 Show that $4\frac{2}{3} \div 1\frac{1}{5} = 3\frac{8}{9}$

(Total for Question 1 is 3 marks)

Question 16

3 marks | Algebraic Proof

16 Show that $\dfrac{2\sqrt{3}}{\sqrt{3}-1}$ can be written in the form $a+\sqrt{a}$ where a is an integer.

Show your working clearly.

(Total for Question 16 is 3 marks)

Question 16

2 marks | Algebraic Proof

16 Use algebra to show that $0.1\dot{7}\dot{6} = \frac{35}{198}$

(Total for Question 16 is 2 marks)

Question 6

3 marks | Algebraic Proof

6 Show that $3\frac{3}{7} \div 2\frac{2}{3} = 1\frac{2}{7}$

(Total for Question 6 is 3 marks)

Question 15

5 marks | Algebraic Proof

15 (a) Use algebra to show that $0.3\dot{7}\dot{2} = \frac{41}{110}$

(2)

(b) Express $\frac{\sqrt{125} + \sqrt{80}}{\sqrt{3}}$ in the form $\sqrt{n}$ where n is an integer.

Show your working clearly.

.....

(3)

(Total for Question 15 is 5 marks)

Question 4

3 marks | Algebraic Proof

4 Show that $2\frac{1}{3} \div 5\frac{1}{4} = \frac{4}{9}$

(Total for Question 4 is 3 marks)

Question 14

7 marks | Algebraic Proof

14 (a) Show that $3y(2y + 5)(y + 7)$ can be written in the form $ay^3 + by^2 + cy$ where a, b and c are integers.

(3)

(b) Solve $\frac{2x + 3}{5} + \frac{6x - 5}{4} = \frac{163}{100}$

Show clear algebraic working.

$x =$ .....

(4)

(Total for Question 14 is 7 marks)

Question 17

3 marks | Algebraic Proof

17 Show that $\dfrac{1+\sqrt{5}}{3-\sqrt{5}}$ can be written in the form $a+\sqrt{b}$ where a and b are integers.

Show each stage of your working clearly.

(Total for Question 17 is 3 marks)

Question 18

2 marks | Algebraic Proof

18 Use algebra to show that $0.\dot{3}0\dot{6} = \frac{34}{111}$

(Total for Question 18 is 2 marks)

Question 1

3 marks | Algebraic Proof

1 Show that $1\frac{5}{7} \times 2\frac{3}{16} = 3\frac{3}{4}$

(Total for Question 1 is 3 marks)

Question 15

2 marks | Algebraic Proof

15 Use algebra to show that $0.7\dot{6}\dot{3} = \frac{42}{55}$

(Total for Question 15 is 2 marks)

Question 17

4 marks | Algebraic Proof

17 (a) Express $\sqrt{675}$ in the form $n\sqrt{27}$ where n is a positive integer.

.....

(1)

(b) Show that $\dfrac{5-\sqrt{2}}{\sqrt{2}-1}$ can be written in the form $a+b\sqrt{2}$ where a and b are integers.

(3)

(Total for Question 17 is 4 marks)

Question 23

4 marks | Algebraic Proof

23 Show that $\dfrac{16x^2 - 36}{x - 7} \div \dfrac{2x^2 + 7x + 6}{x^2 - 5x - 14} - (7 + 8x) = n$

where n is an integer to be found.
Show clear algebraic working.

(Total for Question 23 is 4 marks)

Question 3

3 marks | Algebraic Proof

3 Show that $2\frac{1}{4} \times 1\frac{5}{7} = 3\frac{6}{7}$

(Total for Question 3 is 3 marks)

4MA1/2H JUNE 2025

Question 3

3 marks | Algebraic Proof

3 Show that $7\frac{1}{3} - 3\frac{4}{7} = 3\frac{16}{21}$

(Total for Question 3 is 3 marks)

Question 15

4 marks | Algebraic Proof

15 $(\sqrt{3})^5 = k\sqrt{3}$ where k is an integer.

(a) Find the value of k

$k =$ .....

(1)

(b) Show that $\dfrac{21}{3-\sqrt{2}}$ can be written in the form $c + \sqrt{d}$

where c and d are integers.
Show each stage of your working clearly.

(3)

(Total for Question 15 is 4 marks)

Question 16

3 marks | Algebraic Proof

16 Show that $\frac{4}{3\sqrt{5}+7}$ can be written in the form $a-\sqrt{b}$ where a and b are integers.

Show each stage of your working.

(Total for Question 16 is 3 marks)

Question 17

3 marks | Algebraic Proof

17 Prove that, for any three numbers which are consecutive multiples of 4, the difference between the square of the largest number and the square of the smallest number is always a multiple of 64

Show clear algebraic working.

(Total for Question 17 is 3 marks)

Question 18

2 marks | Algebraic Proof

18 Use algebra to show that $0.\dot{7}0\dot{2} = \frac{26}{37}$

(Total for Question 18 is 2 marks)

Question 20

3 marks | Algebraic Proof

20 a, b and c are three consecutive even numbers where $a < b < c$

Prove algebraically that $b^2 = ac + 4$

(Total for Question 20 is 3 marks)

Question 5

3 marks | Algebraic Proof

5 Show that $3\frac{5}{7} + 1\frac{2}{3} = 5\frac{8}{21}$

(Total for Question 5 is 3 marks)

Question 16

2 marks | Algebraic Proof

16 Use algebra to show that $0.3\dot{7}\dot{8} = \frac{25}{66}$

(Total for Question 16 is 2 marks)

Question 17

2 marks | Algebraic Proof

17 Use algebra to show that $0.9\dot{5}\dot{4} = \frac{21}{22}$

(Total for Question 17 is 2 marks)

Question 17

3 marks | Algebraic Proof

17 Show that $\dfrac{2\sqrt{7}+2}{\sqrt{7}-3}$ can be written in the form $a-\sqrt{b}$ where a and b are integers.

Show your working clearly.

(Total for Question 17 is 3 marks)

4MA1/2H JUNE 2026

Question 17

2 marks | Algebraic Proof

17 Use algebra to show that $0.5\dot{3}\dot{9} = \frac{89}{165}$

(Total for Question 17 is 2 marks)

TOPIC

Sequences

Every past-paper question on this topic, 2020 to 2026.

Question 24

5 marks | Sequences

24 The sum of the first 10 terms of an arithmetic series is 4 times the sum of the first 5 terms of the same series.
The 8th term of this series is 45

Find the first term of this series.
Show clear algebraic working.

.....

(Total for Question 24 is 5 marks)

Question 22

4 marks | Sequences

22 The first term of an arithmetic series S is -6
The sum of the first 30 terms of S is 2865

Find the 9th term of S.

(Total for Question 22 is 4 marks)

Question 25

3 marks | Sequences

25 Mario is going to save \$50 in the year 2021

He is going to continue to save, up to and including the year 2070, by increasing the amount he saves each year by \$$k$

Mario will save a total of \$33 125 from 2021 to 2070

Work out the value of k.

$k =$ .....

(Total for Question 25 is 3 marks)

Question 18

4 marks | Sequences

18 In an arithmetic series, the 6th term is 39
In the same arithmetic series, the 19th term is 7.8

Work out the sum of the first 25 terms of the arithmetic series.

(Total for Question 18 is 4 marks)

4MA1/1H MAY/NOVEMBER 2020

Question 24

4 marks | Sequences

24 Here are the first five terms of an arithmetic sequence.

8 15 22 29 36

Work out the sum of all the terms from the 50th term to the 100th term inclusive.

(Total for Question 24 is 4 marks)

Question 21

6 marks | Sequences

21 The nth term of an arithmetic series is u_n where $u_n > 0$ for all n
The sum to n terms of the series is S_n

Given that $u_4 = 6$ and that $S_{11} = (u_6)^2 + 18$

find the value of u_{20}

(Total for Question 21 is 6 marks)

Question 24

4 marks | Sequences

24 An arithmetic series has first term a and common difference d.

The sum of the first $2n$ terms of the series is four times the sum of the first n terms of the series.

Find an expression for a in terms of d.
Show your working clearly.

$a =$ .....

(Total for Question 24 is 4 marks)

Question 2

2 marks | Sequences

2 Here are the first 4 terms of an arithmetic sequence.

85 79 73 67

Find an expression, in terms of n, for the nth term of the sequence.

(Total for Question 2 is 2 marks)

Question 23

5 marks | Sequences

23 The sum of the first N terms of an arithmetic series, S, is 292
The 2nd term of S is 8.5
The 5th term of S is 13

Find the value of N.
Show clear algebraic working.

$N =$ .....

(Total for Question 23 is 5 marks)

Question 20

5 marks | Sequences

20 Here are the first four terms of an arithmetic series.

$$k \quad \frac{3k}{4} \quad \frac{k}{2} \quad \frac{k}{4}$$

Given that the 15th term of the series is $(90 + 2k)$,

calculate the sum of the first 30 terms of the series.

(Total for Question 20 is 5 marks)

Question 16

4 marks | Sequences

16 An arithmetic series has first term 1 and common difference 4

Find the sum of all terms of the series from the 41st term to the 100th term inclusive.

(Total for Question 16 is 4 marks)

Question 26

5 marks | Sequences

26 An arithmetic series has first term a and common difference d, where d is a prime number.

The sum of the first n terms of the series is S_n and

$S_m = 39$

$S_{2m} = 320$

Find the value of d and the value of m
Show clear algebraic working.

$d =$ .....

$m =$ .....

(Total for Question 26 is 5 marks)

4MA1/1H JUNE 2022

Question 1

3 marks | Sequences

1 Here are the first five terms of an arithmetic sequence.

1 5 9 13 17

(a) Find an expression, in terms of n, for the nth term of this sequence.

.....

(2)

The nth term of another arithmetic sequence is $3n + 5$

(b) Find an expression, in terms of m, for the $(2m)$th term of this sequence.

.....

(1)

(Total for Question 1 is 3 marks)

Question 2

4 marks | Sequences

2 In a warehouse there are two types of shelves, type **R** and type **S**.

These two types of shelves are arranged into shelving units that form a sequence of patterns.

Here are the first three terms in the sequence.

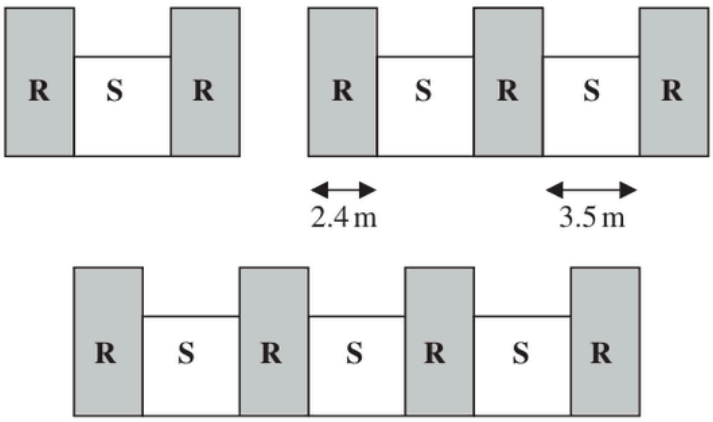


Diagram **NOT** accurately drawn

The width of each type **R** shelf is 2.4 m and the width of each type **S** shelf is 3.5 m

(a) Work out the total width of a shelving unit that has 6 type **R** shelves.

..... m

(2)

A shelving unit has n type **R** shelves.
The total width of this shelving unit is W metres.

(b) Find an expression for W in terms of n
Give your answer in its simplest form.

$W =$ .....

(2)

(Total for Question 2 is 4 marks)

Question 25

5 marks | Sequences

25 The sum of the first 10 terms of an arithmetic series is 4 times the sum of the first 5 terms of the same series.

The 8th term of this series is 45

Find the first term of this series.
Show clear algebraic working.

(Total for Question 25 is 5 marks)

Question 4

2 marks | Sequences

4 Here are the first four terms of an arithmetic sequence.

38 31 24 17

Find an expression, in terms of n, for the nth term of the sequence.

(Total for Question 4 is 2 marks)

Question 20

6 marks | Sequences

20 The sum of the first 80 terms of an arithmetic series, S, is 470

The 75th term of S is 14.5

The sum of the first X terms of S is 171

Work out the value of X
Show your working clearly.

$X =$ .....

(Total for Question 20 is 6 marks)

Question 23

5 marks | Sequences

23 Here are the first three terms of an arithmetic sequence.

$$8p \qquad 7p - 3 \qquad 4p + 2$$

The sum of the first n terms of the sequence is -1914

Work out the value of n
Show your working clearly.

$n =$ .....

(Total for Question 23 is 5 marks)

Question 19

6 marks | Sequences

19 Here are the first 4 terms in an arithmetic sequence.

3 7 11 15

The last term of the sequence is x
The sum of the terms of the sequence is 7260

Find the value of x
Show clear algebraic working.

$x =$ .....

(Total for Question 19 is 6 marks)

Question 1

3 marks | Sequences

1 Here are the first four terms of an arithmetic sequence.

1 4 7 10

(a) Find an expression, in terms of n, for the nth term of this sequence.

.....

(2)

The nth term of a different arithmetic sequence is $5n + 17$

(b) Find the 12th term of this sequence.

.....

(1)

(Total for Question 1 is 3 marks)

Question 23

4 marks | Sequences

23 Here are the first three terms of an arithmetic sequence.

$$(4x-14) \quad , \quad (x+2) \quad , \quad (7x-9)$$

Find, as an integer, the sum of the first 40 terms of the sequence.
Show clear algebraic working.

(Total for Question 23 is 4 marks)

Question 24

6 marks | Sequences

24 A polygon has n sides, where $n > 5$

The interior angles of the polygon form an arithmetic sequence.

The smallest angle of the polygon is 84°
The common difference of the sequence is 4°

Work out the sum of the interior angles of the polygon.
Show clear algebraic working.

.....°

(Total for Question 24 is 6 marks)

Question 19

5 marks | Sequences

19 An arithmetic series has first term a and common difference d

The sum of the first 30 terms of the arithmetic series is 4395

The sum of the 10th term and the 20th term is 284

Work out the sum of the first 45 terms of the arithmetic series.
Show clear algebraic working.

(Total for Question 19 is 5 marks)

Question 5

3 marks | Sequences

5 Here are the first five terms of a number sequence.

11 15 19 23 27

(a) Find an expression in terms of n for the nth term of this sequence.

.....

(2)

The nth term of another number sequence is $-5n + 4$

Salim says no term in this sequence is a prime number.

(b) Find a term in this sequence that shows Salim is wrong.

.....

(1)

(Total for Question 5 is 3 marks)

Question 24

5 marks | Sequences

24 An arithmetic series has 30 terms.

The first term is a
The common difference is d

The 20th term is 123
The sum of the 30 terms is 2880

Work out the value of a and the value of d
Show clear algebraic working.

$a =$ .....

$d =$ .....

(Total for Question 24 is 5 marks)

Question 24

6 marks | Sequences

24 The first 3 terms of an arithmetic series are

$$(2x + 5) \qquad (3y - 4) \qquad (4x - 2)$$

where x and y are constants.

The sum of the first 9 terms of the series is 216

Find the value of x and the value of y
Show clear algebraic working.

$x =$ .....

$y =$ .....

(Total for Question 24 is 6 marks)

Question 24

4 marks | Sequences

24 The 21st term of an arithmetic series is 109
The sum of the first 52 terms of the series is 4381

Work out the 5th term of the series.
Show clear algebraic working.

.....

(Total for Question 24 is 4 marks)

Question 24

6 marks | Sequences

24 An arithmetic series P has first term a and common difference d

The sum of the first 40 terms of P is 2070

An arithmetic series Q has first term $2a$ and common difference $3d$

The 25th term of Q is 186

Work out the sum of the first 40 terms of Q
Show clear algebraic working.

(Total for Question 24 is 6 marks)

Question 25

5 marks | Sequences

25 The first term of an arithmetic series is 10
The 20th term of the series is 86

The sum of the first N terms of the series is 5194

Work out the value of N
Show your working clearly.

$N =$ .....

(Total for Question 25 is 5 marks)

Question 26

5 marks | Sequences

26 The first term of an arithmetic series is 10
The 20th term of the series is 86

The sum of the first N terms of the series is 5194

Work out the value of N
Show your working clearly.

$N =$ .....

(Total for Question 26 is 5 marks)

Question 2

5 marks | Sequences

2 The nth term of an arithmetic sequence is given by $8n - 5$

(a) Work out the ratio of the 40th term of the sequence to the 60th term of the sequence.
Give your ratio in its simplest form.

.....

(3)

Here are the first five terms of a different arithmetic sequence.

3 8 13 18 23

(b) Find an expression for the nth term of this sequence.

.....

(2)

(Total for Question 2 is 5 marks)

Question 2

2 marks | Sequences

2 Here are the first five terms of an arithmetic sequence.

14 8 2 –4 –10

Find an expression, in terms of n, for the nth term of this sequence.

.....

(Total for Question 2 is 2 marks)

Question 25

6 marks | Sequences

25 Here are the first four terms of an arithmetic series.

$$(k + 2) \qquad (k + 5) \qquad (k + 8) \qquad (k + 11)$$

The sum of the first $2n$ terms of the series is 4 times the sum of the first n terms of the series.

Work out the numerical value of the 100th term of the series.
Show your working clearly.

(Total for Question 25 is 6 marks)

Question 25

5 marks | Sequences

25 An arithmetic series has first term 3 and common difference 8

The nth term of the series is U_n
The sum of the first n terms of the series is S_n

Given that $S_{5k} - S_{3k} = 25\,560$

find the value of U_{4k}
Show clear algebraic working.

.....

(Total for Question 25 is 5 marks)

4MA1/2HR JUNE 2026

Question 26

6 marks | Sequences

26 Here are the first four terms of an arithmetic series.

$$(k + 2) \qquad (k + 5) \qquad (k + 8) \qquad (k + 11)$$

The sum of the first $2n$ terms of the series is 4 times the sum of the first n terms of the series.

Work out the numerical value of the 100th term of the series.
Show your working clearly.

.....

(Total for Question 26 is 6 marks)

TOPIC

Direct & Inverse Proportion

Every past-paper question on this topic, 2020 to 2026.

Question 16

4 marks | Direct & Inverse Proportion

16 M is directly proportional to h^3
$M = 4$ when $h = 0.5$

Find the value of h when $M = 500$

$h =$ .....

(Total for Question 16 is 4 marks)

Question 14

3 marks | Direct & Inverse Proportion

14 F is inversely proportional to the square of v.

Given that $F = 6.5$ when $v = 4$

find a formula for F in terms of v.

(Total for Question 14 is 3 marks)

Question 16

6 marks | Direct & Inverse Proportion

16 A is inversely proportional to the square of r

$A = 5$ when $r = 0.3$

(a) Find a formula for A in terms of r

.....

(3)

(b) Find the value of A when $r = 7.5A$

$A =$ .....

(3)

(Total for Question 16 is 6 marks)

Question 15

3 marks | Direct & Inverse Proportion

15 A is inversely proportional to C^2

$A = 40$ when $C = 1.5$

Calculate the value of C when $A = 1000$

$C =$ .....

(Total for Question 15 is 3 marks)

Question 20

4 marks | Direct & Inverse Proportion

20 y is inversely proportional to $\sqrt{x}$
x is directly proportional to T^3

Given that $y = 8$ when $T = 25$

find the exact value of T when $y = 27$

$T =$ .....

(Total for Question 20 is 4 marks)

Question 17

4 marks | Direct & Inverse Proportion

17 M varies directly as the cube of h
$M = 4$ when $h = 0.5$

Find the value of h when $M = 500$

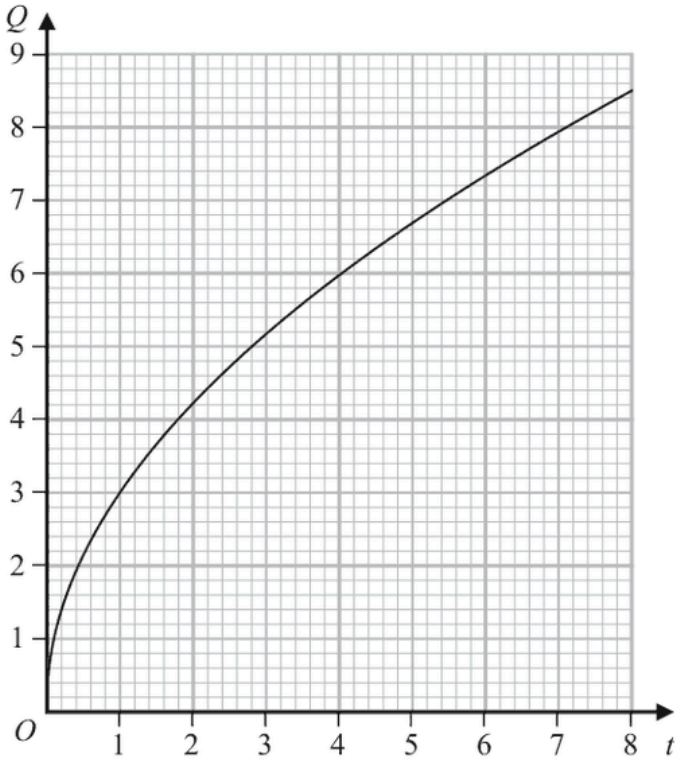
(Total for Question 17 is 4 marks)

Question 16

5 marks | Direct & Inverse Proportion

16 Q is directly proportional to $\sqrt{t}$

The graph shows the relationship between Q and t for $0 < t < 8$



(a) Find a formula for Q in terms of t

.....

(3)

Q is increased by 20%

(b) Find the percentage increase in t

.....%

(2)

(Total for Question 16 is 5 marks)

Question 17

4 marks | Direct & Inverse Proportion

17 F is inversely proportional to the square of r

$F = 36$ when $r = 4$

(a) Find a formula for F in terms of r

.....

(3)

(b) Work out the value of F when $r = 48$

.....

(1)

(Total for Question 17 is 4 marks)

Question 17

3 marks | Direct & Inverse Proportion

17 Q is directly proportional to the square root of d

$Q = 4.5$ when $d = 324$

Find a formula for Q in terms of d

(Total for Question 17 is 3 marks)

Question 14

3 marks | Direct & Inverse Proportion

14 B is inversely proportional to the square of d

$B = 0.25$ when $d = 12$

Find a formula for B in terms of d

(Total for Question 14 is 3 marks)

Question 18

4 marks | Direct & Inverse Proportion

18 y is inversely proportional to x^3

$y = 4$ when $x = 3$

Work out the value of x when $y = 864$

$x =$ .....

(Total for Question 18 is 4 marks)

Question 18

5 marks | Direct & Inverse Proportion

18 F is inversely proportional to the cube of r

$F = 6$ when $r = 2$

(a) Find a formula for F in terms of r

.....

(3)

(b) Find the value of r when $F = 3072$

$r =$ .....

(2)

(Total for Question 18 is 5 marks)

Question 18

3 marks | Direct & Inverse Proportion

18 W is inversely proportional to y^2

$W = 50$ when $y = 4$

Find a formula for W in terms of y

.....

(Total for Question 18 is 3 marks)

Question 17

3 marks | Direct & Inverse Proportion

17 T is inversely proportional to $\sqrt{m}$

$T = 15$ when $m = 36$

Find a formula for T in terms of m

(Total for Question 17 is 3 marks)

Question 17

3 marks | Direct & Inverse Proportion

17 T is inversely proportional to $\sqrt{m}$

$T = 15$ when $m = 36$

Find a formula for T in terms of m

(Total for Question 17 is 3 marks)

Question 16

3 marks | Direct & Inverse Proportion

16 m is directly proportional to r^2

$m = 180$ when $r = 6$

Find a formula for m in terms of r

(Total for Question 16 is 3 marks)

Question 19

4 marks | Direct & Inverse Proportion

19 M is directly proportional to p^2

$M = 2$ when $p = 5$

(a) Find a formula for M in terms of p

.....

(3)

(b) Work out the value of M when $p = 15$

$M =$ .....

(1)

(Total for Question 19 is 4 marks)

4MA1/1HR JUNE 2026

Question 20

5 marks | Direct & Inverse Proportion

20 y is directly proportional to t^2
$y = 40$ when $t = 4$

t is directly proportional to the cube root of x
$t = 12$ when $x = 8$

Work out the value of y when $x = 27$

$y =$ .....

(Total for Question 20 is 5 marks)

TOPIC

Linear Graphs

Every past-paper question on this topic, 2020 to 2026.

Question 9

7 marks | Linear Graphs

9 (a) Simplify $3a^4b^5 \times 4a^7b^2$

.....

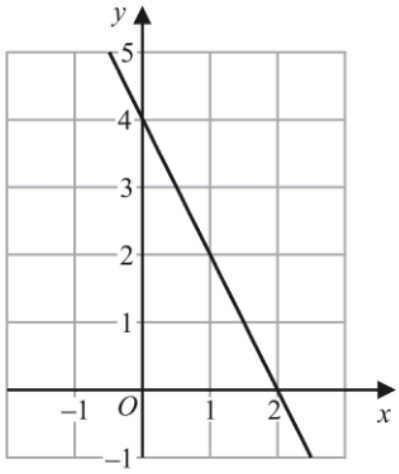
(2)

(b) Factorise fully $14x^2y^4 + 21x^3y^2$

.....

(2)

The diagram shows a straight line drawn on a grid.



(c) Find an equation of the line.

.....

(2)

A different straight line has equation $y = 3x - 5$

(d) Write down the coordinates of the point at which the line crosses the y-axis.

(....., ...)

(1)

(Total for Question 9 is 7 marks)

Question 23

6 marks | Linear Graphs

23 $ABCD$ is a kite.

$AB = AD$ and $CB = CD$

The point B has coordinates $(k, 1)$ where k is a negative constant.
The point D has coordinates $(8, 7)$

The straight line **L** passes through the points B and D and has a gradient of $\frac{3}{5}$

Find an equation of AC
Give your answer in the form $px + qy = r$ where p, q and r are integers.
Show your working clearly.

.....

(Total for Question 23 is 6 marks)

Question 1

4 marks | Linear Graphs

1 The point A has coordinates $(5, -4)$
The point B has coordinates $(13, 1)$

(a) Work out the coordinates of the midpoint of AB.

(..... , ...)

(2)

Line **L** has equation $y = 2 - 3x$

(b) Write down the gradient of line **L**.

.....

(1)

Line **L** has equation $y = 2 - 3x$

(c) Does the point with coordinates $(100, -302)$ lie on line **L**?
You must give a reason for your answer.

.....

(1)

(Total for Question 1 is 4 marks)

Question 19

5 marks | Linear Graphs

19 (a) Write down an equation of a line that is parallel to the line with equation $y = 7 - 4x$

.....

(1)

The line **L** passes through the points with coordinates $(-3, 1)$ and $(2, -2)$

(b) Find an equation of the line that is perpendicular to **L** and passes through the point with coordinates $(-6, 4)$
Give your answer in the form $ax + by + c = 0$ where a, b and c are integers.

.....

(4)

(Total for Question 19 is 5 marks)

Question 22

6 marks | Linear Graphs

22 Triangle HJK is isosceles with $HJ = HK$ and $JK = \sqrt{80}$

H is the point with coordinates $(-4, 1)$
J is the point with coordinates $(j, 15)$ where $j < 0$
K is the point with coordinates $(6, k)$

M is the midpoint of JK.
The gradient of HM is 2

Find the value of j and the value of k.

$j =$ .....

$k =$ .....

(Total for Question 22 is 6 marks)

Question 22

5 marks | Linear Graphs

22 The line with equation $y = x + 2$ intersects the curve with equation $x^2 + y^2 - 2y = 24$ at the points A and B.

Find the coordinates of A and B.
Show clear algebraic working.

(..... , ...)

(..... , ...)

(Total for Question 22 is 5 marks)

Question 24

5 marks | Linear Graphs

24 $\mathbf{L}_1$ and $\mathbf{L}_2$ are two straight lines.
The origin of the coordinate axes is O.

$\mathbf{L}_1$ has equation $5x + 10y = 8$
$\mathbf{L}_2$ is perpendicular to $\mathbf{L}_1$ and passes through the point with coordinates (8, 6)

$\mathbf{L}_2$ crosses the x-axis at the point A.
$\mathbf{L}_2$ intersects the straight line with equation $x = -3$ at the point B.

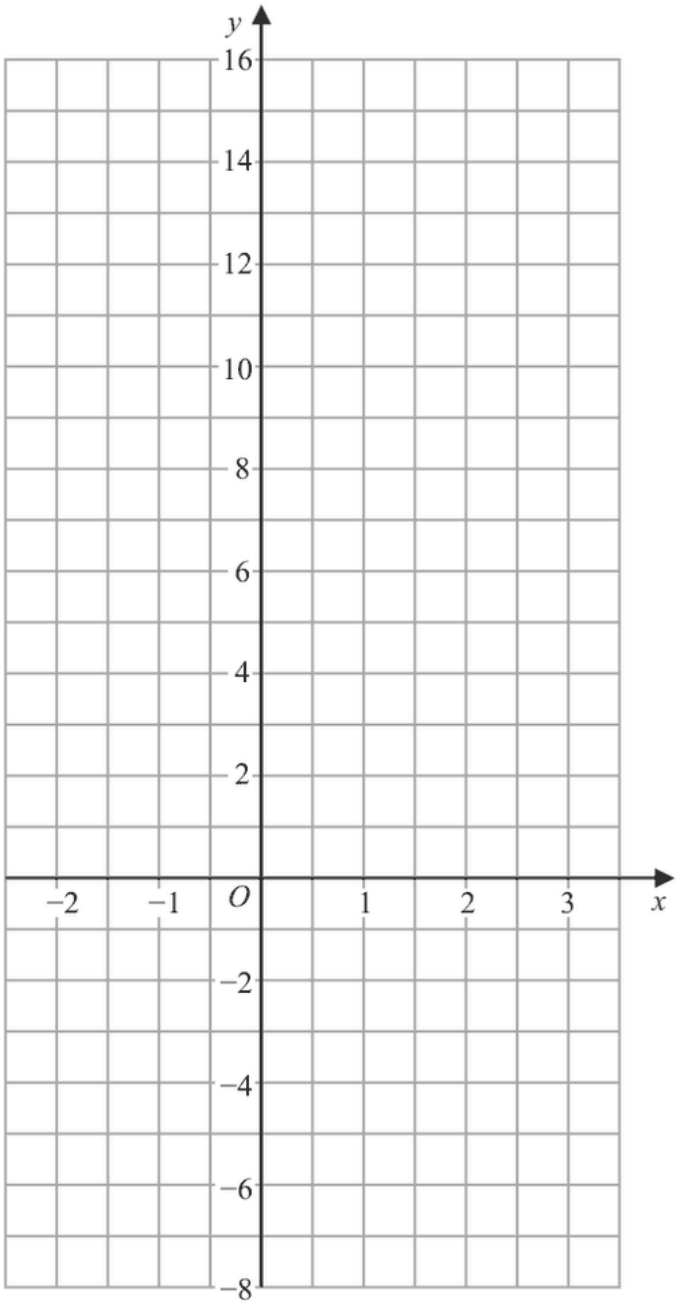
Find the area of triangle AOB.
Show your working clearly.

(Total for Question 24 is 5 marks)

Question 3

3 marks | Linear Graphs

3 On the grid, draw the graph of $y = 7 - 4x$ for values of x from -2 to 3



(Total for Question 3 is 3 marks)

Question 6

2 marks | Linear Graphs

6 Point A has coordinates $(-3, 11)$
Point B has coordinates $(47, b)$
The midpoint of AB has coordinates $(a, -19)$

Find the value of a and the value of b.

$a =$ .....

$b =$ .....

(Total for Question 6 is 2 marks)

Question 22

4 marks | Linear Graphs

22 $ABCD$ is a rhombus.

The diagonals, AC and BD, intersect at the point M.
The coordinates of M are $(6, -11)$

The points A and C both lie on the line with equation $2y + 7x = 20$

Find the exact coordinates of the point where the line through B and D intersects the y-axis.

(..... , ...)

(Total for Question 22 is 4 marks)

Question 13

3 marks | Linear Graphs

13 Point A has coordinates (5, 8)
Point B has coordinates (9, –4)

(a) Work out the gradient of AB.

.....

(2)

The straight line **L** has equation $y = -4x + 5$

(b) Write down the gradient of a straight line that is perpendicular to **L**.

.....

(1)

(Total for Question 13 is 3 marks)

Question 18

7 marks | Linear Graphs

18 A rectangle $ABCD$ is to be drawn on a centimetre grid such that

A has coordinates $(-4, -2)$
B has coordinates $(1, 10)$
C has coordinates $(19, a)$
D has coordinates (b, c)

(a) Work out the value of a, the value of b and the value of c.

$a =$ .....

$b =$ .....

$c =$ .....

(4)

(b) Calculate the perimeter, in centimetres, of rectangle $ABCD$.

..... cm

(3)

(Total for Question 18 is 7 marks)

Question 22

5 marks | Linear Graphs

22 ABC is an isosceles triangle with $AB = AC$.

B is the point with coordinates $(-1, 5)$
C is the point with coordinates $(2, 10)$
M is the midpoint of BC.

Find an equation of the line through the points A and M.
Give your answer in the form $py + qx = r$ where p, q and r are integers.

(Total for Question 22 is 5 marks)

Question 17

4 marks | Linear Graphs

17 The straight line **L** passes through the points (4, −1) and (6, 4)

The straight line **M** is perpendicular to **L** and intersects the y-axis at the point (0, 8)

Find the coordinates of the point where **M** intersects the x-axis.

(..... , ...)

(Total for Question 17 is 4 marks)

Question 19

6 marks | Linear Graphs

19 The straight line **L** has equation $x - y = 3$
The curve **C** has equation $3x^2 - y^2 + xy = 9$

L and **C** intersect at the points P and Q.

Find the coordinates of the midpoint of PQ.
Show clear algebraic working.

(..... , ...)

(Total for Question 19 is 6 marks)

Question 20

7 marks | Linear Graphs

20 The straight line **L** passes through point A $(-6, 2)$ and point B $(5, 3)$
The straight line **M** is perpendicular to **L** and passes through the midpoint of A and B.
The line **M** intersects the line $x = -1$ at point C.

Calculate the area of triangle ABC.

(Total for Question 20 is 7 marks)

Question 10

3 marks | Linear Graphs

10 The straight line **L** has equation $2y + 7x = 10$

(a) Find the gradient of **L**

.....

(2)

(b) Find the coordinates of the point where **L** crosses the y-axis.

(..... , ...)

(1)

(Total for Question 10 is 3 marks)

Question 18

5 marks | Linear Graphs

18 The line with equation $2y = x + 1$ intersects the curve with equation $3y^2 + 7y + 16 = x^2 - x$ at the points A and B

Find the coordinates of A and the coordinates of B
Show clear algebraic working.

(..... , ...) and (..... , ...)

(Total for Question 18 is 5 marks)

Question 22

5 marks | Linear Graphs

22 ABC is a triangle in which angle $ABC = 90°$

p and q are integers such that

the coordinates of A are $(p, 10)$
the coordinates of B are $(-1, -5)$
the coordinates of C are $(8, q)$

Given that the gradient of AC is $-\frac{6}{7}$

work out the value of p and the value of q

$p =$ .....

$q =$ .....

(Total for Question 22 is 5 marks)

Question 10

4 marks | Linear Graphs

10 Two circles, C_1 and C_2, are drawn on a centimetre grid, with a scale of 1 cm for 1 unit on each axis.

The centre of circle C_1 is at the point with coordinates $(-1, 3)$ and the radius of C_1 is 13 cm.

The centre of circle C_2 is at the point with coordinates $(7, 18)$ and the radius of C_2 is 6 cm.

(a) Work out the distance between the centre of C_1 and the centre of C_2

..... cm

(3)

(b) Explain why circle C_1 intersects circle C_2

.....

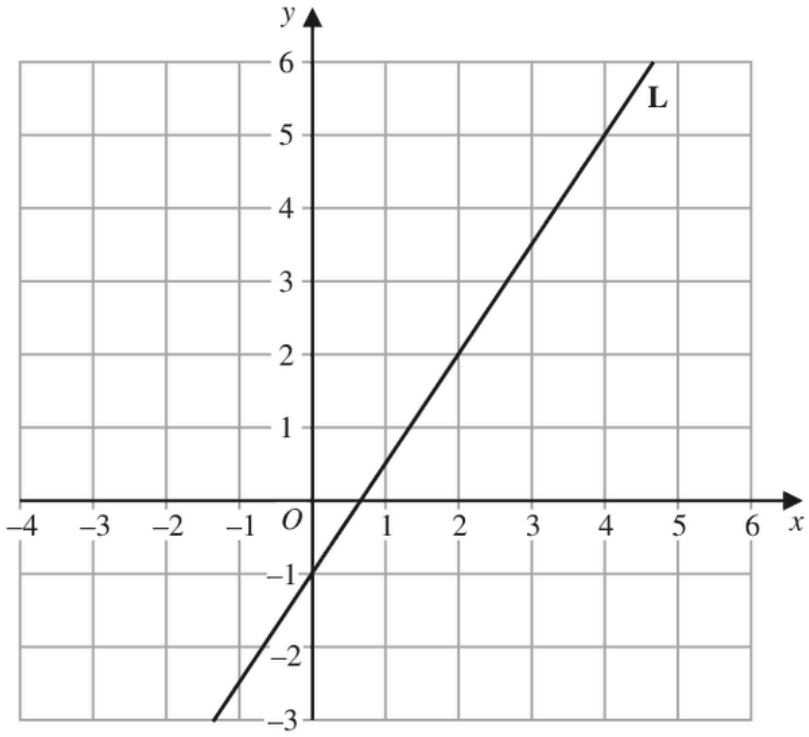
(1)

(Total for Question 10 is 4 marks)

Question 10

3 marks | Linear Graphs

10 Line **L** is drawn on the grid.



Find an equation for **L**
Give your answer in the form $y = mx + c$

(Total for Question 10 is 3 marks)

Question 20

4 marks | Linear Graphs

20 The centre O of a circle has coordinates (4, 7)

The point A, on the circle, has coordinates (6, 11) and AOP is a diameter of the circle.

Find an equation of the tangent to the circle at the point P

(Total for Question 20 is 4 marks)

Question 22

7 marks | Linear Graphs

22 *ABCD* is a kite, with diagonals *AC* and *BD*, drawn on a centimetre square grid, with a scale of 1 cm for 1 unit on each axis.

A is the point with coordinates (−3, 4)

The diagonals of the kite intersect at the point *M* with coordinates (0, 2)

Given that $AB = AD = 6.5$ cm and the x coordinate of *B* is positive,

find the coordinates of the points *B* and *D*.

(..... , ...)

(..... , ...)

(Total for Question 22 is 7 marks)

Question 13

3 marks | Linear Graphs

13 A is the point with coordinates $(-5, 12)$

B is the point with coordinates $(19, -48)$

Find an equation of the straight line that passes through the points A and B

(Total for Question 13 is 3 marks)

Question 21

5 marks | Linear Graphs

21 Work out the coordinates of the points of intersection of

$$y - 2x = 1 \quad \text{and} \quad y^2 + xy = 7$$

Show clear algebraic working.

(..... , ...)

(..... , ...)

(Total for Question 21 is 5 marks)

Question 24

6 marks | Linear Graphs

24 $ABCD$ is a kite with $AB = AD$ and $CB = CD$

A is the point with coordinates $(-2, 10)$

B is the point with coordinates $\left(-\frac{27}{5}, 4\right)$

C is the point with coordinates $(4, -5)$

Work out the coordinates of D

(..... , ...)

(Total for Question 24 is 6 marks)

Question 25

6 marks | Linear Graphs

25 The straight line with equation $y - 2x = 7$ is the perpendicular bisector of the line AB where A is the point with coordinates $(j, 7)$ and B is the point with coordinates $(6, k)$

Find the coordinates of the midpoint of the line AB
Show clear algebraic working.

(..... , ...)

(Total for Question 25 is 6 marks)

Question 9

2 marks | Linear Graphs

9 A straight line passes through the points with coordinates (0, –3) and (2, 0)

Find an equation of the line.

(Total for Question 9 is 2 marks)

Question 21

5 marks | Linear Graphs

21 The line with equation $x + 2y = 5$ intersects the curve with equation $x^2 + 3y^2 = 13$ at the points A and B

Find the coordinates of A and the coordinates of B
Show clear algebraic working.

(..... , ...)

(..... , ...)

(Total for Question 21 is 5 marks)

Question 22

6 marks | Linear Graphs

22 [In this question 1 cm = 1 unit on the x-axis and 1 cm = 1 unit on the y-axis]

P is a point on a circle with centre (0, 0)
The coordinates of P are (8, −10)

The line **L** is the tangent to the circle at the point P
L crosses the x-axis at the point Q and crosses the y-axis at the point R

Work out the length of RQ
Give your answer correct to 3 significant figures.

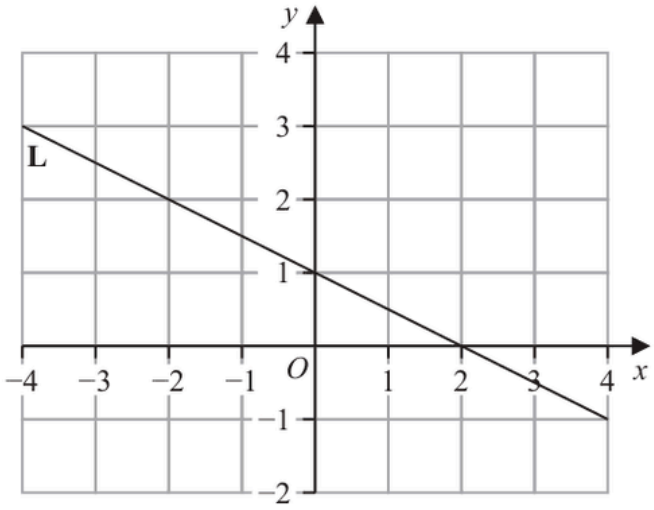
..... cm

(Total for Question 22 is 6 marks)

Question 9

3 marks | Linear Graphs

9 Line **L** is drawn on the grid.



Find an equation for **L**
Give your answer in the form $y = mx + c$

(Total for Question 9 is 3 marks)

Question 18

2 marks | Linear Graphs

18 The straight line **P** has equation $5y + 2x = 7$

Find the gradient of a straight line that is perpendicular to **P**

(Total for Question 18 is 2 marks)

Question 21

4 marks | Linear Graphs

21 $ABCD$ is a square.

The point A has coordinates $(-5, 2)$
The point B has coordinates $(3, 5)$

Find an equation of the line that passes through B and C
Give your answer in the form $ax + by + c = 0$ where a, b and c are integers.

(Total for Question 21 is 4 marks)

Question 22

5 marks | Linear Graphs

22 The straight line **L** has equation $x + y = 5$

The curve **C** has equation $2x^2 + 3y^2 = 210$

Find the coordinates of the points where **L** and **C** intersect.
Show clear algebraic working.

(..... , ...) (..... , ...)

(Total for Question 22 is 5 marks)

Question 18

4 marks | Linear Graphs

18 The straight line **L** is perpendicular to the straight line with equation $2x + y = 9$ and passes through the point with coordinates (8, 11)

Find an equation for **L**
Give your answer in the form $y = mx + c$

(Total for Question 18 is 4 marks)

Question 10

2 marks | Linear Graphs

10 A straight line, **L**, is parallel to the line with equation $y = 2 - 5x$
The line **L** passes through the point (0, 6)

Find an equation of the line **L**

(Total for Question 10 is 2 marks)

Question 23

5 marks | Linear Graphs

23 A circle C has centre $(3q, 4q)$ where q is an integer.

The straight line with equation $y = -\frac{5}{4}x + \frac{21}{4}$ is the tangent to C at the point $(p, p+3)$ where p is an integer.

Work out the radius of C
Give your answer in the form $\sqrt{a}$ where a is an integer.
Show your working clearly.

(Total for Question 23 is 5 marks)

Question 24

6 marks | Linear Graphs

24 PQ is a straight line drawn on a square grid, with a scale of 1 cm for 1 unit on each axis.

P has coordinates $(-5, a)$ and Q has coordinates $(7, 3a)$ where $a > 0$

The length of PQ is $4\sqrt{10}$ cm

Find an equation of the perpendicular bisector of PQ
Give your answer in the form $y = mx + c$ where m and c are integers.

(Total for Question 24 is 6 marks)

Question 24

5 marks | Linear Graphs

24 $PQRS$ is a square.

PR is a diagonal of the square.

P is the point with coordinates (4, 7)
R is the point with coordinates (8, –5)

Find an equation of the straight line that passes through the points Q and S
Give your answer in the form $ay = bx + c$ where a, b and c are integers.

(Total for Question 24 is 5 marks)

Question 25

5 marks | Linear Graphs

25 $PQRS$ is a square.

PR is a diagonal of the square.

P is the point with coordinates (4, 7)
R is the point with coordinates (8, –5)

Find an equation of the straight line that passes through the points Q and S
Give your answer in the form $ay = bx + c$ where a, b and c are integers.

(Total for Question 25 is 5 marks)

Question 1

2 marks | Linear Graphs

1 The point P has coordinates (3, 4)
The point Q has coordinates (9, 16)

M is the midpoint of the line PQ

Find the coordinates of M

(..... , ...)

(Total for Question 1 is 2 marks)

Question 20

3 marks | Linear Graphs

20 The straight line **L** has equation $y = 4x + 7$

The straight line **M** is perpendicular to **L** and passes through the point with coordinates (8, 1)

Find an equation for **M**
Give your answer in the form $y = mx + c$

(Total for Question 20 is 3 marks)

Question 27

5 marks | Linear Graphs

27 $ABCD$ is a rhombus with $AB = BC = CD = DA$

A has coordinates $(16, -9)$

C has coordinates $(24, 15)$

Find an equation of the line BD
Give your answer in the form $ax + by + c = 0$ where a, b and c are integers.
Show your working clearly.

(Total for Question 27 is 5 marks)

Question 28

6 marks | Linear Graphs

28 The curve **C** has equation $x^2 + y^2 = d - 11x$ where d is an integer.
The line **L** has equation $y = 3x + e$ where e is an integer.

C and **L** intersect at the point A and at the point B

The coordinates of A are $(0.2, 2.6)$

Work out the coordinates of B
Show your working clearly.

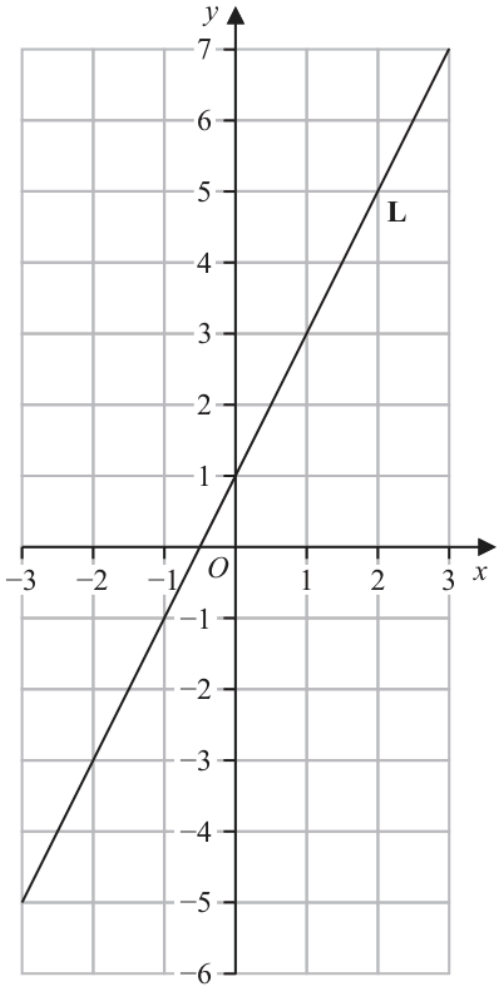
(..... , ...)

(Total for Question 28 is 6 marks)

Question 10

3 marks | Linear Graphs

10 The line **L** is drawn on a grid.



Find an equation for **L**

.....

(Total for Question 10 is 3 marks)

Question 13

3 marks | Linear Graphs

13 The straight line **L** has equation $4y - 10x - 5 = 0$

(a) Find the gradient of **L**

.....

(2)

(b) Find the coordinates of the point where **L** crosses the y-axis.

(..... , ...)

(1)

(Total for Question 13 is 3 marks)

Question 15

2 marks | Linear Graphs

15 Point A has coordinates $(-3, 4)$
Point B has coordinates $(2, -6)$

Work out the gradient of the line AB

.....

(Total for Question 15 is 2 marks)

Question 17

4 marks | Linear Graphs

17 The line **L** is perpendicular to the line with equation $y = 7 + 4x$

L passes through the point A with coordinates $\left(0, \frac{19}{2}\right)$

L crosses the x-axis at the point B

Find the area of triangle AOB where O is the origin.
Show your working clearly.

.....

(Total for Question 17 is 4 marks)

TOPIC

Graphs of Functions

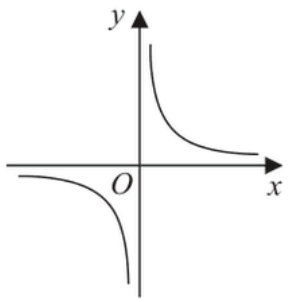
Every past-paper question on this topic, 2020 to 2026.

Question 15

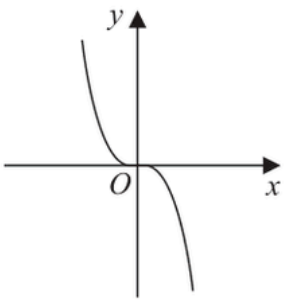
3 marks | Graphs of Functions

15 Here are six graphs.

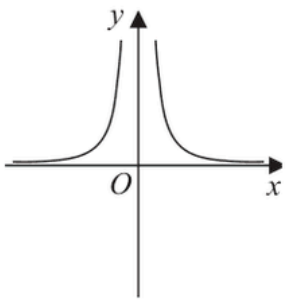
Graph A



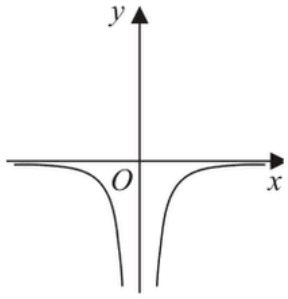
Graph B



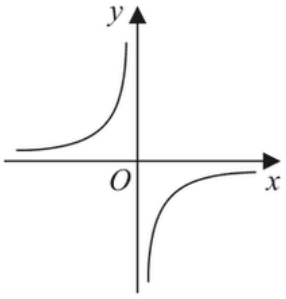
Graph C



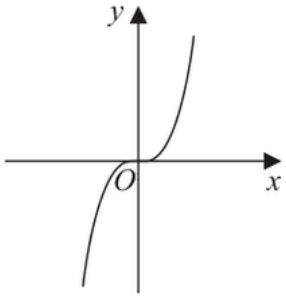
Graph D



Graph E



Graph F



Complete the table below with the letter of the graph that could represent each given equation.

Write your answers on the dotted lines.

Equation	Graph
$y = \frac{2}{x^2}$	.....
$y = -\frac{1}{2}x^3$	.....
$y = -\frac{5}{x}$	.....

(Total for Question 15 is 3 marks)

Question 15

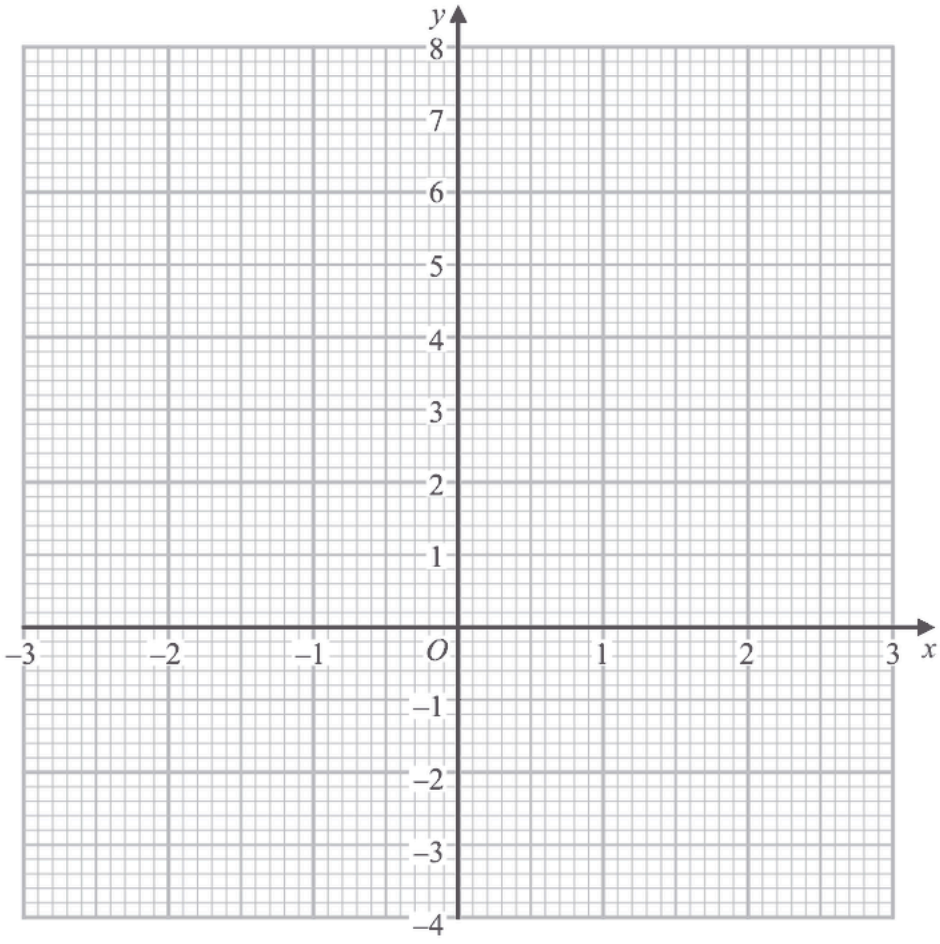
4 marks | Graphs of Functions

15 (a) Complete the table of values for $y = x^2 - \frac{x}{2} - 3$

x	–3	–2	–1	0	1	2	3
y	7.5				–2.5		4.5

(2)

(b) On the grid, draw the graph of $y = x^2 - \frac{x}{2} - 3$ for values of x from –3 to 3



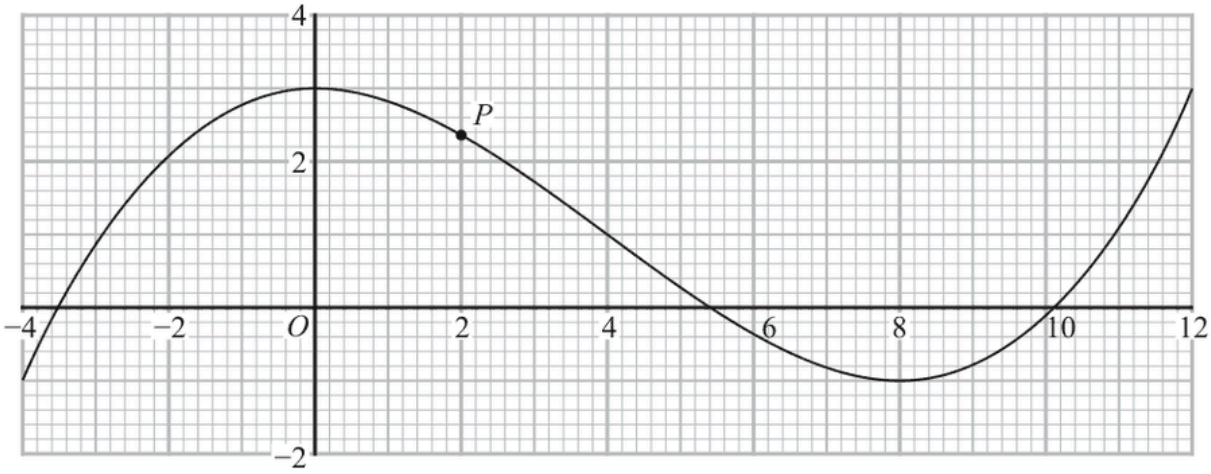
(2)

(Total for Question 15 is 4 marks)

Question 18

7 marks | Graphs of Functions

18 The diagram shows the graph of $y = f(x)$ for $-4 \leqslant x \leqslant 12$



The point P on the curve has x coordinate 2

(a) (i) Use the graph to find an estimate for the gradient of the curve at P.

.....

(3)

(ii) Hence find an equation of the tangent to the curve at P.
Give your answer in the form $y = mx + c$

.....

(2)

The equation $f(x) = k$ has exactly two different solutions for $-4 \leqslant x \leqslant 12$

(b) Use the graph to find the two possible values of k.

..... , ...

(2)

(Total for Question 18 is 7 marks)

Question 20

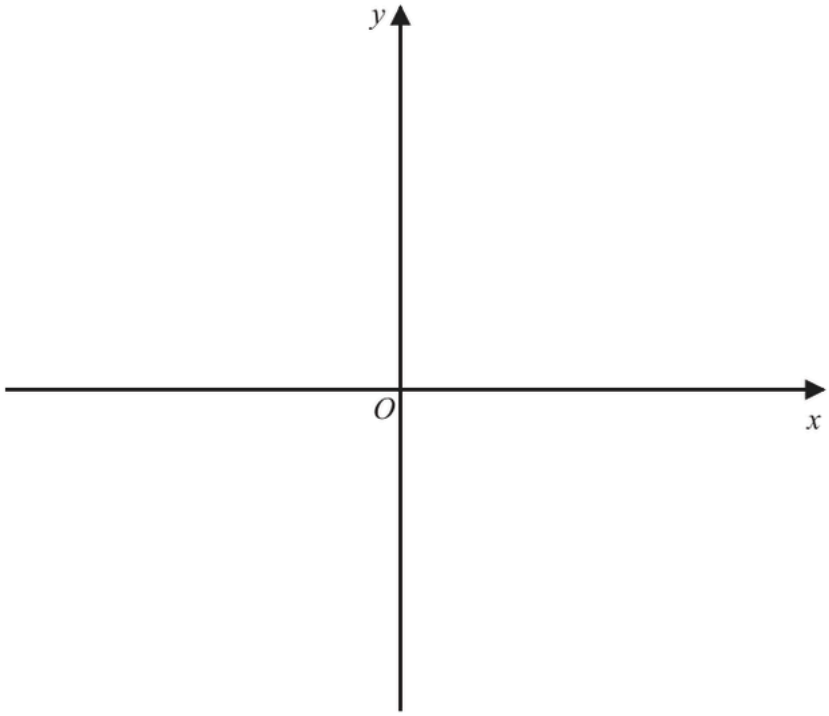
4 marks | Graphs of Functions

20 The curve **C** has equation $y = 4(x - 1)^2 - a$ where $a > 4$

Using the axes below, sketch the curve **C**.
On your sketch show clearly, in terms of a,

(i) the coordinates of any points of intersection of **C** with the coordinate axes,

(ii) the coordinates of the turning point.



(Total for Question 20 is 4 marks)

Question 15

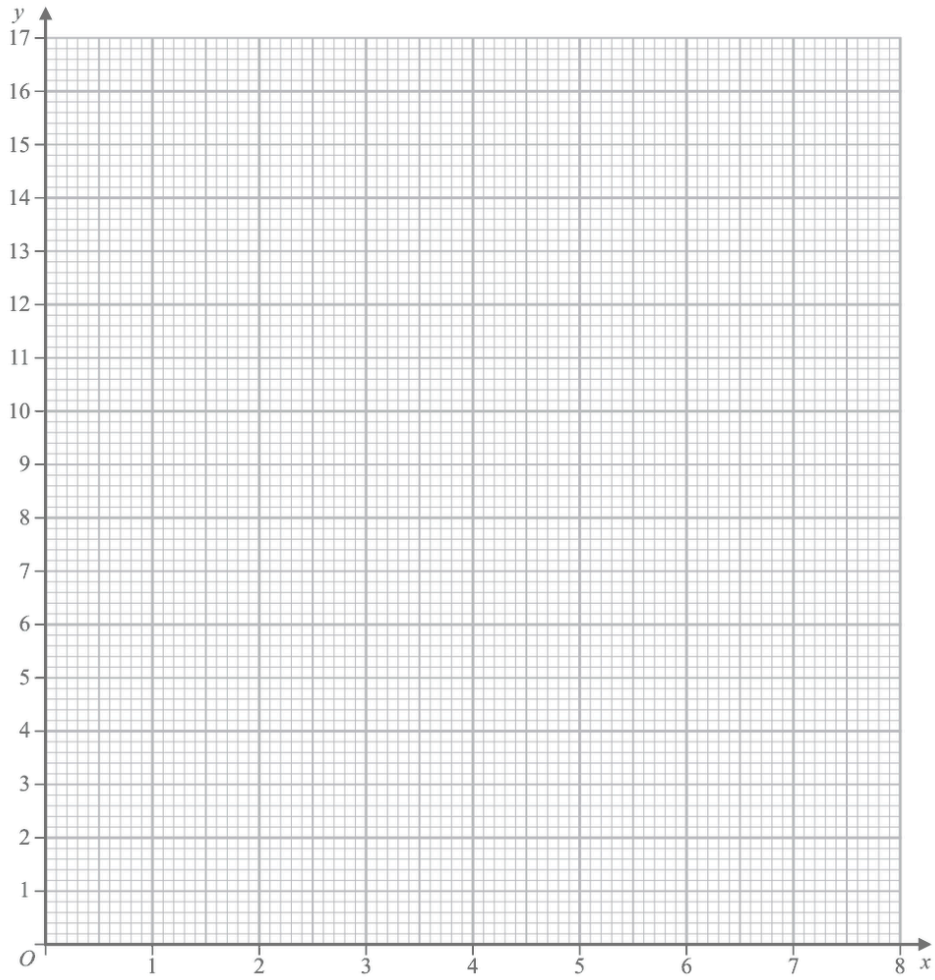
4 marks | Graphs of Functions

15 (a) Complete the table of values for $y = \frac{1}{x}(x^2 + 4)$

x	0.25	0.5	1	2	4	8
y	16.25					8.5

(2)

(b) On the grid, draw the graph of $y = \frac{1}{x}(x^2 + 4)$ for $0.25 \leqslant x \leqslant 8$



(2)

(Total for Question 15 is 4 marks)

Question 4

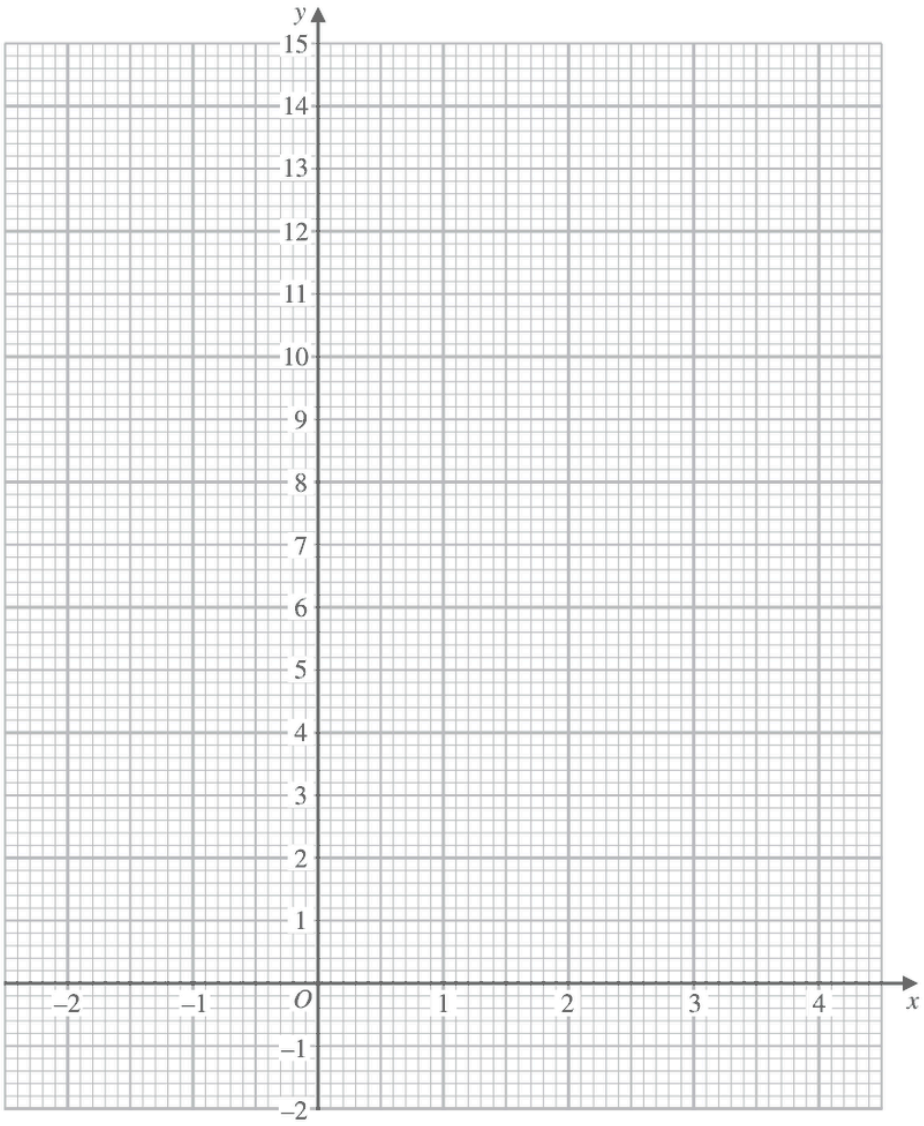
4 marks | Graphs of Functions

4 (a) Complete the table of values for $y = x^2 - 4x + 3$

x	–2	–1	0	1	2	3	4
y		8	3			0	

(2)

(b) On the grid, draw the graph of $y = x^2 - 4x + 3$ for values of x from –2 to 4



(2)

(Total for Question 4 is 4 marks)

Question 11

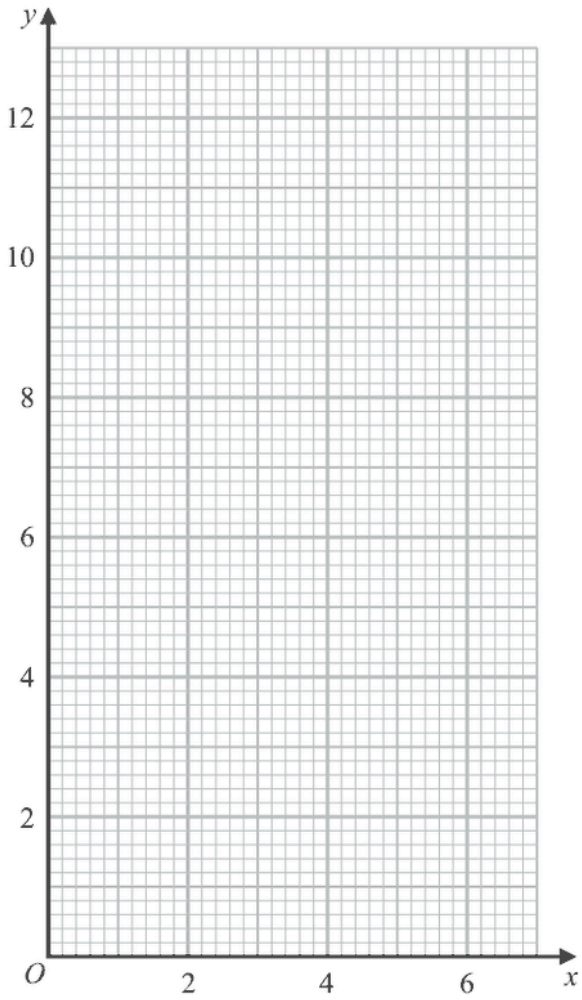
4 marks | Graphs of Functions

11 (a) Complete the table of values for $y = \frac{6}{x}$

x	0.5	1	2	3	4	5	6
y		6		2			1

(2)

(b) On the grid, draw the graph of $y = \frac{6}{x}$ for $0.5 \leqslant x \leqslant 6$



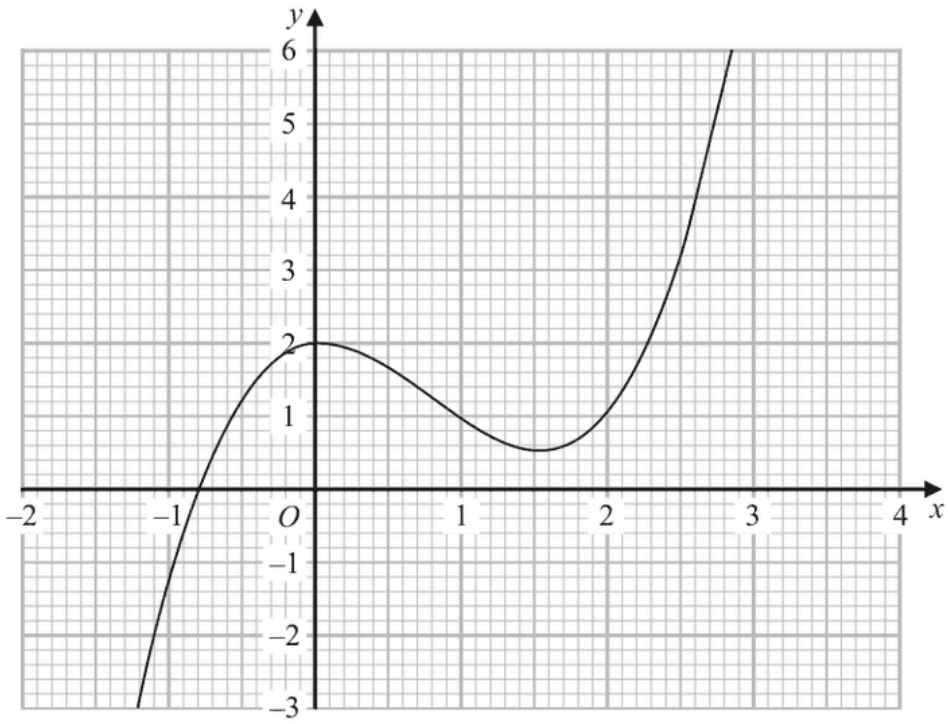
(2)

(Total for Question 11 is 4 marks)

Question 17

3 marks | Graphs of Functions

17 Part of the curve with equation $y = f(x)$ is shown on the grid.



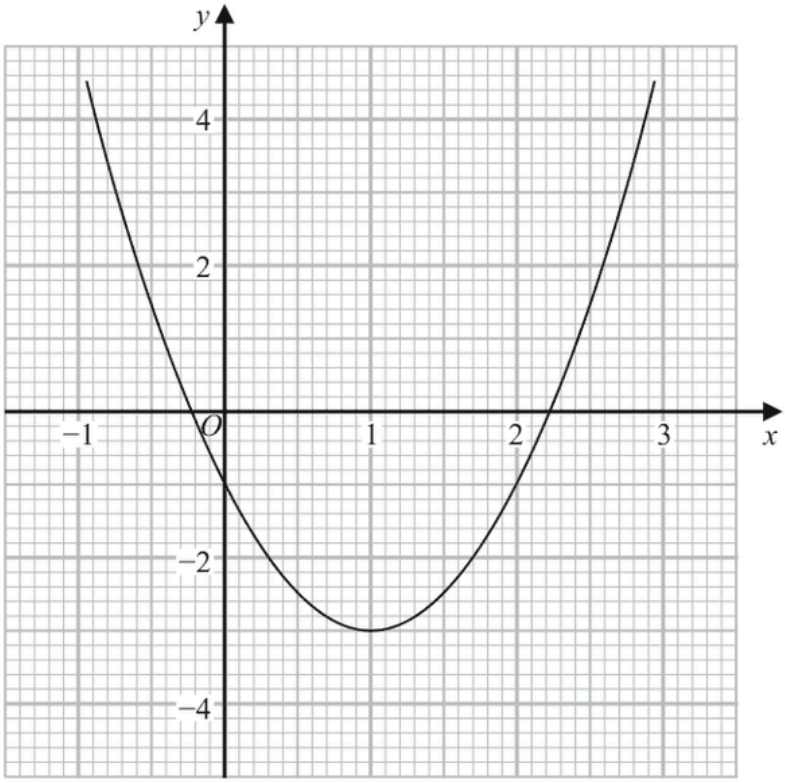
Find an estimate for the gradient of the curve at the point where $x = 2$
Show your working clearly.

(Total for Question 17 is 3 marks)

Question 21

5 marks | Graphs of Functions

21 Part of the graph of $y = 2x^2 - 4x - 1$ is shown on the grid.



(a) Use the graph to find estimates for the solutions of the equation $2x^2 - 4x - 1 = 0$
Give your solutions correct to one decimal place.

.....

(2)

(b) By drawing a suitable straight line on the grid, find estimates for the solutions of the equation $x^2 - x - 1 = 0$
Show your working clearly.
Give your solutions correct to one decimal place.

.....

(3)

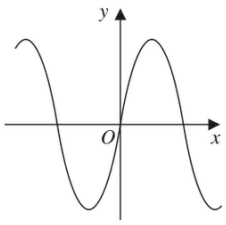
(Total for Question 21 is 5 marks)

Question 16

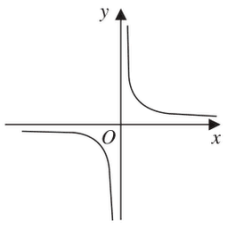
3 marks | Graphs of Functions

16 Here are nine graphs.

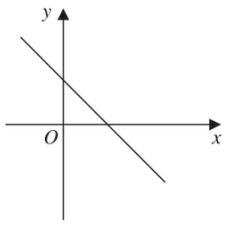
Graph A



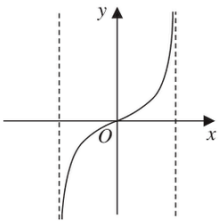
Graph B



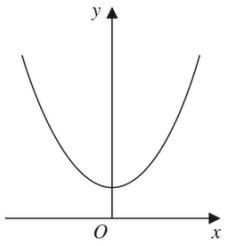
Graph C



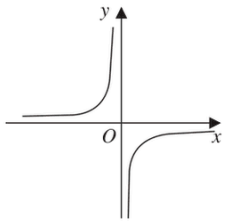
Graph D



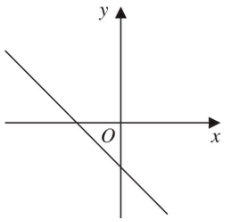
Graph E



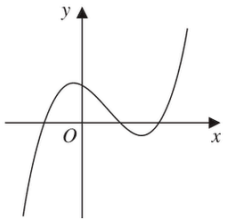
Graph F



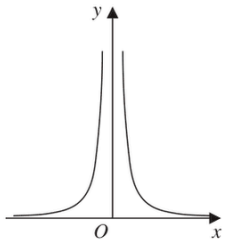
Graph G



Graph H



Graph I



Complete the table below with the letter of the graph that could represent each given equation.
Write each answer on the dotted line.

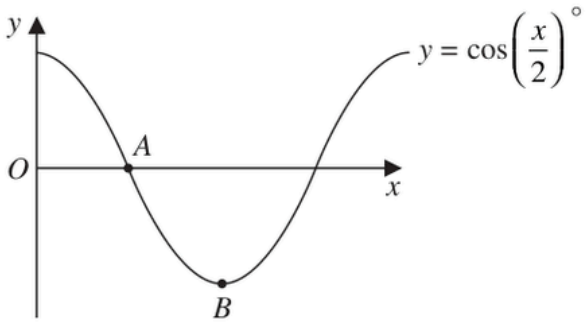
Equation	Graph
$y = -2x + 3$	.....
$y = -\frac{1}{x}$	.....
$y = \tan x°$	.....
$y = (x + 1)(x - 1)(x - 2)$	.....

(Total for Question 16 is 3 marks)

Question 23

2 marks | Graphs of Functions

23 The diagram shows a sketch of the graph of $y = \cos\left(\frac{x}{2}\right)^\circ$



(i) Find the coordinates of the point A

(..... , ...)

(1)

(ii) Find the coordinates of the point B

(..... , ...)

(1)

(Total for Question 23 is 2 marks)

Question 4

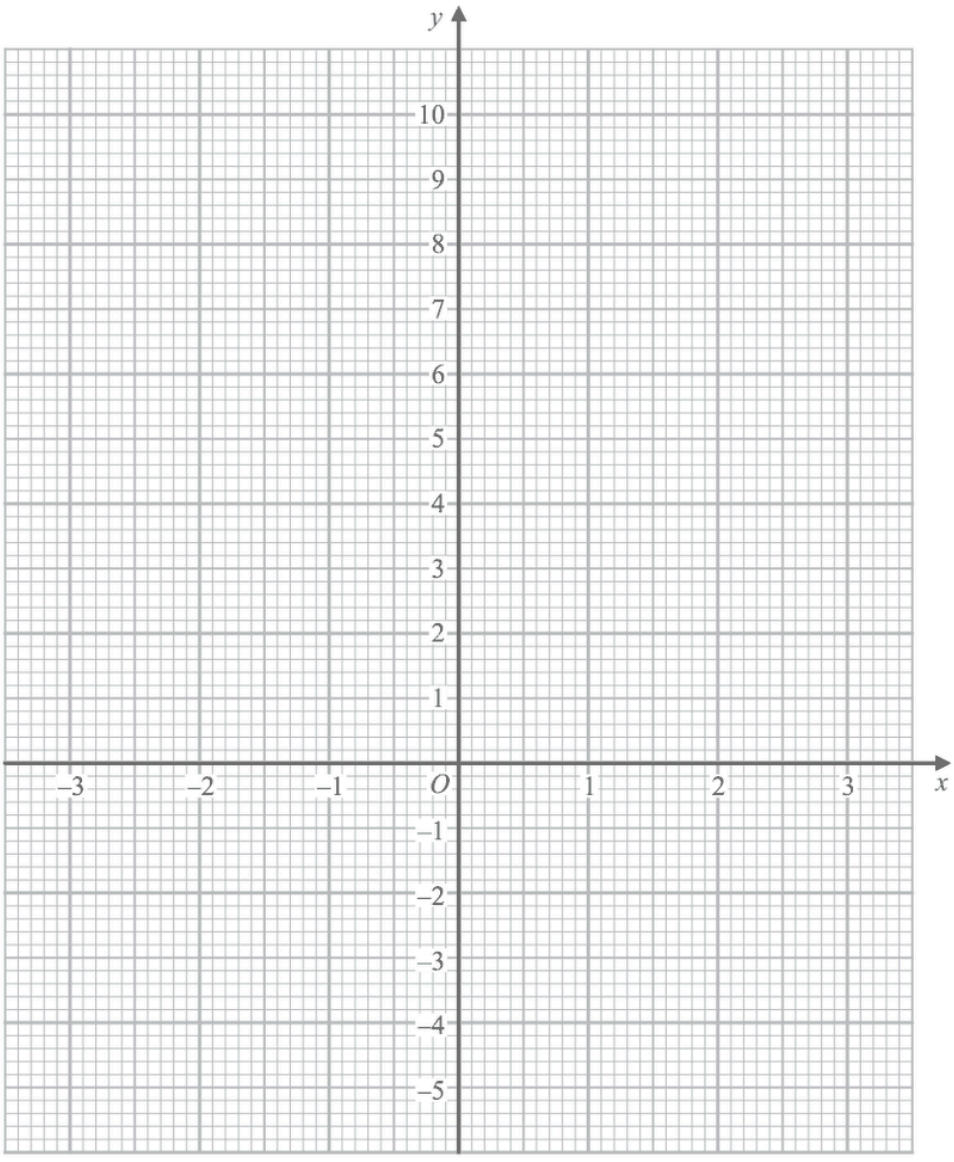
4 marks | Graphs of Functions

4 (a) Complete the table of values for $y = x^2 - x - 4$

x	–3	–2	–1	0	1	2	3
y		2			–4		

(2)

(b) On the grid below, draw the graph of $y = x^2 - x - 4$ for values of x from –3 to 3



(2)

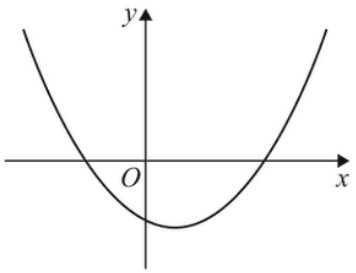
(Total for Question 4 is 4 marks)

Question 12

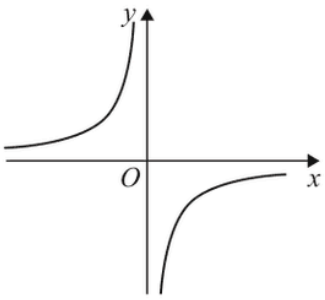
3 marks | Graphs of Functions

12 Here are six graphs.

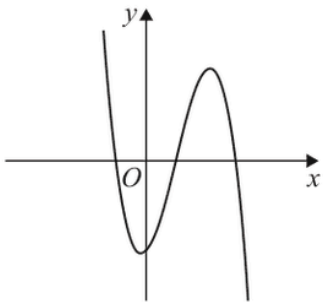
Graph **A**



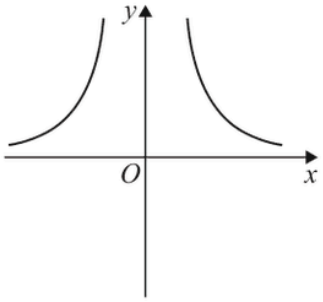
Graph **B**



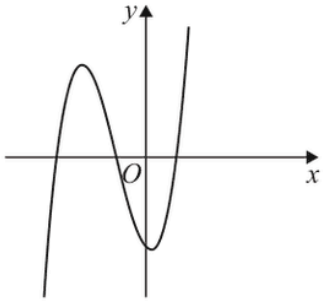
Graph **C**



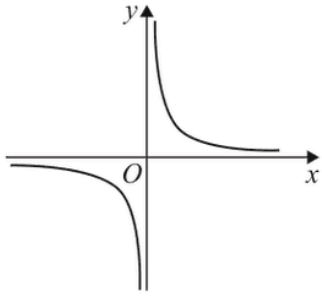
Graph **D**



Graph **E**



Graph **F**



Write down the letter of the graph of

(a) $y = \frac{10}{x^2}$

.....

(1)

(b) $y = x - 3 + 3x^2 - x^3$

.....

(1)

(c) $y = -\frac{3}{x}$

.....

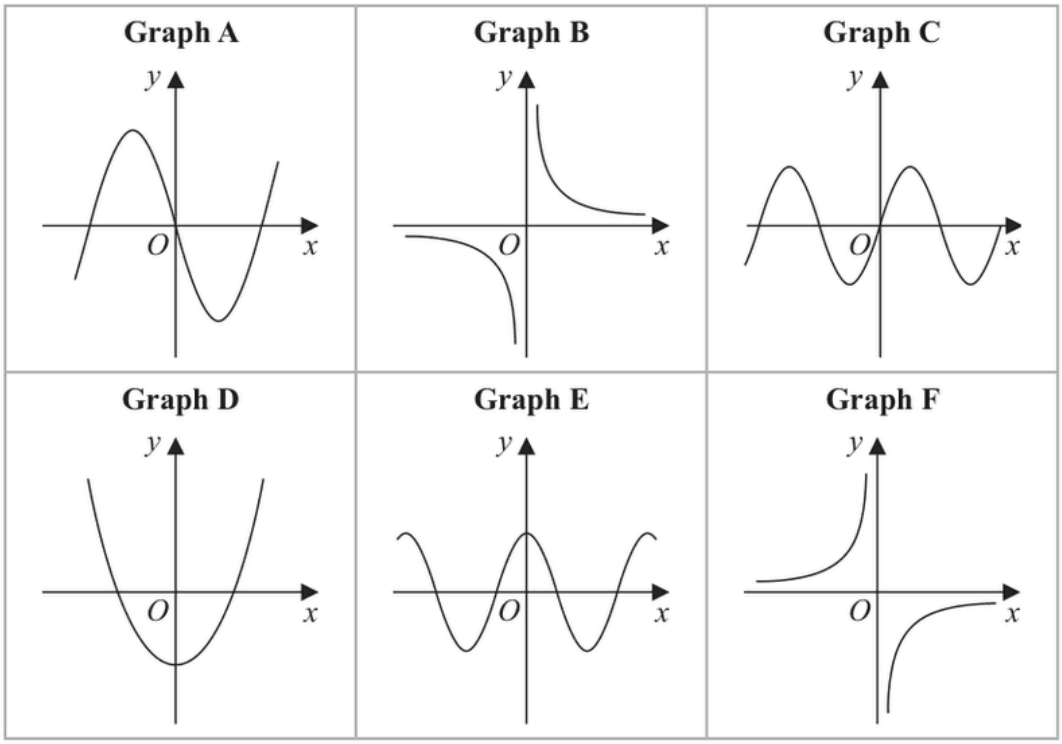
(1)

(Total for Question 12 is 3 marks)

Question 18

3 marks | Graphs of Functions

18 Here are 6 graphs.



Complete the table below with the letter of the graph that could represent each given equation.

Write your answers on the dotted lines.

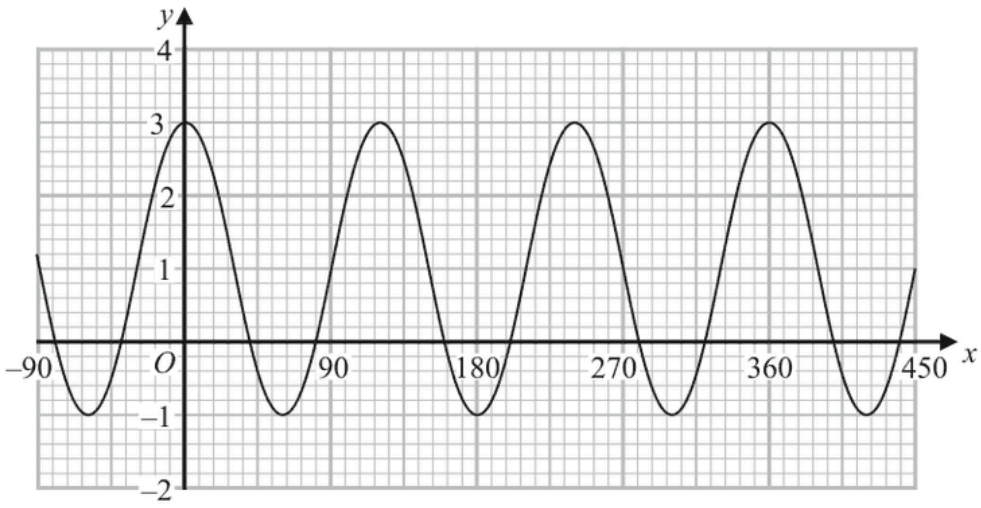
Equation	Graph
$y = \sin x$	.....
$y = -\frac{3}{x}$	.....
$y = 4x^3 - 5x$	.....

(Total for Question 18 is 3 marks)

Question 26

3 marks | Graphs of Functions

26 Here is a sketch of the curve with equation $y = a\cos bx° + c$ where $-90 \leqslant x \leqslant 450$



Find the value of a, the value of b and the value of c

$a =$ .....

$b =$ .....

$c =$ .....

(Total for Question 26 is 3 marks)

Question 12

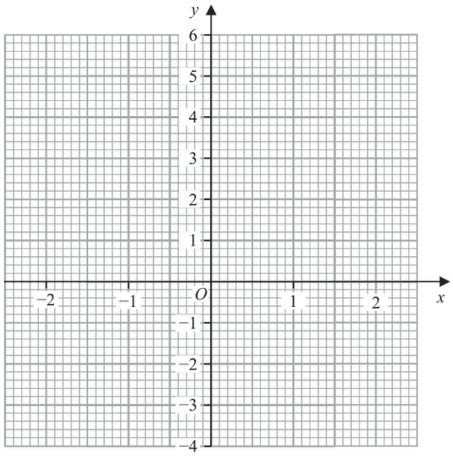
5 marks | Graphs of Functions

12 (a) Complete the table of values for $y = x^3 - 3x + 1$

x	−2	−1	0	1	2
y				−1	

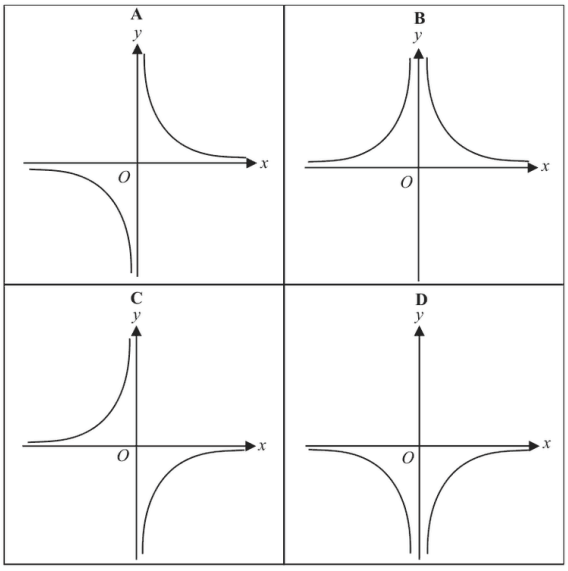
(2)

(b) On the grid, draw the graph of $y = x^3 - 3x + 1$ for values of x from − 2 to 2



(2)

Here are four graphs.



(c) Write down the letter of the graph that could have the equation $y = -\frac{1}{x^2}$

.....

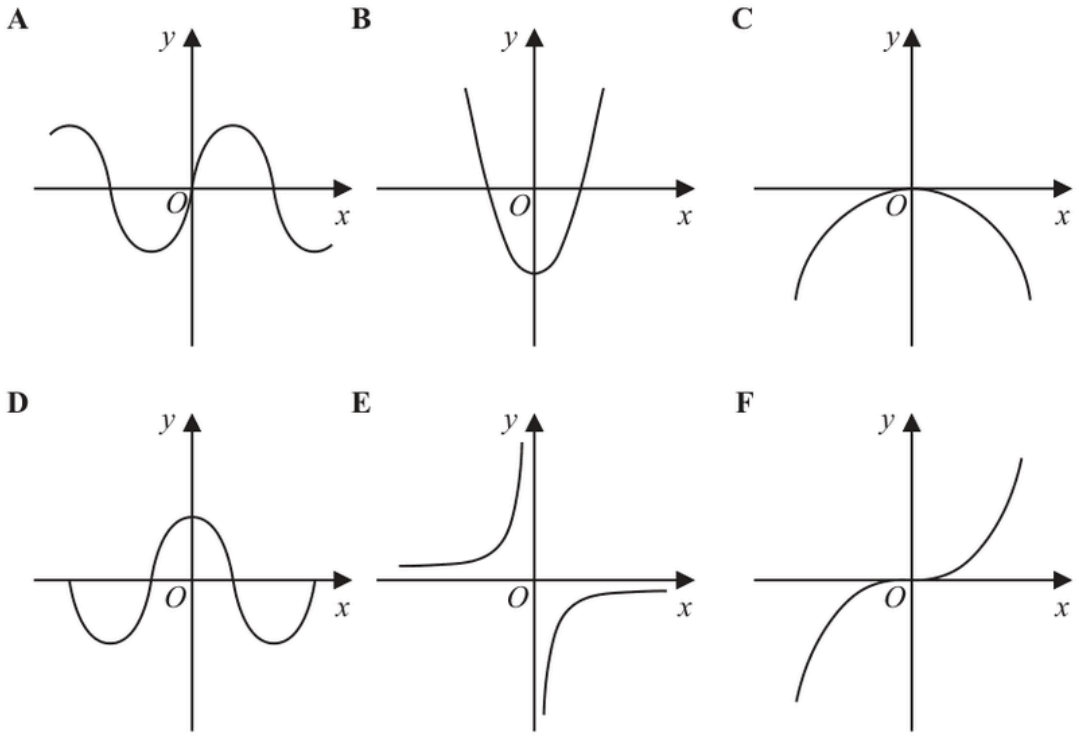
(1)

(Total for Question 12 is 5 marks)

Question 16

2 marks | Graphs of Functions

16 Here are six graphs.



Write down the letter of the graph that could have the equation

(i) $y = -\frac{1}{x}$

.....

(1)

(ii) $y = \sin x°$

.....

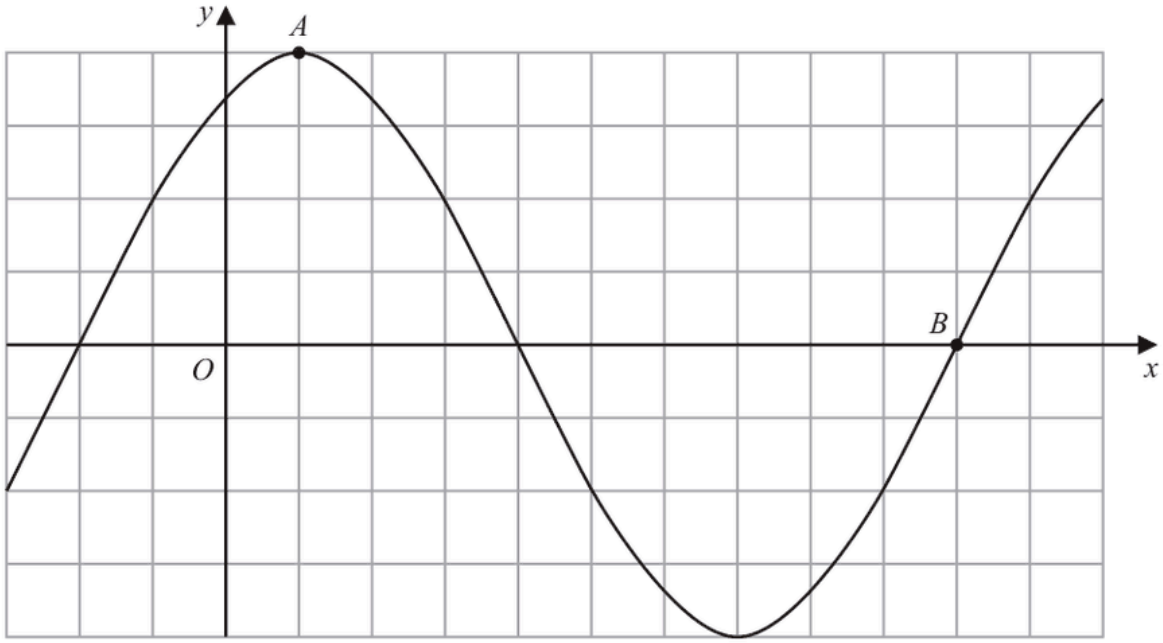
(1)

(Total for Question 16 is 2 marks)

Question 25

2 marks | Graphs of Functions

25 The diagram shows a sketch of the graph of $y = 2\sin(x + 60)°$



(i) Find the coordinates of the point A

(..... , ...)

(1)

(ii) Find the coordinates of the point B

(..... , ...)

(1)

(Total for Question 25 is 2 marks)

Question 11

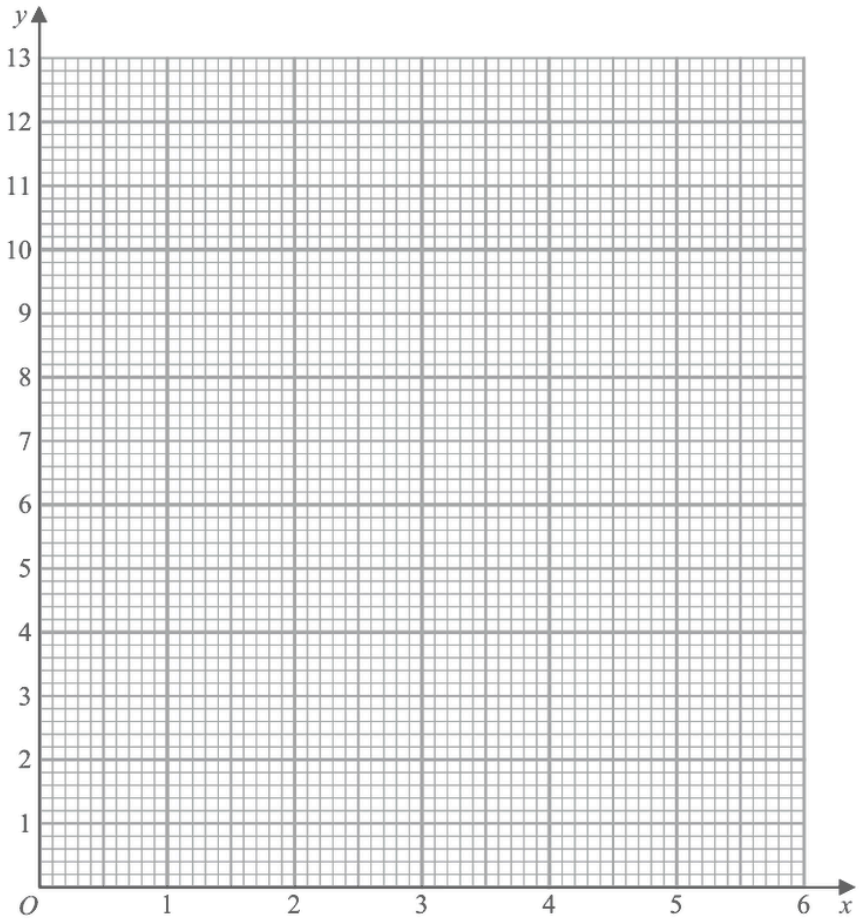
4 marks | Graphs of Functions

11 (a) Complete the table of values for $y = 2\left(x + \frac{1}{x}\right)$

x	0.5	1	2	3	4	5	6
y			5	6.7			12.3

(2)

(b) On the grid, draw the graph of $y = 2\left(x + \frac{1}{x}\right)$ for $0.5 \leqslant x \leqslant 6$



(2)

(Total for Question 11 is 4 marks)

Question 23

5 marks | Graphs of Functions

23 The curve **C** has equation $y = x^2 - 8x - 9$
The straight line **L** has equation $y = k$ where k is an integer.

C and **L** intersect at the points A and B

The coordinates of point A are (p, k)
The coordinates of point B are (q, k)

Given that $p - q = 14$

find the value of k
Show clear algebraic working.

$k =$ .....

(Total for Question 23 is 5 marks)

Question 10

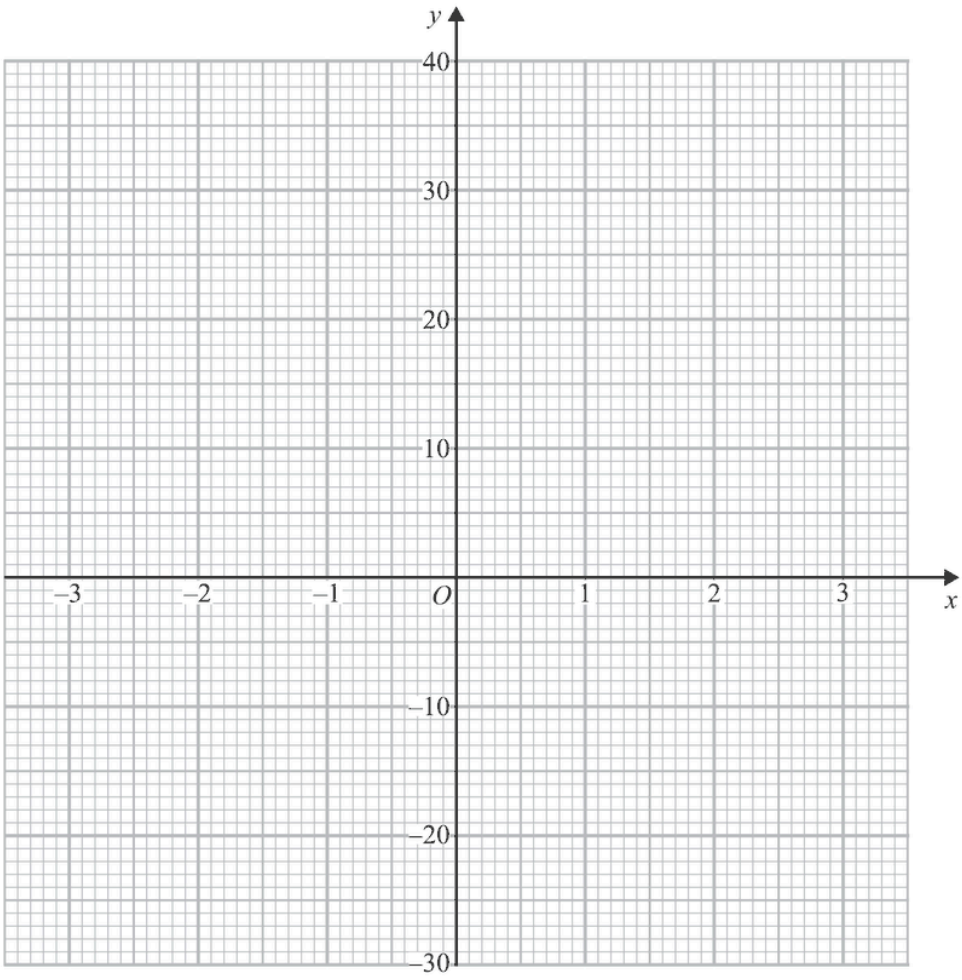
3 marks | Graphs of Functions

10 (a) Complete the table of values for $y = x^3 + 2x + 3$

x	–3	–2	–1	0	1	2	3
y		–9	0	3	6		36

(1)

(b) On the grid, draw the graph of $y = x^3 + 2x + 3$ for $-3 \leqslant x \leqslant 3$



(2)

(Total for Question 10 is 3 marks)

Question 13

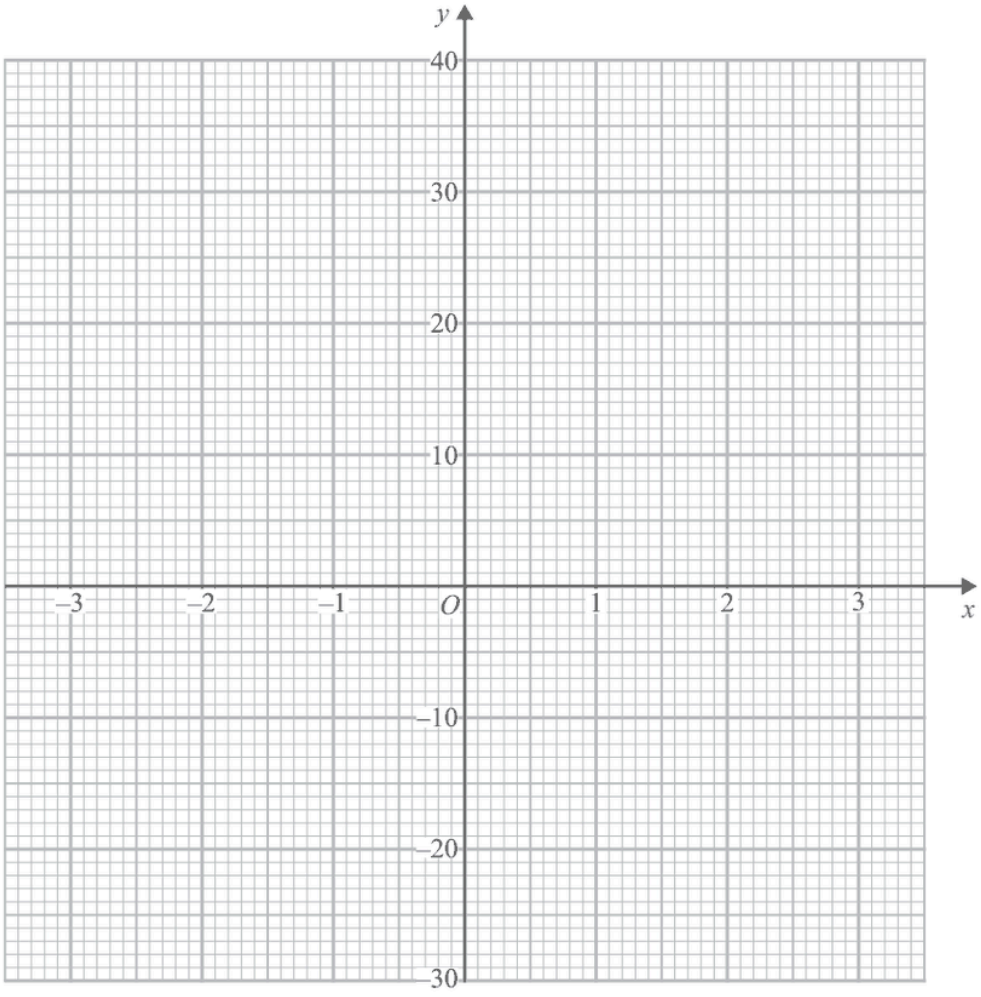
3 marks | Graphs of Functions

13 (a) Complete the table of values for $y = x^3 + 2x + 3$

x	–3	–2	–1	0	1	2	3
y		–9	0	3	6		36

(1)

(b) On the grid, draw the graph of $y = x^3 + 2x + 3$ for $-3 \leqslant x \leqslant 3$



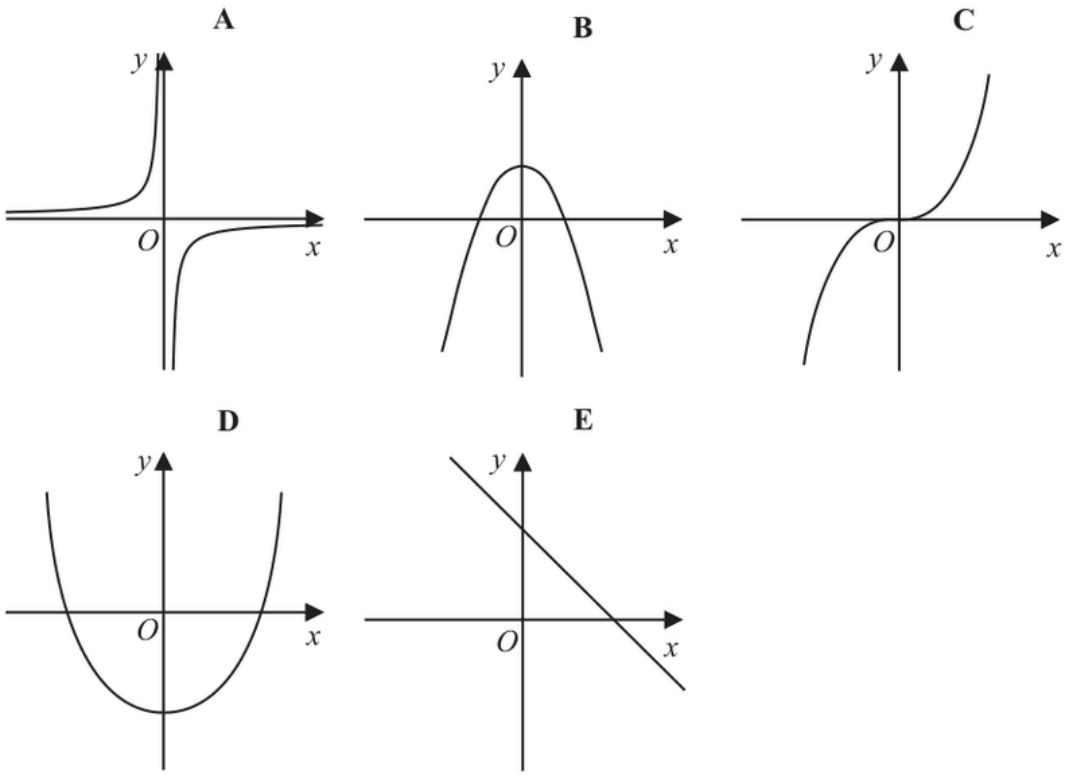
(2)

(Total for Question 13 is 3 marks)

Question 14

2 marks | Graphs of Functions

14 Here are five graphs.



(a) Write down the letter of the graph that could have the equation $y = 5 - x^2$

.....

(1)

(b) Write down the letter of the graph that could have the equation $y = 2x^3$

.....

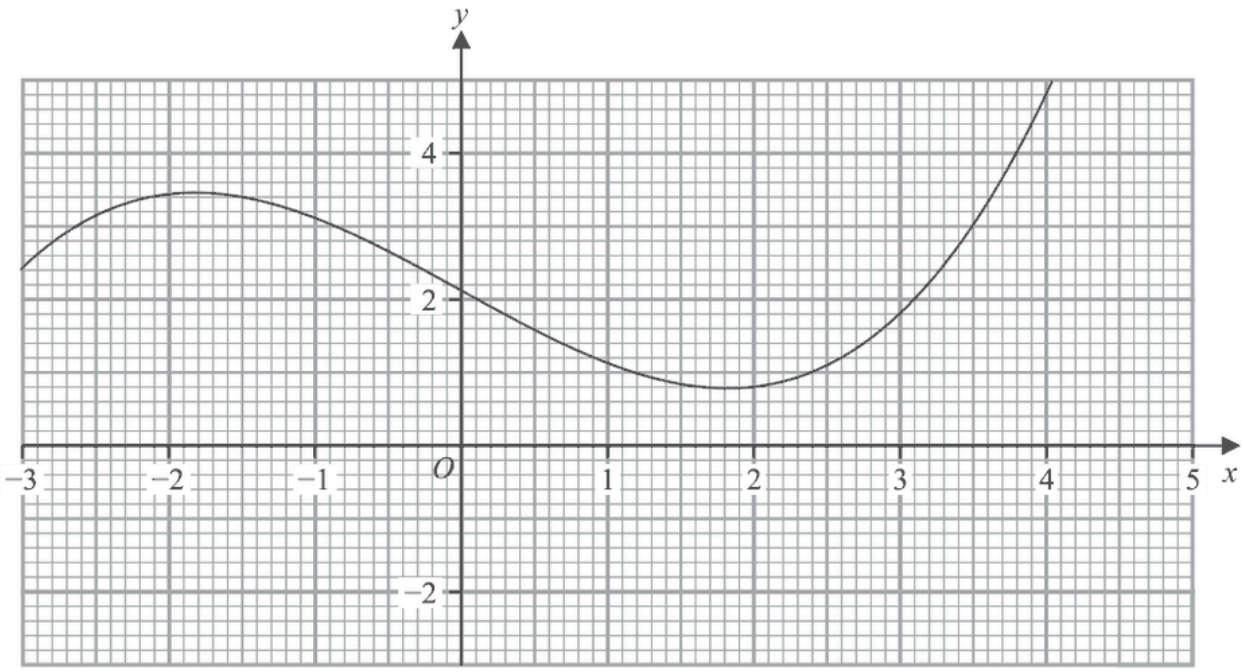
(1)

(Total for Question 14 is 2 marks)

Question 19

3 marks | Graphs of Functions

19 The diagram shows the graph of $y = f(x)$



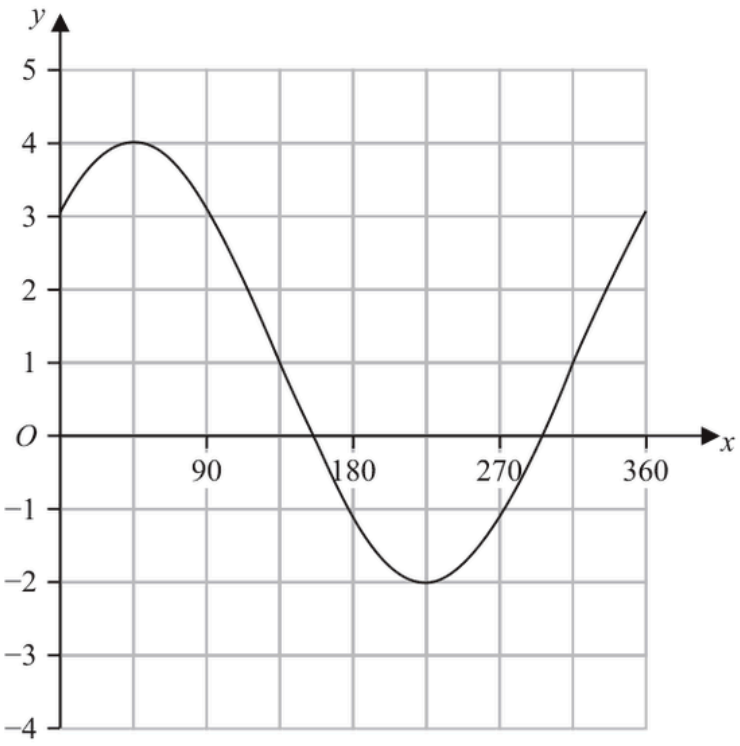
Find an estimate for the gradient of the graph at the point where $x = 3$
Show your working clearly.

(Total for Question 19 is 3 marks)

Question 23

3 marks | Graphs of Functions

23 The graph of $y = a\sin(x + b)^\circ + c$ for $0 \leqslant x \leqslant 360$ is drawn on the grid below.



Find a suitable value for a, for b and for c

$a =$ .....

$b =$ .....

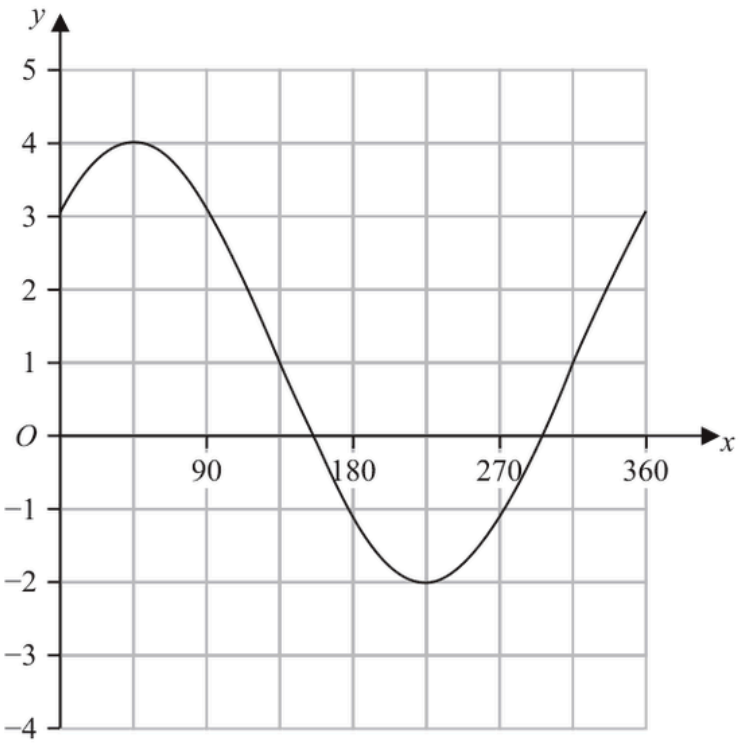
$c =$ .....

(Total for Question 23 is 3 marks)

Question 25

3 marks | Graphs of Functions

25 The graph of $y = a\sin(x + b)^\circ + c$ for $0 \leqslant x \leqslant 360$ is drawn on the grid below.



Find a suitable value for a, for b and for c

$a =$ .....

$b =$ .....

$c =$ .....

(Total for Question 25 is 3 marks)

Question 12

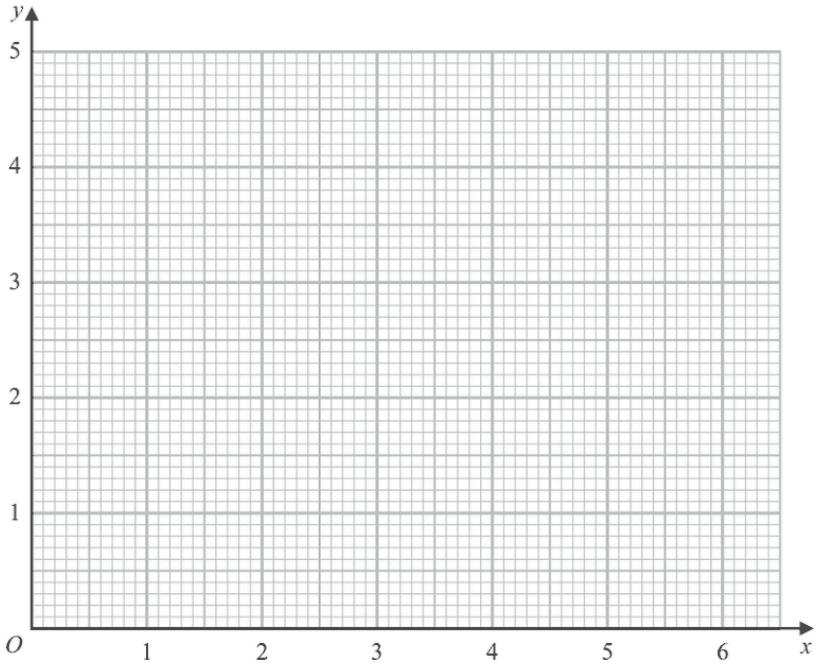
5 marks | Graphs of Functions

12 (a) Complete the table of values for $y = \frac{1}{2}\left(x + \frac{4}{x}\right)$

x	0.5	1	2	3	4	5	6
y	4.25			2.17	2.5	2.9	3.33

(1)

(b) Draw the graph of $y = \frac{1}{2}\left(x + \frac{4}{x}\right)$ for $0.5 \leqslant x \leqslant 6$



(2)

(c) By drawing a suitable line on the grid, find estimates for the solutions of the equation $x + \frac{4}{x} = 6$

Give your answers correct to one decimal place.

.....

(2)

(Total for Question 12 is 5 marks)

Question 25

3 marks | Graphs of Functions

25 A curve has equation $y = f(x)$

There is one minimum point on this curve.

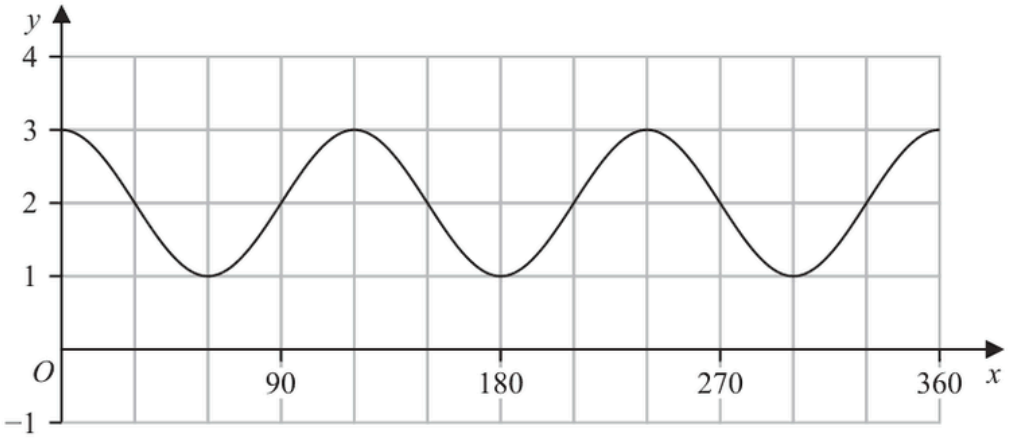
The coordinates of this minimum point are $(8, 1)$

(a) Write down the coordinates of the minimum point on the curve with equation $y = f(4x)$

(..... , ...)

(1)

The diagram shows the graph of $y = \cos(ax) + b$ for $0 \leqslant x \leqslant 360$



(b) (i) Find the value of a

$a =$ .....

(1)

(ii) Find the value of b

$b =$ .....

(1)

(Total for Question 25 is 3 marks)

Question 13

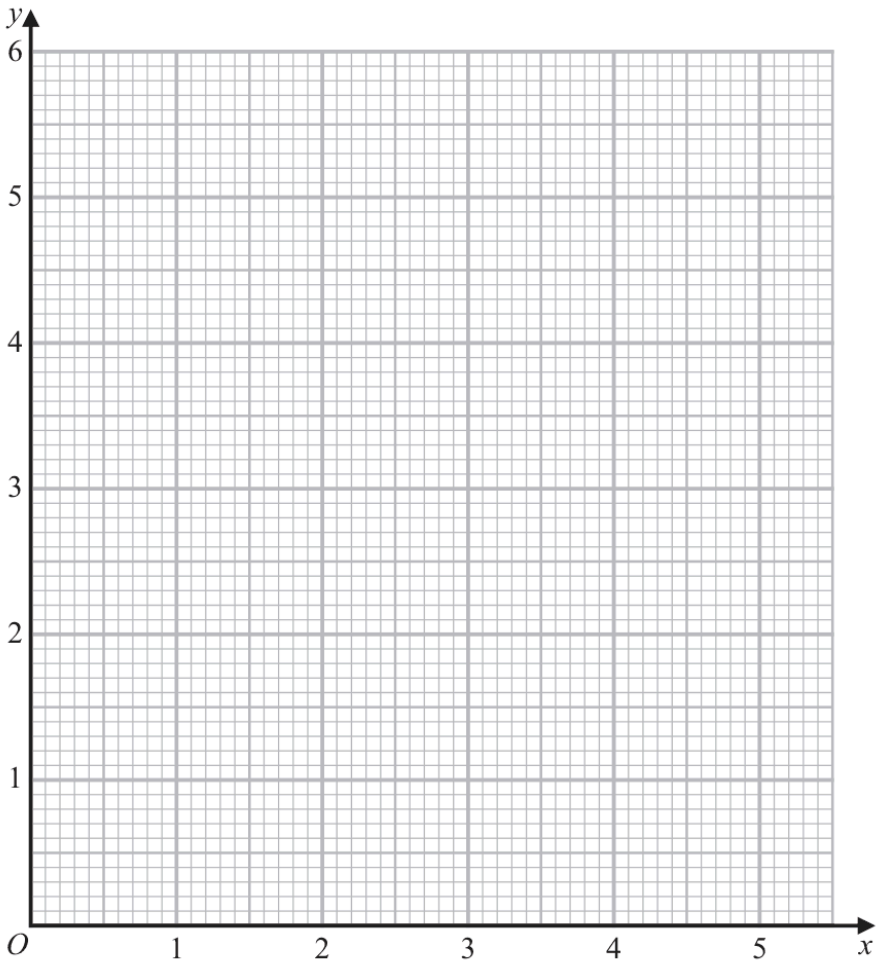
4 marks | Graphs of Functions

13 (a) Complete the table of values for $y = x + \frac{1}{x}$

x	0.25	0.5	1	2	3	4	5
y	4.25			2.5	3.33		

(2)

(b) On the grid, draw the graph of $y = x + \frac{1}{x}$ for $0.25 \leqslant x \leqslant 5$



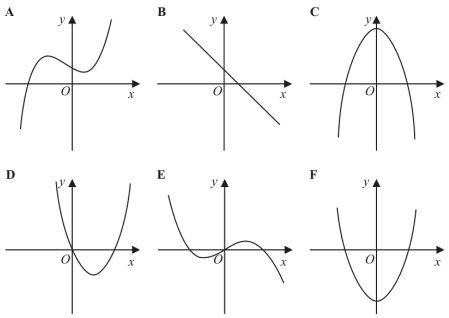
(2)

(Total for Question 13 is 4 marks)

Question 14

6 marks | Graphs of Functions

14 Here are six graphs.



(a) Write down the letter of the graph that could have the equation

(i) $y = x^2 - 3x$

.....

(1)

(ii) $y = -x^3 + 9x$

.....

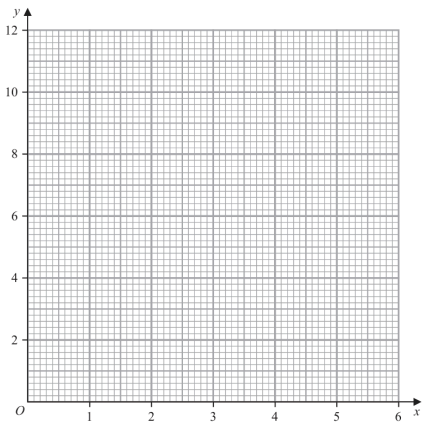
(1)

(b) Complete the table of values for $y = \frac{12}{x^2}$

x	1	1.5	2	3	4	5	6
y		5.33		1.33			0.33

(2)

(c) On the grid, draw the graph of $y = \frac{12}{x^2}$ for $1 \leqslant x \leqslant 6$



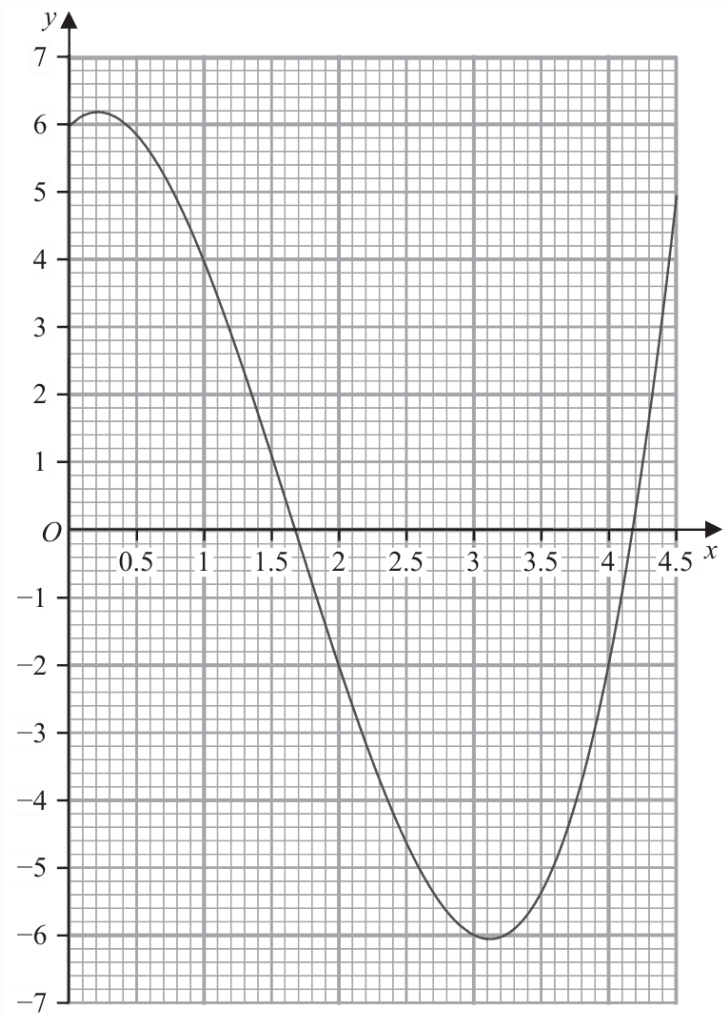
(2)

(Total for Question 14 is 6 marks)

Question 21

5 marks | Graphs of Functions

21 The curve with equation $y = f(x)$ is drawn on a grid.



(a) By drawing a suitable straight line (at least 3 cm long) on the grid, work out an estimate for the gradient of the curve at the point where $x = 1$
Show your working clearly.

.....

(2)

(b) By drawing a suitable straight line on the grid, find the solutions of the equation $x = 3 + \frac{1}{2}f(x)$
Show your working clearly.

.....

(3)

(Total for Question 21 is 5 marks)

TOPIC

Functions

Every past-paper question on this topic, 2020 to 2026.

Question 13

4 marks | Functions

13 The function f is defined as

$$f : x \mapsto \frac{2x}{x-6}$$

(a) Find f(10)

.....

(1)

(b) Express the inverse function f^{-1} in the form $f^{-1} : x \mapsto \ldots$

$f^{-1} : x \mapsto$ .....

(3)

Question 17

4 marks | Functions

17 The function f is such that $f(x) = (x - 4)^2$ for all values of x.

(a) Find f(1)

.....

(1)

(b) State the range of the function f.

.....

(1)

The function g is such that $g(x) = \dfrac{4}{x+3}$ $\quad x \neq -3$

(c) Work out fg(2)

.....

(2)

(Total for Question 17 is 4 marks)

Question 21

5 marks | Functions

21 The functions f and g are such that

$$f(x) = x^2 - 2x \qquad g(x) = x + 3$$

The function h is such that $h(x) = fg(x)$ for $x \geqslant -2$

Express the inverse function $h^{-1}(x)$ in the form $h^{-1}(x) = \ldots$

$h^{-1}(x) =$ .....

(Total for Question 21 is 5 marks)

Question 16

9 marks | Functions

16 The functions f and g are defined as

$$f: x \mapsto 5x - 7$$

$$g: x \mapsto \frac{5x}{x+4}$$

(a) Write down the value of x that must be excluded from any domain of g

.....

(1)

(b) Find gf(2.6)

.....

(2)

(c) Solve $fg(x) = 2$

$x =$ .....

(3)

(d) Express the inverse function g^{-1} in the form $g^{-1}: x \mapsto ...$

$g^{-1}: x \mapsto$ .....

(3)

(Total for Question 16 is 9 marks)

Question 17

9 marks | Functions

17 The functions f and g are defined as

$f(x) = x^2 + 6$
$g(x) = x - 10$

(a) Find fg(3)

.....

(2)

(b) Solve the equation $fg(x) = f(x)$
Show clear algebraic working.

.....

(3)

The function h is defined as

$$h(x) = \frac{2x - 4}{x}$$

(c) State the value of x that cannot be included in the domain of h

.....

(1)

(d) Express the inverse function h^{-1} in the form $h^{-1}(x) = \ldots$

$h^{-1}(x) =$ .....

(3)

(Total for Question 17 is 9 marks)

Question 22

3 marks | Functions

22 The function f is such that $f(x) = x^2 - 8x + 5$ where $x \leqslant 4$

Express the inverse function f^{-1} in the form $f^{-1}(x) = ...$

$f^{-1}(x) =$ .....

(Total for Question 22 is 3 marks)

Question 24

6 marks | Functions

24 The functions f and g are defined as

$$f(x) = 5x^2 - 10x + 7 \qquad \text{where } x \geqslant 1$$

$$g(x) = 7x - 6$$

(a) Find fg(2)

.....

(2)

(b) Express the inverse function f^{-1} in the form $f^{-1}(x) = ...$

$f^{-1}(x) =$ .....

(4)

(Total for Question 24 is 6 marks)

Question 15

6 marks | Functions

15 The functions f and g are such that

$$f(x) = 2x - 3$$

$$g(x) = \frac{x}{3x + 1}$$

(a) State the value of x that cannot be included in any domain of g

.....

(1)

(b) Find $gf(x)$
Simplify your answer.

$gf(x) =$ .....

(2)

(c) Express the inverse function g^{-1} in the form $g^{-1}(x) = ...$

$g^{-1}(x) =$ .....

(3)

(Total for Question 15 is 6 marks)

Question 23

4 marks | Functions

23 The functions f and g are such that

$$f(x) = x + 25 \qquad g(x) = x^2 - 12x$$

The function h is such that $h(x) = fg(x)$

The domain of h is $\{x : x \leqslant 6\}$

Express the inverse function h^{-1} in the form $h^{-1}(x) = ...$

$h^{-1}(x) =$ .....

(Total for Question 23 is 4 marks)

Question 25

5 marks | Functions

25 The function g is defined as

$$g: x \mapsto 5 + 6x - x^2 \quad \text{with domain} \quad \{x : x \geqslant 3\}$$

(a) Express the inverse function g^{-1} in the form $g^{-1}: x \mapsto \ldots$

$g^{-1}: x \mapsto$ .....

(4)

(b) State the domain of g^{-1}

.....

(1)

(Total for Question 25 is 5 marks)

Question 14

4 marks | Functions

14 The function f is defined as

$$f: x \mapsto \frac{2x}{x-6} \qquad x \neq 6$$

(a) Find f(10)

.....

(1)

(b) Express the inverse function f^{-1} in the form $f^{-1}: x \mapsto \ldots$

$f^{-1}: x \mapsto$ .....

(3)

(Total for Question 14 is 4 marks)

Question 19

4 marks | Functions

19 $f(x) = x^2 - 4$

$g(x) = 2x + 1$

Solve $fg(x) > 0$

Show clear algebraic working.

(Total for Question 19 is 4 marks)

Question 17

4 marks | Functions

17 The functions g and h are such that

$$g(x) = \frac{11}{2x - 5}$$

$$h(x) = x^2 + 4 \qquad x \geqslant 0$$

(a) What value of x must be excluded from any domain of g?

.....

(1)

(b) Solve $gh(x) = 1$

.....

(3)

(Total for Question 17 is 4 marks)

Question 19

7 marks | Functions

19 The functions f and g are such that

$$f: x \mapsto 5x + 7$$

$$g: x \mapsto \frac{5}{2x - 9}$$

(a) State which value of x cannot be included in any domain of g

.....

(1)

(b) Find fg(4)

.....

(2)

The function h is such that

$$h: x \mapsto 3x^2 - 12x + 8 \quad \text{where } x > 2$$

(c) Express the inverse function h^{-1} in the form $h^{-1}: x \mapsto ...$

$h^{-1}: x \mapsto$ .....

(4)

(Total for Question 19 is 7 marks)

Question 15

4 marks | Functions

15 The function f is defined as

$$f: x \mapsto \frac{3x+1}{x-2}$$

(a) State the value of x that cannot be included in any domain of the function f

.....

(1)

(b) Express the inverse function f^{-1} in the form $f^{-1}(x) = ...$

$f^{-1}(x) =$ .....

(3)

(Total for Question 15 is 4 marks)

Question 17

3 marks | Functions

17 $f(x) = \dfrac{x}{2x - 4}$ $\quad g(x) = 3x + 1$

Given that $fg(k) = 2$

work out the value of k

$k =$ .....

(Total for Question 17 is 3 marks)

Question 25

4 marks | Functions

25 The function f is such that $f(x) = 2x^2 - 24x + 7$ where $x \geqslant 6$

Find the inverse function $f^{-1}(x)$

$f^{-1}(x) =$ .....

(Total for Question 25 is 4 marks)

Question 16

4 marks | Functions

16 $f(x) = 9 - \sqrt{x}$ where $x \geqslant 0$

$g(x) = 4x^2$

(a) Find $f(9)$

.....

(1)

(b) Solve $fg(x) < 0$

Show clear algebraic working.

.....

(3)

(Total for Question 16 is 4 marks)

Question 17

4 marks | Functions

17 The function g is defined as

$$g(x) = \frac{3x}{x-2}$$

(a) State the value of x that cannot be included in any domain of g

.....

(1)

(b) Express the inverse function g^{-1} in the form $g^{-1}(x) = \ldots$

$g^{-1}(x) =$ .....

(3)

(Total for Question 17 is 4 marks)

Question 19

3 marks | Functions

19 The functions f and g are such that

$$f(x) = 3x - 4 \text{ where } x > 2$$

$$g(x) = \frac{x}{2x + 1}$$

(a) State the value of x that cannot be included in any domain of g

.....

(1)

(b) Find $gf(x)$
Give your answer in its simplest form.

$gf(x) =$ .....

(2)

(Total for Question 19 is 3 marks)

Question 21

7 marks | Functions

21 The function g is defined as

$$g(x) = \frac{7x + 20}{2x} \qquad x \neq 0$$

(a) Solve gg $(x) = 6$
Show clear algebraic working.

$x =$ .....

(3)

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The function h is defined as

$$h(x) = 5x^2 + 30x - 7 \qquad x \geqslant -3$$

(b) Express the inverse function h^{-1} in the form $h^{-1}(x) = \ldots$

$h^{-1}(x) =$ .....

(4)

(Total for Question 21 is 7 marks)

Question 19

3 marks | Functions

19 The functions f and g are such that

$$f(x) = 3x - 2 \qquad g(x) = \frac{x}{2x - 1}$$

(a) Find g(3)

.....

(1)

(b) Find gf(x)
Give your answer in its simplest form.

gf(x) = ...

(2)

(Total for Question 19 is 3 marks)

Question 21

7 marks | Functions

21 The functions f and g are defined as

$$f(x) = 5x - 3$$

$$g(x) = 4x^2 + 16x - 9 \qquad \text{where} \quad x \geqslant -2$$

(a) Find g(–1)

.....

(1)

(b) Find fg(x)

Give your answer in its simplest form.

fg(x) = ...

(2)

$g(x) = 4x^2 + 16x - 9$ where $x \geqslant -2$

(c) Express the inverse function g^{-1} in the form $g^{-1}(x) = ...$

$g^{-1}(x)$ = ...

(4)

(Total for Question 21 is 7 marks)

Question 16

5 marks | Functions

16 The functions f and g are such that

$$f(x) = 4 + x \qquad g(x) = 3x^2 + 2$$

(a) Find $g(4)$

.....

(1)

(b) Find $f^{-1}(7)$

.....

(2)

(c) Express $gf(x)$ in the form $ax^2 + bx + c$ where a, b and c are integers.

$gf(x) =$ .....

(2)

(Total for Question 16 is 5 marks)

Question 17

4 marks | Functions

17 The functions f and g are such that

$$f(x) = x^2 - 5$$
$$g(x) = 2x + 1$$

Solve $fg(x) = 2gf(x)$
Show clear algebraic working.

$x =$ .....

(Total for Question 17 is 4 marks)

Question 23

7 marks | Functions

23 The function f is such that $f(x) = \frac{1}{x}$

(a) Write down the value of x that cannot be included in any domain of f

.....

(1)

The function g is such that $g(x) = 4x^2 - 8x + 15$
The domain of g is $x \geqslant 1$

(b) Work out $gf(0.5)$

.....

(2)

(c) Express the inverse function g^{-1} in the form $g^{-1}(x) = ...$

$g^{-1}(x) =$ .....

(4)

(Total for Question 23 is 7 marks)

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TOPIC

Differentiation & Turning Points

Every past-paper question on this topic, 2020 to 2026.

Question 17

5 marks | Differentiation & Turning Points

17 A particle P moves along a straight line.
The fixed point O lies on this line.

The displacement of P from O at time t seconds, $t \geqslant 1$, is s metres where

$$s = 4t^2 + \frac{125}{t}$$

The velocity of P at time t seconds, $t \geqslant 1$, is v m/s

Work out the distance of P from O at the instant when $v = 0$

..... m

(Total for Question 17 is 5 marks)

Question 15

8 marks | Differentiation & Turning Points

15

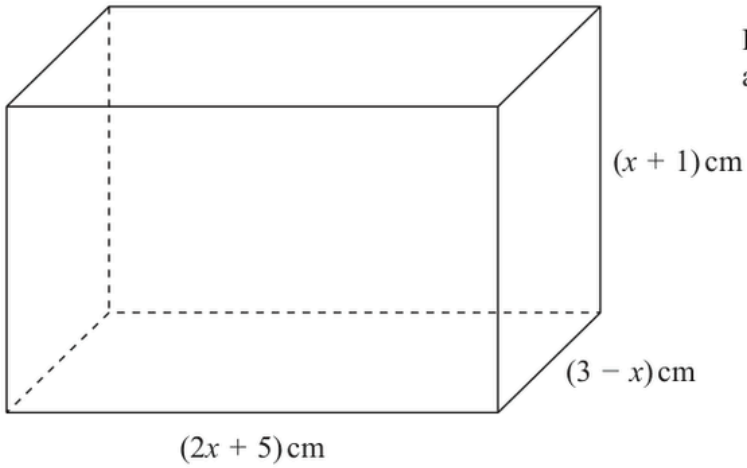


Diagram **NOT** accurately drawn

The diagram shows a cuboid of volume $V\,\text{cm}^3$

(a) Show that $V = 15 + 16x - x^2 - 2x^3$

(3)

There is a value of x for which the volume of the cuboid is a maximum.

(b) Find this value of x.
Show your working clearly.
Give your answer correct to 3 significant figures.

$x =$ .....

(5)

(Total for Question 15 is 8 marks)

Question 23

6 marks | Differentiation & Turning Points

23 A particle moves along a straight line.
The fixed point O lies on this line.
The displacement of the particle from O at time t seconds, $t \geqslant 0$, is s metres where

$$s = t^3 + 4t^2 - 5t + 7$$

At time T seconds the velocity of P is V m/s where $V \geqslant -5$

Find an expression for T in terms of V.

Give your expression in the form $\dfrac{-4 + \sqrt{k + mV}}{3}$ where k and m are integers to be found.

$T =$ .....

(Total for Question 23 is 6 marks)

Question 13

6 marks | Differentiation & Turning Points

13 The curve **C** has equation $y = 5x^3 - x^2 - 6x + 4$

(a) Find $\frac{dy}{dx}$

$\frac{dy}{dx} =$ .....

(2)

There are two points on the curve **C** at which the gradient of the curve is 2

(b) Find the x coordinate of each of these two points.
Show clear algebraic working.

.....

(4)

(Total for Question 13 is 6 marks)

Question 23

4 marks | Differentiation & Turning Points

23 Curve **C** has equation $y = px^3 - mx$ where p and m are positive integers.

Find the range of values of x, in terms of p and m, for which the gradient of **C** is negative.

(Total for Question 23 is 4 marks)

Question 17

5 marks | Differentiation & Turning Points

17 A solid, **S**, is made from a hemisphere and a cylinder.

The centre of the circular face of the hemisphere and the centre of the top face of the cylinder are at the same point.

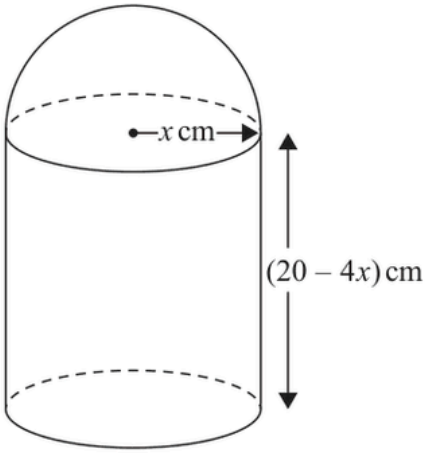


Diagram **NOT** accurately drawn

The radius of the cylinder and the radius of the hemisphere are both x cm.
The height of the cylinder is $(20 - 4x)$ cm.

The volume of **S** is $V\,\text{cm}^3$ where $V = \frac{1}{3}\pi y$

Find the maximum value of y.
Show clear algebraic working.

(Total for Question 17 is 5 marks)

Question 19

5 marks | Differentiation & Turning Points

19 A particle P is moving along a straight line.
The fixed point O lies on this line.

At time t seconds where $t \geqslant 0$, the displacement, s metres, of P from O is given by

$$s = t^3 + 5t^2 - 8t + 10$$

Find the displacement of P from O when P is instantaneously at rest.

Give your answer in the form $\frac{a}{b}$ where a and b are integers.

..... metres

(Total for Question 19 is 5 marks)

Question 20

5 marks | Differentiation & Turning Points

20 A particle P is moving along a straight line.
The fixed point O lies on the line.

At time t seconds ($t \geqslant 0$), the displacement of P from O is s metres where

$$s = t^3 - 9t^2 + 33t - 6$$

Find the minimum speed of P.

..... m/s

(Total for Question 20 is 5 marks)

Question 21

5 marks | Differentiation & Turning Points

21 The point A is the only stationary point on the curve with equation $y = kx^2 + \frac{16}{x}$ where k is a constant.

Given that the coordinates of A are $\left(\frac{2}{3}, a\right)$

find the value of a.
Show your working clearly.

$a =$ .....

(Total for Question 21 is 5 marks)

Question 23

6 marks | Differentiation & Turning Points

23 Two particles, P and Q, move along a straight line.
The fixed point O lies on this line.

The displacement of P from O at time t seconds is s metres, where

$$s = t^3 - 4t^2 + 5t \quad \text{for } t > 1$$

The displacement of Q from O at time t seconds is x metres, where

$$x = t^2 - 4t + 4 \quad \text{for } t > 1$$

Find the range of values of t where $t > 1$ for which both particles are moving in the same direction along the straight line.

(Total for Question 23 is 6 marks)

Question 24

6 marks | Differentiation & Turning Points

24 The curve **C** has equation $y = ax^3 + bx^2 - 12x + 6$ where a and b are constants.

The point A with coordinates $(2, -6)$ lies on **C**
The gradient of the curve at A is 16

Find the y coordinate of the point on the curve whose x coordinate is 3
Show clear algebraic working.

$y =$ .....

(Total for Question 24 is 6 marks)

Question 24

5 marks | Differentiation & Turning Points

24 A particle P moves along a straight line that passes through the fixed point O

The displacement, x metres, of P from O at time t seconds, where $t \geqslant 0$, is given by

$$x = 4t^3 - 27t + 8$$

The direction of motion of P reverses when P is at the point A on the line.

The acceleration of P at the instant when P is at A is $a\ \text{m/s}^2$

Find the value of a

$a =$ .....

(Total for Question 24 is 5 marks)

Question 17

5 marks | Differentiation & Turning Points

17 A particle P moves along a straight line.
The fixed point O lies on this line.

The displacement of P from O at time t seconds, $t \geqslant 1$, is s metres where

$$s = 4t^2 + \frac{125}{t}$$

The velocity of P at time t seconds, $t \geqslant 1$, is v m/s

Work out the distance of P from O at the instant when $v = 0$

..... m

(Total for Question 17 is 5 marks)

Question 22

7 marks | Differentiation & Turning Points

22 The diagram shows a sketch of part of the curve with equation $y = x^2 - \frac{p}{x}$ where p is a positive constant.

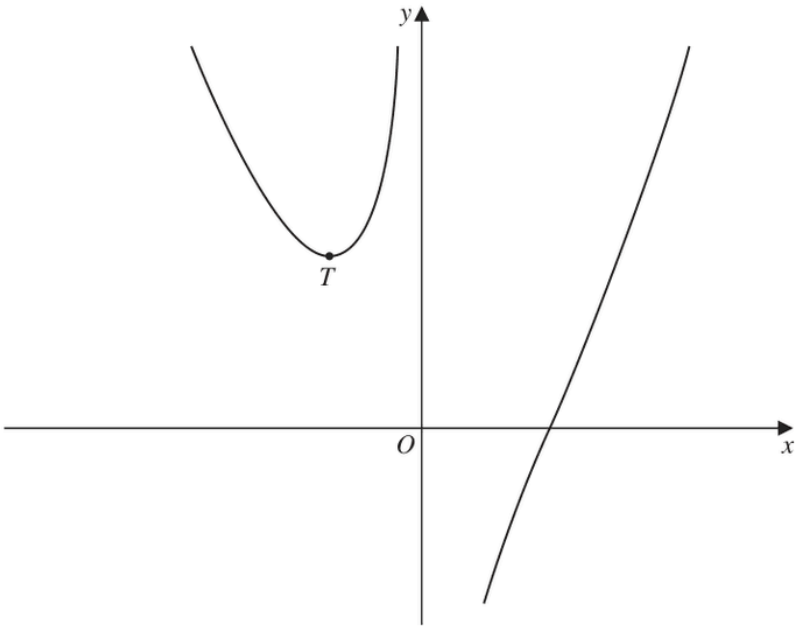


Diagram **NOT** accurately drawn

For all values of p, the curve has exactly one turning point and this turning point is a minimum shown as the point T in the sketch.

For the curve where the x coordinate of T is -3

(a) find the value of p

$p =$ .....

(4)

The line with equation $y = k$ is a tangent to the curve with equation $y = x^2 - \frac{16}{x}$

(b) Find the value of k

$k =$ .....

(3)

(Total for Question 22 is 7 marks)

Question 11

6 marks | Differentiation & Turning Points

11 The curve **C** has equation $y = 4x^3 + x^2 - 20x$

(a) Find $\frac{dy}{dx}$

$\frac{dy}{dx} =$ .....

(2)

(b) Find the x coordinates of the points on **C** where the gradient is 4
Show clear algebraic working.

.....

(4)

(Total for Question 11 is 6 marks)

Question 21

6 marks | Differentiation & Turning Points

21 The curve **T** has equation $y = x^3 - 2x^2 - 9x + 15$

(a) Find $\frac{dy}{dx}$

$\frac{dy}{dx} =$ .....

(2)

(b) Find the range of values of x for which **T** has a positive gradient.
Give your values correct to 3 significant figures.
Show your working clearly.

(4)

(Total for Question 21 is 6 marks)

Question 16

4 marks | Differentiation & Turning Points

16 A curve has equation $y = 4x^3 - 8x + 5$

Find the x coordinates of the two points on the curve where the gradient is $\frac{1}{3}$

(Total for Question 16 is 4 marks)

Question 18

4 marks | Differentiation & Turning Points

18 A particle is moving along a straight line that passes through the fixed point O
The displacement, s metres, of the particle from O at time t seconds is given by

$$s = 2t^3 - 5t^2 + 6t - 5$$

Find the value of t when the acceleration of the particle is 5 m/s²

$t =$ .....

(Total for Question 18 is 4 marks)

Question 18

5 marks | Differentiation & Turning Points

18 A curve C has equation $y = x^3 - 40x + 1$

Find the coordinates of both the points on C at which the gradient is 8

(.....,.....)

(.....,.....)

(Total for Question 18 is 5 marks)

Question 19

5 marks | Differentiation & Turning Points

19 A curve C has equation $y = x^3 - 8x^2 - 12x + 5$

Curve C has exactly two stationary points, one at point A and one at point B such that

x coordinate of point $A > x$ coordinate of point B

Find the coordinates of point A
Show clear algebraic working.

(..... , ...)

(Total for Question 19 is 5 marks)

Question 20

4 marks | Differentiation & Turning Points

20 The curve with equation $y = 2x^4 - 64x$ has a minimum point.

Find an equation of the tangent to the curve at the minimum point.
Show clear algebraic working.

(Total for Question 20 is 4 marks)

Question 17

6 marks | Differentiation & Turning Points

17 $y = 4x^3 + 5x^2 + 2x$

(a) Find $\frac{dy}{dx}$

$\frac{dy}{dx} =$ .....

(2)

(b) Find the coordinates of the turning points on the graph with equation $y = 4x^3 + 5x^2 + 2x$
Show clear algebraic working.

.....

(4)

(Total for Question 17 is 6 marks)

Question 22

5 marks | Differentiation & Turning Points

22 The diagram shows a solid cuboid.

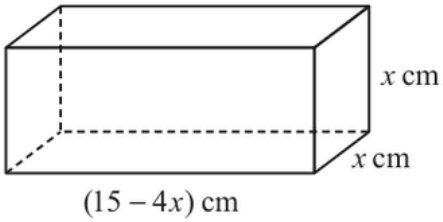


Diagram **NOT** accurately drawn

The volume of the cuboid is V cm^3

Find the maximum value of V

(Total for Question 22 is 5 marks)

Question 22

4 marks | Differentiation & Turning Points

22 Work out the range of values of x for which the graph of $y = x^3 + \frac{2}{}x^2 - 10x + 5$ has a positive gradient.
Show clear algebraic working.

.....

(Total for Question 22 is 4 marks)

Question 22

6 marks | Differentiation & Turning Points

22 Curve **C** has equation $y = x^3 - 16x + 7$

At two points on **C**, the gradient is 11
The tangents to **C** at these two points have equations of the form $y = ax + b$

Work out the two possible values of b
Show clear algebraic working.

(Total for Question 22 is 6 marks)

Question 22

6 marks | Differentiation & Turning Points

22 Curve **C** has equation $y = x^3 - 16x + 7$

At two points on **C**, the gradient is 11
The tangents to **C** at these two points have equations of the form $y = ax + b$

Work out the two possible values of b
Show clear algebraic working.

(Total for Question 22 is 6 marks)

Question 17

5 marks | Differentiation & Turning Points

17 $y = x^3 + 5x^2 - 8x$

(a) Find $\frac{dy}{dx}$

$\frac{dy}{dx} =$ .....

(2)

The curve with equation $y = x^3 + 5x^2 - 8x$ has two stationary points, P and Q
The x-coordinate of P is less than the x-coordinate of Q

(b) Work out the coordinates of P
Show clear algebraic working.

(..... , ...)

(3)

(Total for Question 17 is 5 marks)

Question 21

5 marks | Differentiation & Turning Points

21 The diagram shows a solid cuboid.

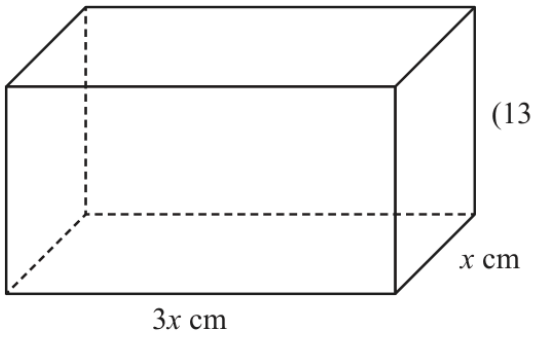


Diagram **NOT** accurately drawn

The volume of the cuboid is V cm^3

Find the maximum value of V
Show clear algebraic working.

$V =$ .....

(Total for Question 21 is 5 marks)

Question 23

5 marks | Differentiation & Turning Points

23 A particle is moving along a straight line that passes through the fixed point O

The displacement, s metres, of the particle from O at time t seconds is given by

$$s = 15t^2 - t^3 + 12$$

Find the maximum velocity of the particle where $0 < t < 11$
Show clear algebraic working.

..... m/s

(Total for Question 23 is 5 marks)

TOPIC

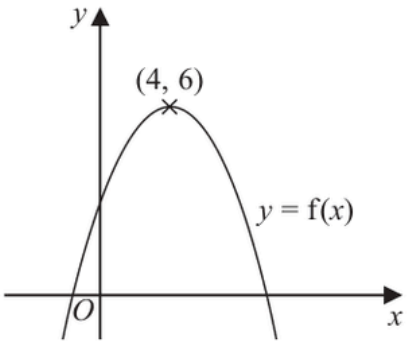
Transformations of Graphs

Every past-paper question on this topic, 2020 to 2026.

Question 21

4 marks | Transformations of Graphs

21 The diagram shows a sketch of part of the curve with equation $y = f(x)$



There is one maximum point on this curve.
The coordinates of this maximum point are (4, 6)

(a) Write down the coordinates of the maximum point on the curve with equation

(i) $y = f(x + 4)$

(..... , ...)

(ii) $y = f(2x)$

(..... , ...)

(2)

The equation of a curve **C** is $y = x^2 + 3x + 4$

The curve **C** is transformed to curve **S** under the translation $\begin{pmatrix} 4 \\ 6 \end{pmatrix}$

(b) Find an equation of curve **S**.

You do not need to simplify the equation.

.....

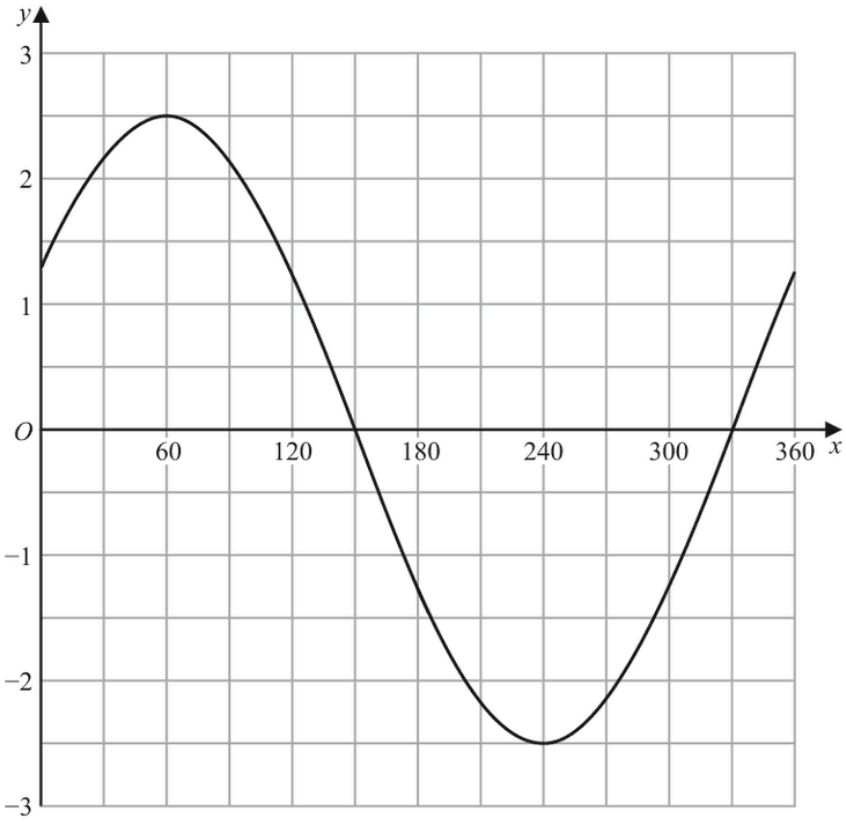
(2)

(Total for Question 21 is 4 marks)

Question 22

4 marks | Transformations of Graphs

22 The graph of $y = a\cos(x + b)°$ for $0 \leqslant x \leqslant 360$ is drawn on the grid.



(a) Find the value of a and the value of b.

$a =$ .....

$b =$ .....

(2)

Another curve C has equation $y = f(x)$
The coordinates of the minimum point of C are (4, 5)

(b) Write down the coordinates of the minimum point of the curve with equation

(i) $y = f(2x)$

(..... , ...)

(ii) $y = f(x) - 7$

(..... , ...)

(2)

(Total for Question 22 is 4 marks)

Question 20

2 marks | Transformations of Graphs

20 A curve has equation $y = f(x)$
There is only one maximum point on the curve.
The coordinates of this maximum point are $(-3, 4)$

Write down the coordinates of the maximum point on the curve with equation

(i) $y = f(x) - 6$

(..... , ...)

(ii) $y = f(2x)$

(..... , ...)

(Total for Question 20 is 2 marks)

Question 25

3 marks | Transformations of Graphs

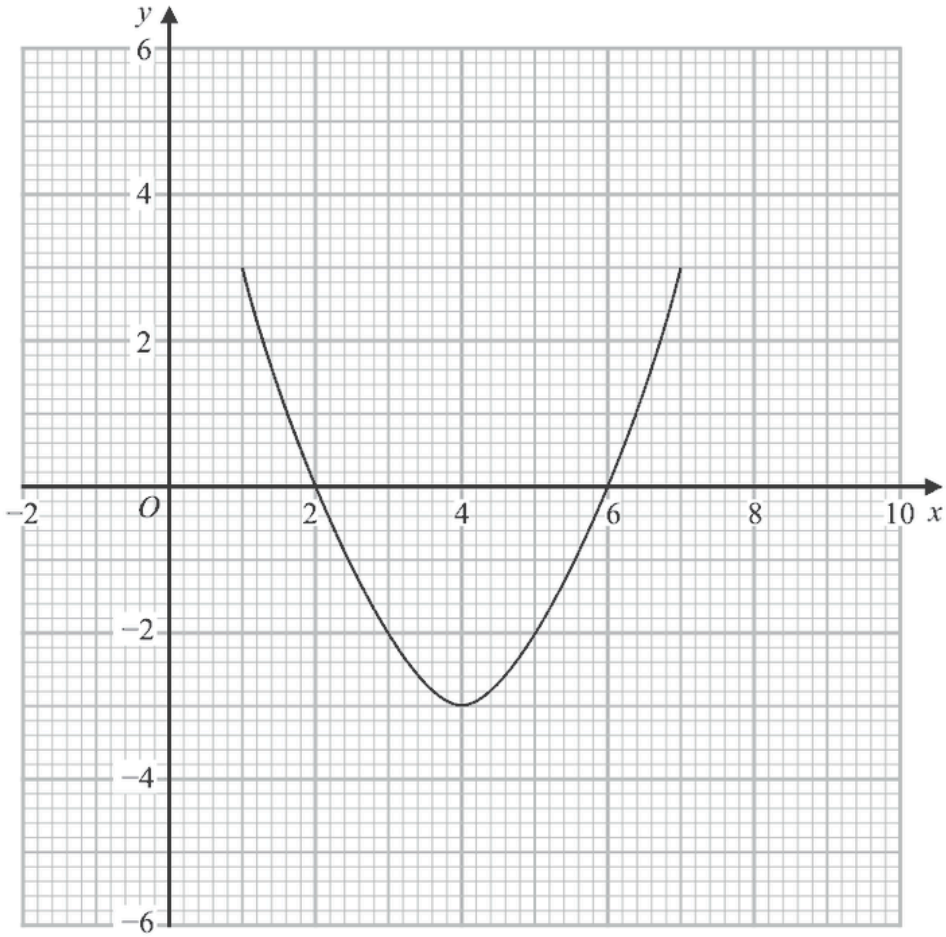
25 The curve with equation $y = g(x)$ is transformed to the curve with equation $y = -g(x)$ by the single transformation **T**.

(a) Describe fully the transformation **T**.

.....

(1)

The diagram shows the graph of $y = f(x)$



(b) On the grid, draw the graph of $y = 2f(x - 1)$

(2)

(Total for Question 25 is 3 marks)

Question 21

4 marks | Transformations of Graphs

21 A curve has equation $y = f(x)$

The coordinates of the minimum point on this curve are $(-9, 15)$

(a) Write down the coordinates of the minimum point on the curve with equation

(i) $y = f(x + 3)$

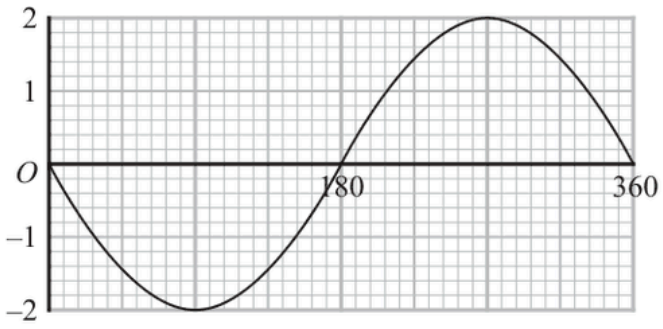
(..... , ...)

(ii) $y = \frac{1}{3} f(x)$

(..... , ...)

(2)

The graph of $y = a\cos(x + b)°$ for $0 \leqslant x \leqslant 360$ is drawn on the grid below.



Given that $a > 0$ and that $0 < b < 360$

(b) find the value of a and the value of b.

$a =$ .....

$b =$ .....

(2)

(Total for Question 21 is 4 marks)

Question 21

6 marks | Transformations of Graphs

21 The curve **C** has equation $y = f(x)$ where $f(x) = 9 - 3(x + 2)^2$
The point A is the maximum point on **C**.

(a) Write down the coordinates of A.

(..... , ...)

(1)

The curve **C** is transformed to the curve **S** by a translation of $\begin{pmatrix} 4 \\ 0 \end{pmatrix}$

(b) Find an equation for the curve **S**.

.....

(1)

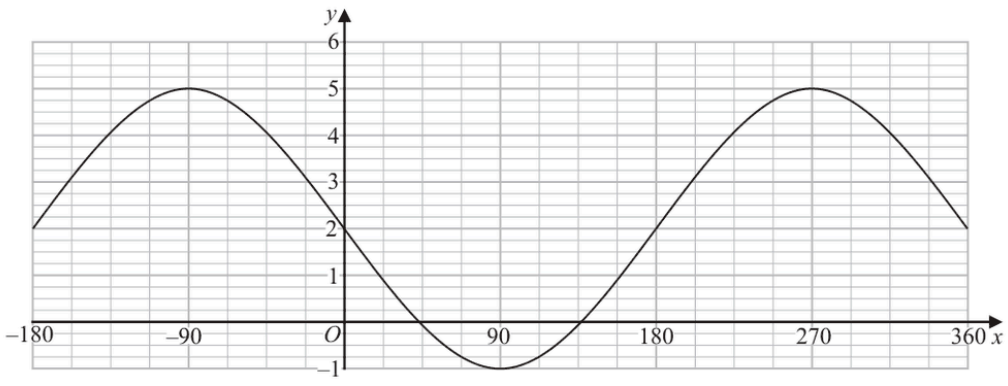
The curve **C** is transformed to the curve **T**.
The curve **T** has equation $y = 3(x + 2)^2 - 9$

(c) Describe fully the transformation that maps curve **C** onto curve **T**.

.....

(1)

The graph of $y = a\cos(x - b)° + c$ for $-180 \leqslant x \leqslant 360$ is drawn on the grid below.



(d) Find the value of a, the value of b and the value of c.

$a =$ .....

$b =$ .....

$c =$ .....

(3)

(Total for Question 21 is 6 marks)

Question 20

6 marks | Transformations of Graphs

20 The curve with equation $y = f(x)$ has one turning point.

The coordinates of this turning point are $(-6, -4)$

(a) Write down the coordinates of the turning point on the curve with equation

(i) $y = f(x) + 5$

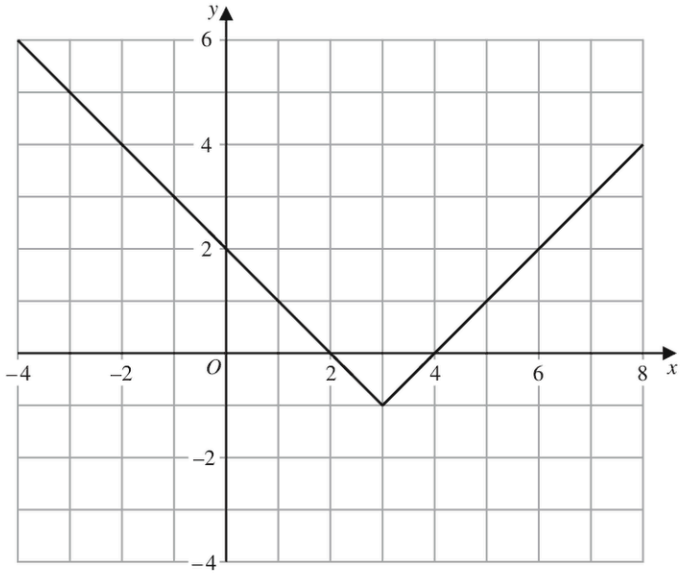
(.....)

(ii) $y = f(3x)$

(.....)

(2)

The graph of $y = g(x)$ is shown on the grid below.



(b) On the grid, sketch the graph of $y = 2g(x)$ for $-1 \leqslant x \leqslant 7$

(2)

The graph of $y = h(x)$ intersects the x-axis at two points.
The coordinates of the two points are $(-1, 0)$ and $(6, 0)$

The graph of $y = h(x + a)$ passes through the point with coordinates $(2, 0)$, where a is a constant.

(c) Find the two possible values of a

....., ...

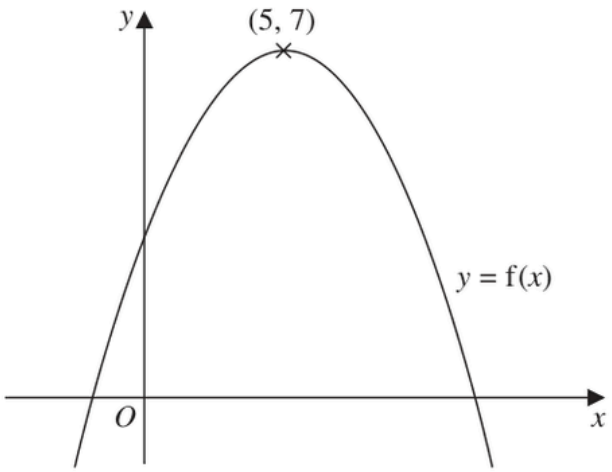
(2)

(Total for Question 20 is 6 marks)

Question 23

2 marks | Transformations of Graphs

23 The diagram shows a sketch of the curve with equation $y = f(x)$



There is only one maximum point on the curve.
The coordinates of this maximum point are (5, 7)

Write down the coordinates of the maximum point on the curve with equation

(i) $y = f(x + 9)$

(..... , ...)

(ii) $y = f(x) + 3$

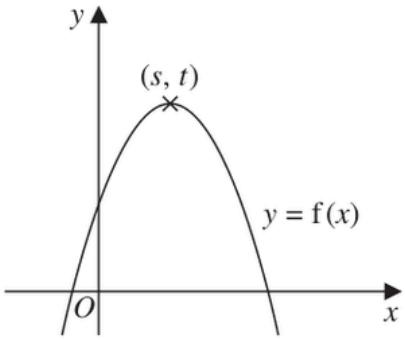
(..... , ...)

(Total for Question 23 is 2 marks)

Question 20

2 marks | Transformations of Graphs

20 The diagram shows a sketch of part of the curve with equation $y = f(x)$



There is one maximum point on this curve.
The coordinates of this maximum point are (s, t)

Find, in terms of s and t, the coordinates of the maximum point on the curve with equation

(i) $y = f(x - 2)$

(..... , ...)
(1)

(ii) $y = 3f(x)$

(..... , ...)
(1)

(Total for Question 20 is 2 marks)

Question 22

4 marks | Transformations of Graphs

22 The point A with coordinates $(-3, 2)$ lies on the straight line with equation $y = f(x)$

(a) Find the coordinates of the image of the point A on the straight line with equation

(i) $y = f(x) - 3$

(..... , ...)

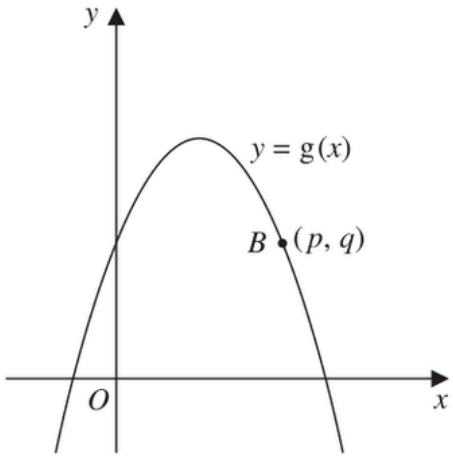
(1)

(ii) $y = f\left(\frac{x}{2}\right)$

(..... , ...)

(1)

Here is a sketch of part of the curve with equation $y = g(x)$



The point B with coordinates (p, q) lies on the curve.

(b) Find the coordinates of the image of the point B on the curve with equation

$$y = -g(x - c)$$

where c is a constant.

(..... , ...)

(2)

(Total for Question 22 is 4 marks)

Question 20

7 marks | Transformations of Graphs

20 Curve **C** has equation $y = f(x)$
The graph of curve **C** has one maximum point.
The coordinates of this maximum point are (3, 5)

(a) Write down the coordinates of the maximum point on the curve with equation

(i) $y = 2f(x)$

(..... , ...)
(1)

(ii) $y = f(x) - 7$

(..... , ...)
(1)

(iii) $y = f(-x)$

(..... , ...)
(1)

Curve **L** has equation $y = x^2 + 7x + 20$

Curve **L** is transformed to curve **S** under the translation $\begin{pmatrix} 2 \\ 0 \end{pmatrix}$

(b) Find an equation for **S**
Give your answer in the form $y = ax^2 + bx + c$

$y =$ .....
(4)

(Total for Question 20 is 7 marks)

Question 21

2 marks | Transformations of Graphs

21 A curve has equation $y = f(x)$

There is only one turning point on the curve.
The coordinates of this turning point are (6, 5)

Write down the coordinates of the turning point on the curve with equation

(a) $y = f(x - 4)$

(..... , ...)

(1)

(b) $y = f(3x)$

(..... , ...)

(1)

(Total for Question 21 is 2 marks)

Question 24

4 marks | Transformations of Graphs

24 The curve with equation $f(x) = 5x^2 + 9x + 2$ is transformed to the curve with equation

$g(x) = 5(x+4)^2 + 9(x+4) + 8$ by the translation $\begin{pmatrix} a \\ b \end{pmatrix}$

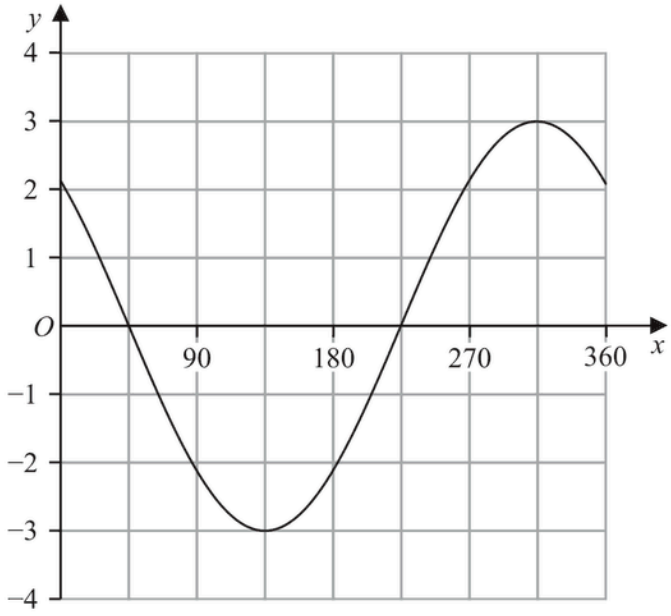
(a) Write down the value of a and the value of b

$a =$ .....

$b =$ .....

(2)

The graph of $y = p\cos(x+q)^\circ$ for $0 \leqslant x \leqslant 360$ is drawn on the grid below.



Given that $p > 0$ and $0 < q < 360$

(b) find the value of p and the value of q

$p =$ .....

$q =$ .....

(2)

(Total for Question 24 is 4 marks)

Question 21

2 marks | Transformations of Graphs

21 A curve has equation $y = f(x)$

There is one minimum point on this curve.
The coordinates of this minimum point are $(5, -4)$

Write down the coordinates of the minimum point on the curve with equation

(i) $y = f(x + 7)$

(.....,.....)

(1)

(ii) $y = f(x) - 6$

(.....,.....)

(1)

(Total for Question 21 is 2 marks)

Question 23

2 marks | Transformations of Graphs

23 A curve has equation $y = f(x)$
The coordinates of the minimum point on this curve are $(6, -3)$

Write down the coordinates of the minimum point on the curve with equation

(i) $y = f(x) + 10$

(..... , ...)
(1)

(ii) $y = f(3x)$

(..... , ...)
(1)

(Total for Question 23 is 2 marks)

Question 19

3 marks | Transformations of Graphs

19 A curve has equation $y = f(x)$

There is only one minimum point on the curve.
The coordinates of this minimum point are (5, 4)

Write down the coordinates of the minimum point on the curve with equation

(i) $y = f(x + 5)$

(..... , ...)

(1)

(ii) $y = 3f(x)$

(..... , ...)

(1)

(iii) $y = f(x) - 7$

(..... , ...)

(1)

(Total for Question 19 is 3 marks)

Question 19

2 marks | Transformations of Graphs

19 The equation of a curve is $y = f(x)$

There is only one minimum point on the curve.
The coordinates of this minimum point are $(8, -12)$

Write down the coordinates of the minimum point on the curve with equation

(i) $y = f(x) + 3$

(..... , ...)

(1)

(ii) $y = f(2x)$

(..... , ...)

(1)

(Total for Question 19 is 2 marks)

Question 21

3 marks | Transformations of Graphs

21 The curve with equation $y = f(x)$ has one turning point.
The coordinates of this turning point are $(-6, 9)$

(a) Write down the coordinates of the turning point on the curve with equation $y = f(3x)$

(..... , ...)

(1)

The curve **C** with equation $y = g(x)$ is transformed to give the curve **S** with equation $y = g(x + a) + b$

The point $(4, -5)$ on **C** is mapped to the point $(1, -16)$ on **S**

(b) Write down the value of a and the value of b

$a =$ .....

$b =$ .....

(2)

(Total for Question 21 is 3 marks)

Question 27

4 marks | Transformations of Graphs

27 A curve has equation $y = f(x)$

There is one maximum point on this curve.
The coordinates of this maximum point are $(6, -5)$

(a) Write down the coordinates of the maximum point on the curve with equation

(i) $y = f(x - 4)$

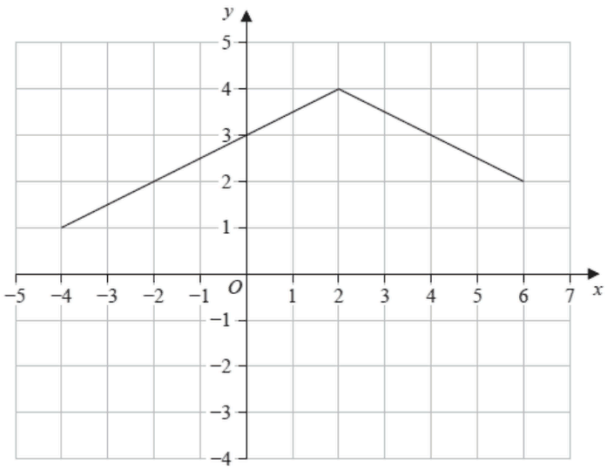
(.....)
(1)

(ii) $y = f(3x)$

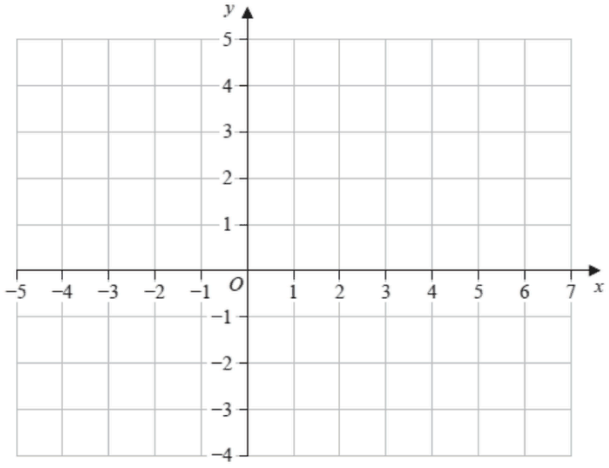
(.....)
(1)

P81641A
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Here is the graph of $y = g(x)$



(b) On the grid below, draw the graph of $y = g(2x) - 3$



(2)

(Total for Question 27 is 4 marks)

Question 24

3 marks | Transformations of Graphs

24 A curve has equation $y = f(x)$

There is only one turning point on the curve.
The coordinates of this turning point are (4, 3)

Write down the coordinates of the turning point on the curve with equation

(i) $y = f(x + 5)$

(..... , ...)
(1)

(ii) $y = f(x) + 7$

(..... , ...)
(1)

(iii) $y = f(2x)$

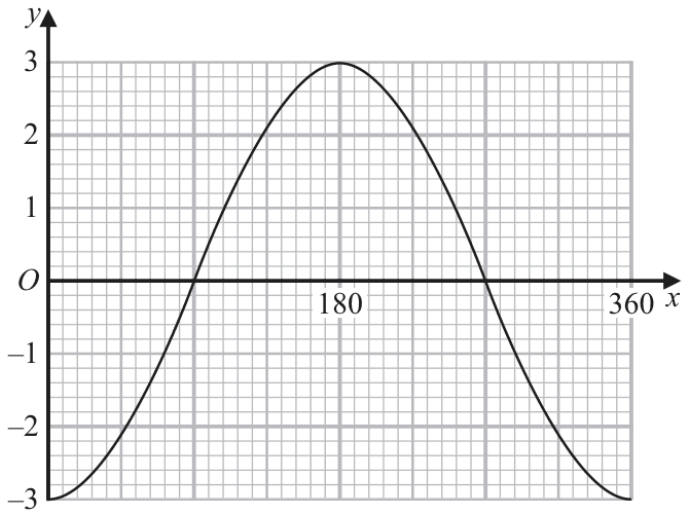
(..... , ...)
(1)

(Total for Question 24 is 3 marks)

Question 25

4 marks | Transformations of Graphs

25 The graph of $y = a\sin(x + b)°$ for $0 \leqslant x \leqslant 360$ is drawn on the grid below.



Given that $a < 0$ and that $0 < b < 360$

(a) find the value of a and the value of b

$a =$ .....

$b =$ .....

(2)

A curve has equation $y = f(x)$
The point T with coordinates (p, q) lies on the curve.

(b) Find the coordinates of the image of T on the curve with equation

$$y = f(2x) + 5$$

Give your coordinates in terms of p and q

(..... , ...)

(2)

(Total for Question 25 is 4 marks)

Question 26

5 marks | Transformations of Graphs

26 The curve **P** has equation $y = f(x)$
The coordinates of the minimum point on **P** are $(-5, 4)$

(a) Write down the coordinates of the minimum point on the curve with equation $y = 3f(x)$

(..... , ...)

(1)

The curve ***Q*** has equation $y = 2 - (x + 3)^2$

The curve ***R*** has equation $y = 2 - (3 - x)^2$

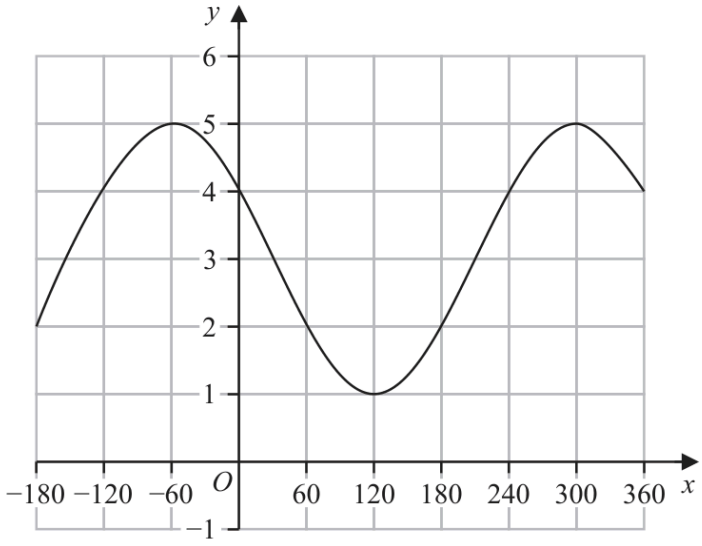
(b) Describe fully the single transformation that maps ***Q*** to ***R***

.....

.....

(1)

The graph of $y = a\cos(x + b)° + c$ for $-180 \leqslant x \leqslant 360$ is drawn on the grid.



Given that $a > 0$ and $0 < b < 360$

(c) find the value of a, the value of b and the value of c

a = ...

b = ...

c = ...

(3)

(Total for Question 26 is 5 marks)

TOPIC

Kinematic Graphs

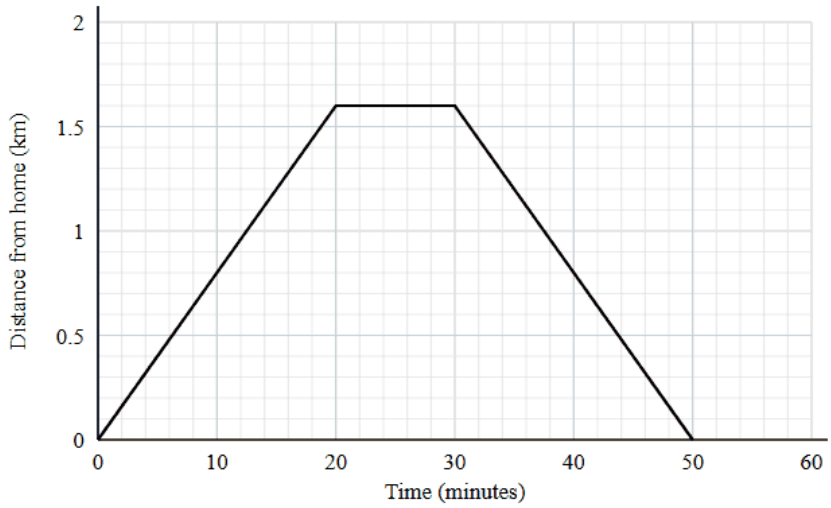
Every past-paper question on this topic, 2020 to 2026.

EP SPECIMEN

Question 8

4 marks | Kinematic Graphs

8 Ali walked from his home to a shop. He stayed at the shop and then walked back home.
Here is the distance-time graph for his journey.



(a) How far was Ali from home after 10 minutes?

..... km

(1)

(b) How many minutes did Ali stay at the shop?

..... minutes

(1)

(c) Work out Ali's speed, in kilometres per hour, on his walk back home.

..... km/h

(2)

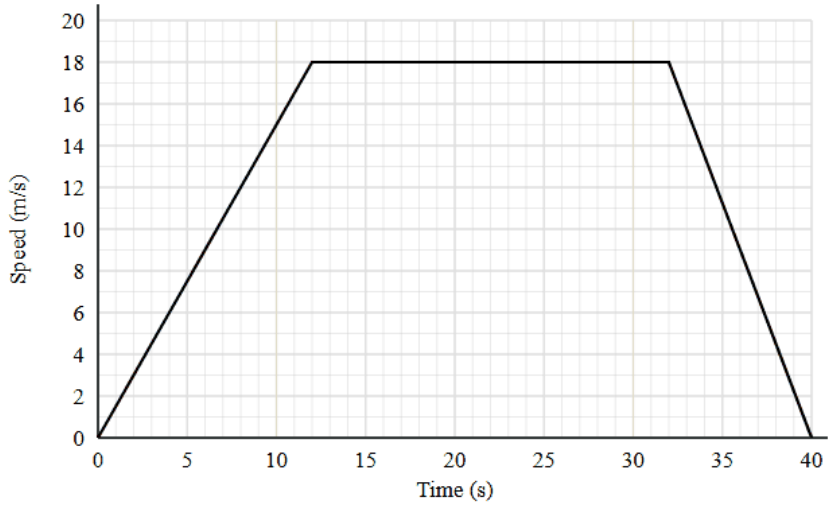
(Total for Question 8 is 4 marks)

EP SPECIMEN

Question 9

5 marks | Kinematic Graphs

9 Here is the speed-time graph for the first 40 seconds of a car's journey.



(a) Work out the acceleration of the car during the first 12 seconds.

..... m/s 2

(2)

(b) Work out the total distance the car travels in the 40 seconds.

..... m

(3)

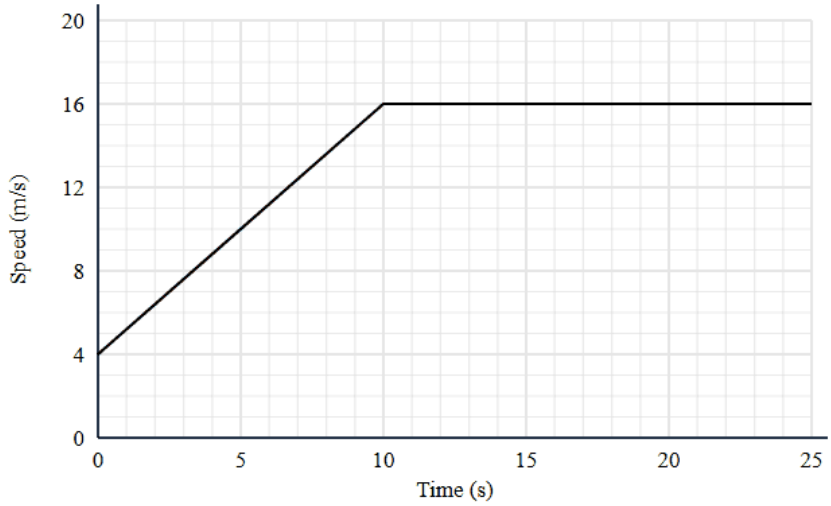
(Total for Question 9 is 5 marks)

EP SPECIMEN

Question 10

4 marks | Kinematic Graphs

10 Here is the speed-time graph for 25 seconds of a cyclist's journey.



(a) Work out the distance the cyclist travels in the 25 seconds.

..... m

(3)

(b) Work out the average speed of the cyclist for the 25 seconds.

..... m/s

(1)

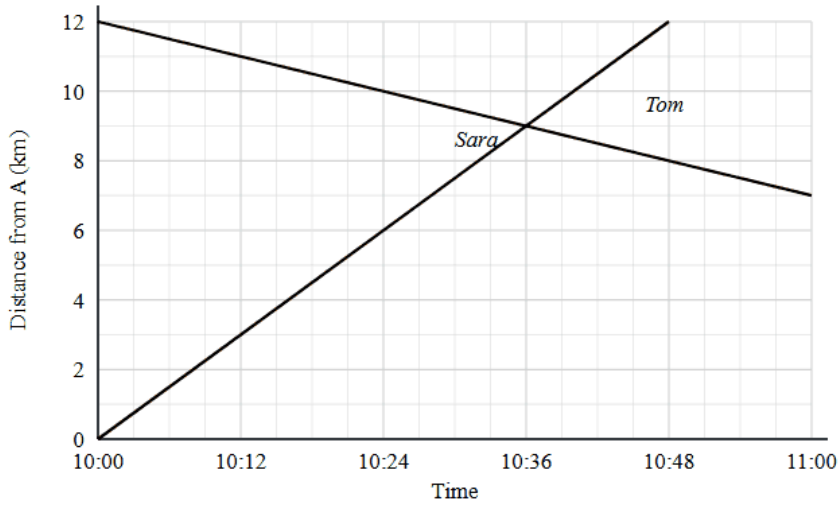
(Total for Question 10 is 4 marks)

EP SPECIMEN

Question 11

4 marks | Kinematic Graphs

11 At 10:00 Sara leaves town A and cycles towards town B.
At 10:00 Tom leaves town B and walks towards town A.
The graph shows their distances from town A.



(a) At what time do Sara and Tom pass each other?

.....

(1)

(b) How far from town A are they when they pass each other?

..... km

(1)

(c) Work out Tom's speed in kilometres per hour.

..... km/h

(2)

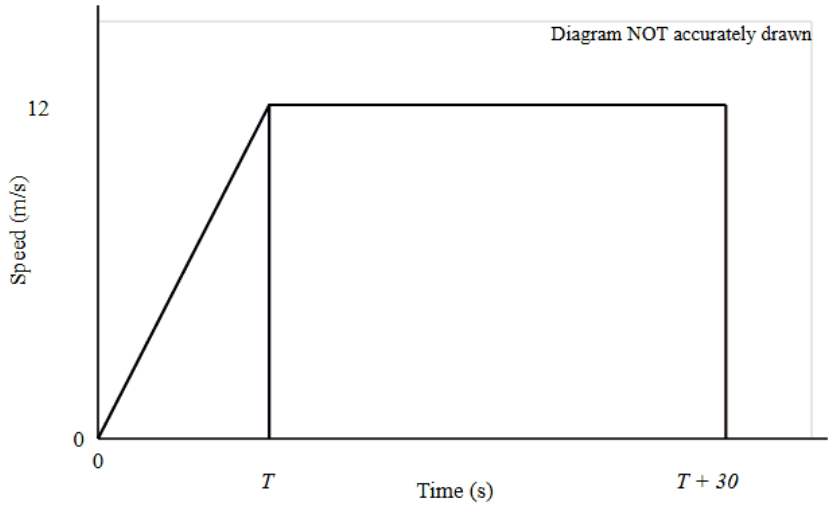
(Total for Question 11 is 4 marks)

EP SPECIMEN

Question 12

3 marks | Kinematic Graphs

12 A particle starts from rest. It speeds up at a constant rate for T seconds until its speed is 12 m/s.
It then travels at 12 m/s for 30 seconds.
The total distance it travels is 450 m.



Work out the value of T.

$T =$ .....

(3)

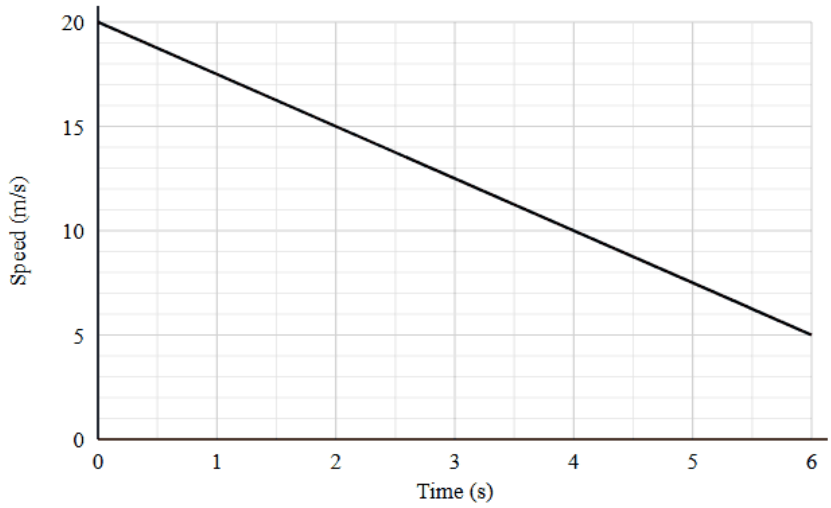
(Total for Question 12 is 3 marks)

EP SPECIMEN

Question 13

4 marks | Kinematic Graphs

13 A car is travelling at 20 m/s. The driver brakes and the car slows down at a constant rate. Here is the speed-time graph for the next 6 seconds.



(a) Work out the deceleration of the car.

..... m/s 2

(2)

(b) Work out the distance the car travels in the 6 seconds.

..... m

(2)

(Total for Question 13 is 4 marks)

EP SPECIMEN

Question 14

4 marks | Kinematic Graphs

14 A train starts from rest and speeds up at a constant rate for 50 seconds until its speed is 30 m/s.
It then travels at 30 m/s for t seconds.
It then slows down at a constant rate and stops 40 seconds later.
The total distance the train travels is 6 km.

Work out the value of t.

$t =$ .....

(4)

(Total for Question 14 is 4 marks)

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TOPIC

Angles in Polygons & Parallel Lines

Every past-paper question on this topic, 2020 to 2026.

Question 4

4 marks | Angles in Polygons & Parallel Lines

4 The diagram shows parts of three regular polygons, **A**, **B** and **C**, meeting at a point.

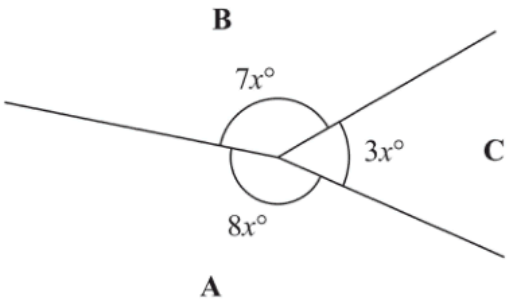


Diagram **NOT** accurately drawn

Polygon **B** has n sides.
Work out the value of n

$n =$ .....

(Total for Question 4 is 4 marks)

Question 4

4 marks | Angles in Polygons & Parallel Lines

4 The diagram shows a triangle.

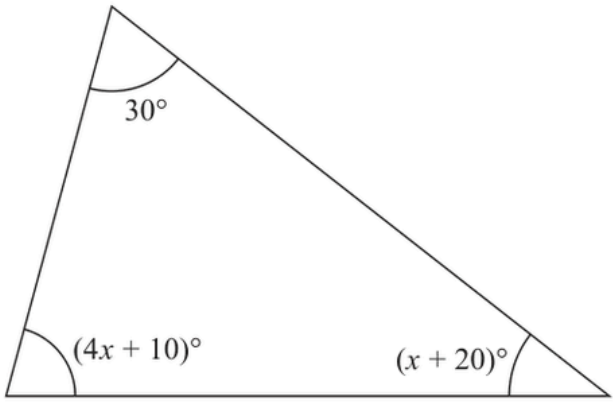


Diagram **NOT** accurately drawn

Work out the value of x.

$x =$ .....

(Total for Question 4 is 4 marks)

Question 8

4 marks | Angles in Polygons & Parallel Lines

8 Here is a 10-sided polygon.

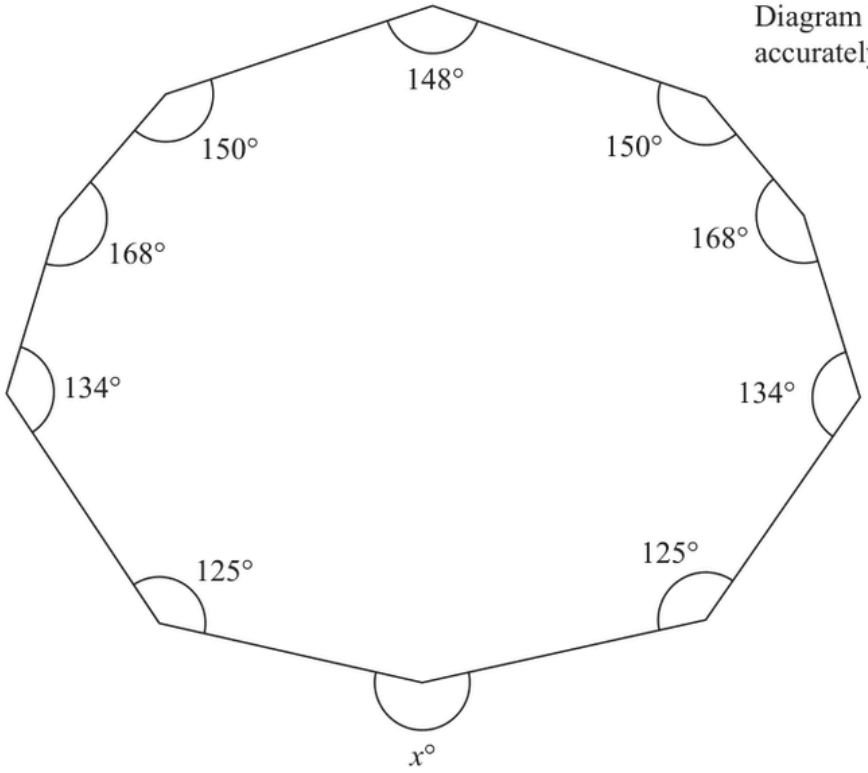


Diagram **NOT** accurately drawn

Work out the value of x.

$x =$ .....

(Total for Question 8 is 4 marks)

Question 8

5 marks | Angles in Polygons & Parallel Lines

8 The diagram shows a regular pentagon, *ABCDE*, a regular hexagon, *CFGHID*, and a quadrilateral, *EDIJ*.

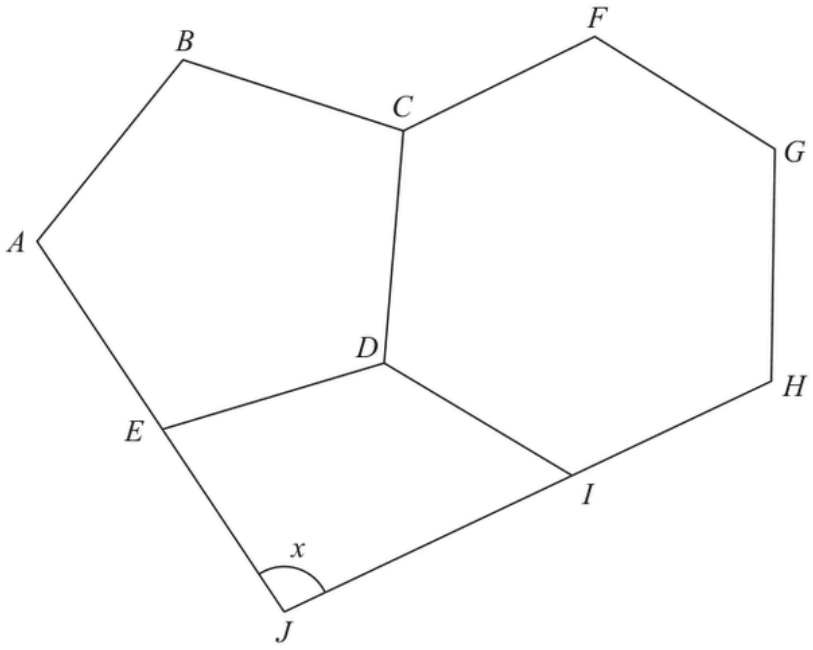


Diagram **NOT** accurately drawn

AEJ and *HIJ* are straight lines.

Work out the size of the angle marked x.
Show your working clearly.

.....°

(Total for Question 8 is 5 marks)

Question 5

5 marks | Angles in Polygons & Parallel Lines

5

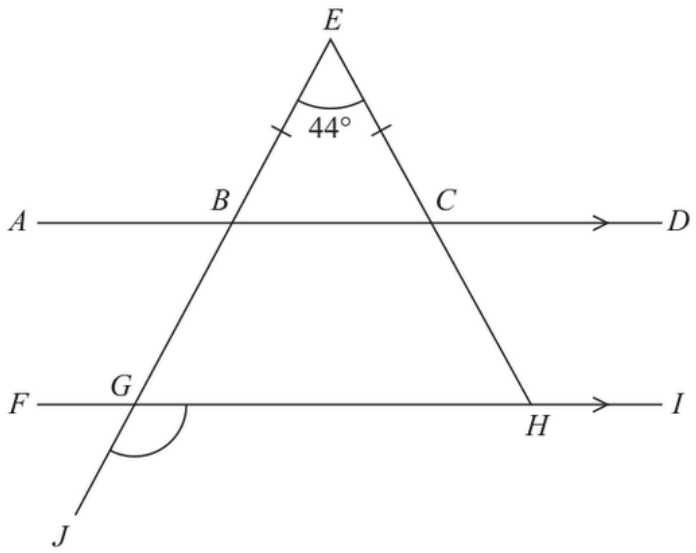


Diagram **NOT** accurately drawn

ABCD and *FGHI* are parallel straight lines.
EBGJ and *ECH* are straight lines.

BE = *CE*
Angle *BEC* = 44°

Work out the size of angle *JGH*.
Give a reason for each stage of your working.

.....°

(Total for Question 5 is 5 marks)

Question 5

5 marks | Angles in Polygons & Parallel Lines

5 The diagram shows a regular octagon *ABCDHIJK* and a pentagon *DEFGH*.

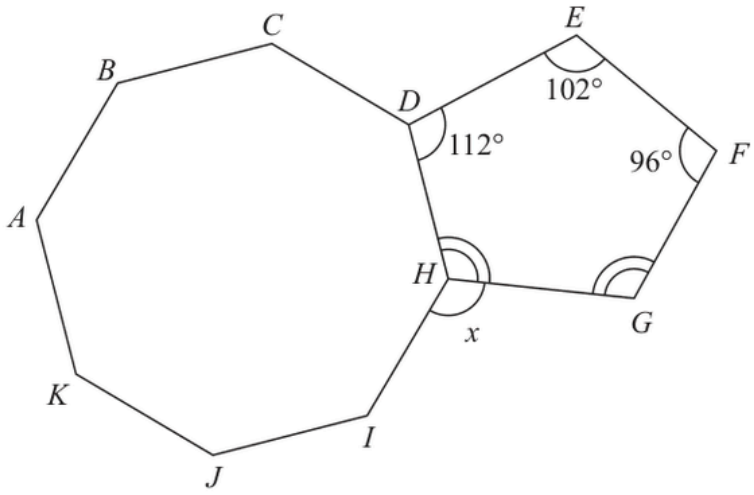


Diagram **NOT** accurately drawn

Angle *GHD* = angle *FGH*.

Work out the size of the angle marked *x*.
Show your working clearly.

.....°

(Total for Question 5 is 5 marks)

Question 4

4 marks | Angles in Polygons & Parallel Lines

4 The diagram shows a regular octagon *ABCDEFGH* and a regular pentagon *ABIJK*

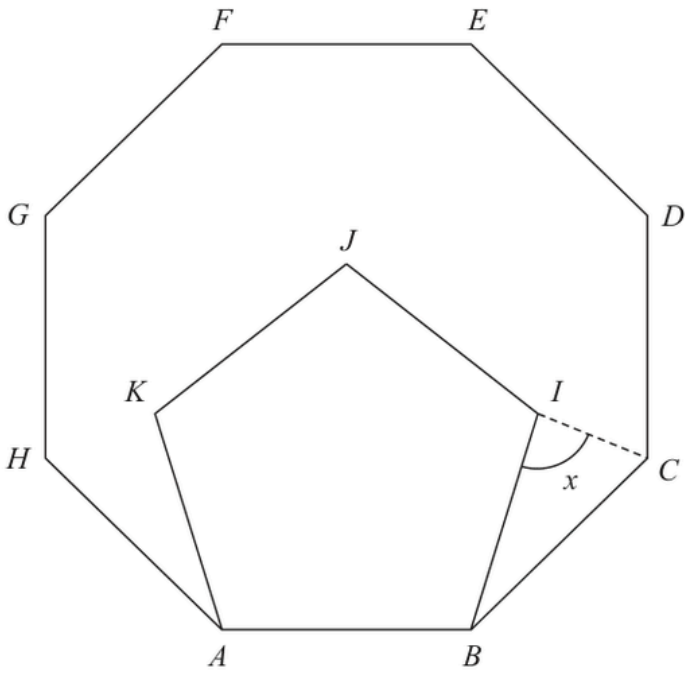


Diagram **NOT** accurately drawn

Work out the size of the angle x

.....°

(Total for Question 4 is 4 marks)

Question 11

4 marks | Angles in Polygons & Parallel Lines

11 The diagram shows a regular 10-sided polygon, *ABCDEFGHIJ*

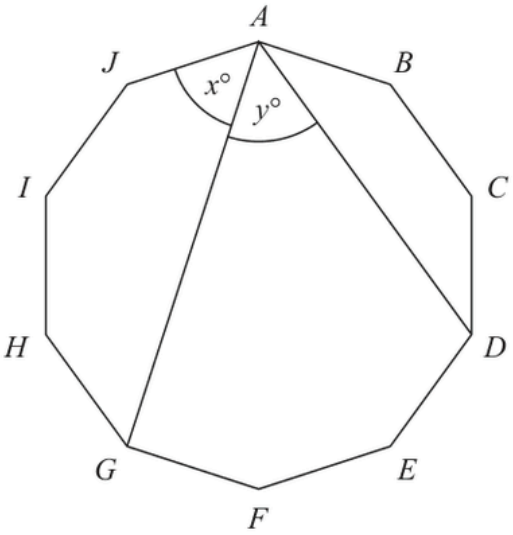


Diagram **NOT** accurately drawn

Show that $x = y$

(Total for Question 11 is 4 marks)

Question 4

4 marks | Angles in Polygons & Parallel Lines

4 The diagram shows parts of three regular polygons, **A**, **B** and **C**, meeting at a point.

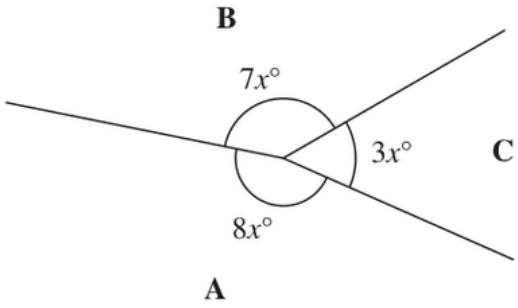


Diagram **NOT** accurately drawn

Polygon **B** has n sides.

Work out the value of n.

$n =$ .....

(Total for Question 4 is 4 marks)

Question 23

6 marks | Angles in Polygons & Parallel Lines

23 A polygon has n sides, where $n > 5$

When arranged in order of size, starting with the largest number, the sizes of the interior angles of the polygon, in degrees, are the terms of an arithmetic sequence.

Here are the first five terms of this sequence.

177 175 173 171 169

Find the value of n
Show clear algebraic working.

Question 23 continued

$n =$ .....

(Total for Question 23 is 6 marks)

Question 3

4 marks | Angles in Polygons & Parallel Lines

3 *ABCD* is a trapezium.

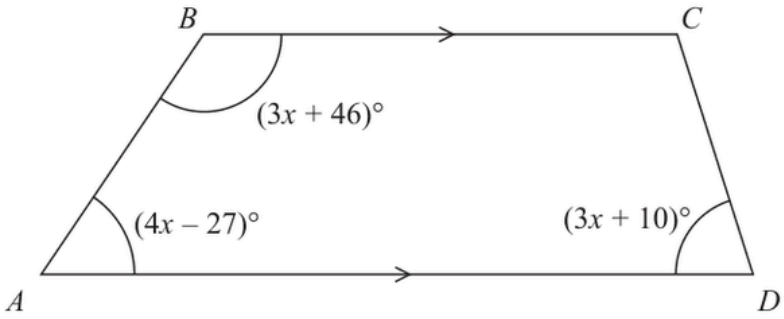


Diagram **NOT** accurately drawn

BC is parallel to *AD*

Find the size of the largest angle inside the trapezium.

.....°

(Total for Question 3 is 4 marks)

Question 11

3 marks | Angles in Polygons & Parallel Lines

11 Here is a 9-sided regular polygon $ABCDEFGHJ$, with centre O

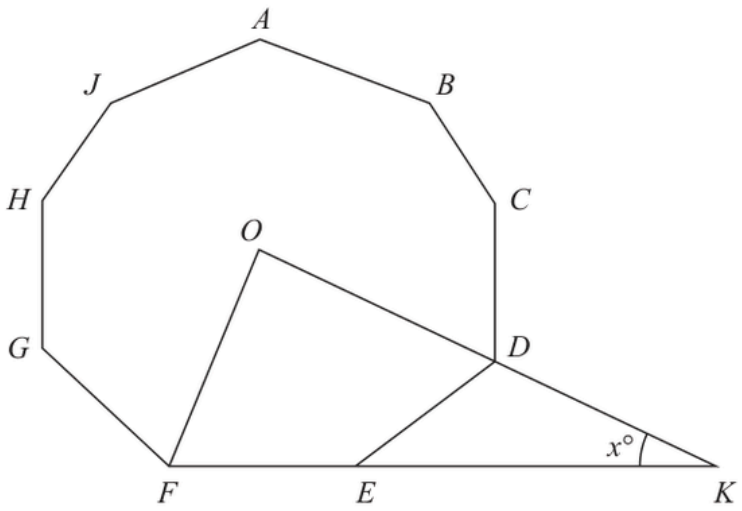


Diagram **NOT** accurately drawn

ODK and FEK are straight lines.

Work out the value of x

$x =$ .....

(Total for Question 11 is 3 marks)

Question 15

4 marks | Angles in Polygons & Parallel Lines

15

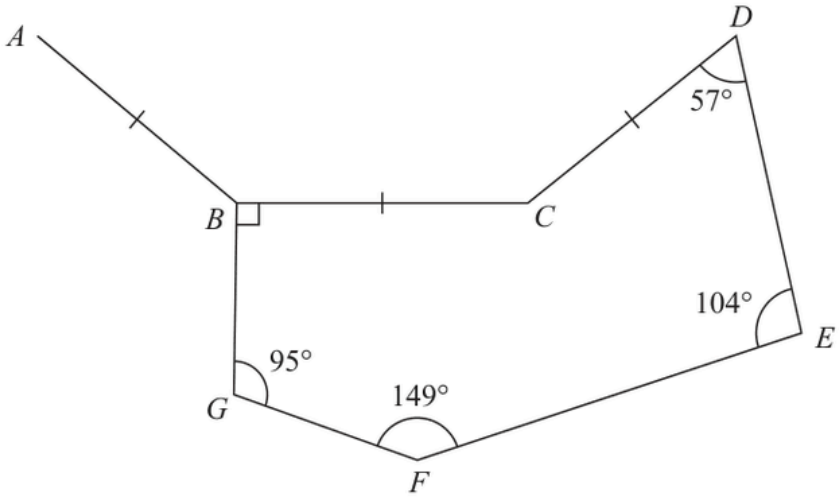


Diagram **NOT** accurately drawn

BCDEFG is a hexagon.
AB, *BC* and *CD* are three sides of a regular *n*-sided polygon.

Calculate the value of *n*
Show your working clearly.

$n =$ .....

(Total for Question 15 is 4 marks)

Question 5

4 marks | Angles in Polygons & Parallel Lines

5 In the diagram, $ABCDE$ is a regular pentagon.

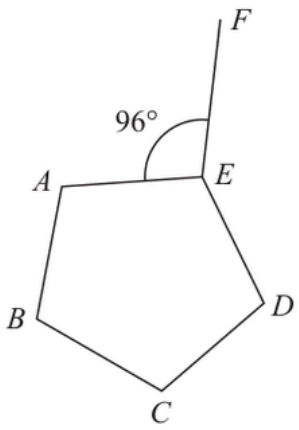


Diagram **NOT** accurately drawn

Angle $AEF = 96°$

Work out the size of the obtuse angle FED
Show your working clearly.

.....°

(Total for Question 5 is 4 marks)

Question 11

5 marks | Angles in Polygons & Parallel Lines

11

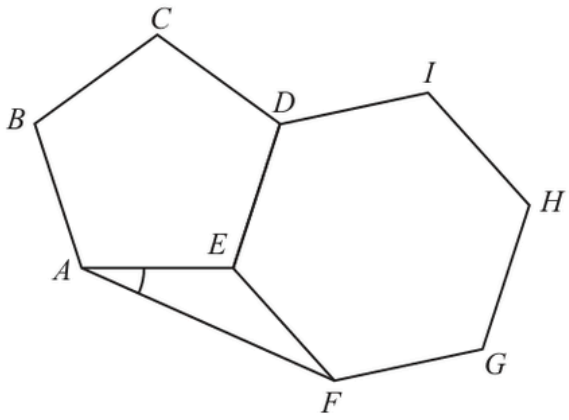


Diagram **NOT** accurately drawn

ABCDE is a regular pentagon.
DEFGHI is a regular hexagon.

AF is a straight line.

Work out the size of angle *EAF*

.....°

(Total for Question 11 is 5 marks)

Question 3

4 marks | Angles in Polygons & Parallel Lines

3

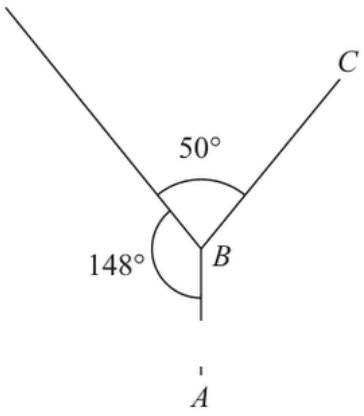


Diagram **NOT** accurately drawn

AB and BC are two sides of a regular polygon with n sides.

Work out the value of n
Show your working clearly.

$n =$ .....

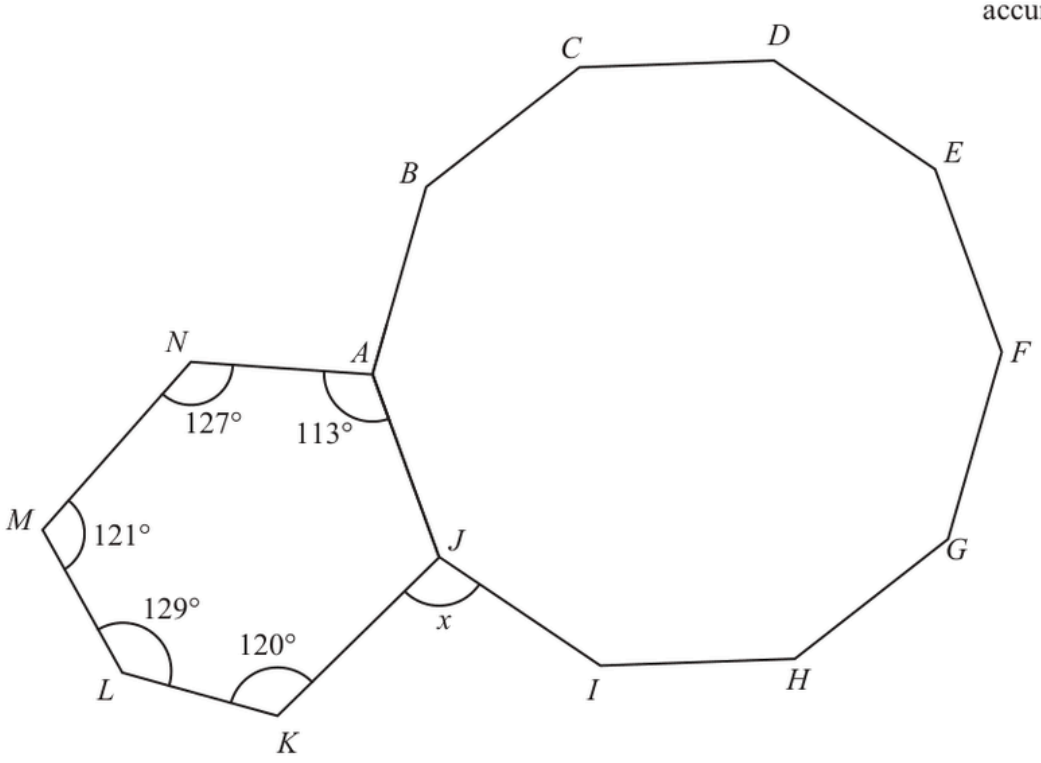
(Total for Question 3 is 4 marks)

Question 10

5 marks | Angles in Polygons & Parallel Lines

10 The diagram shows a regular 10-sided polygon *ABCDEFGHIJ* and a hexagon *AJKLMN*

Diagram **NOT** accurately drawn



Work out the size of the angle marked x
Show your working clearly.

.....°

(Total for Question 10 is 5 marks)

Question 7

4 marks | Angles in Polygons & Parallel Lines

7 *ABCDE* is a regular pentagon and *APQE* is a rectangle.

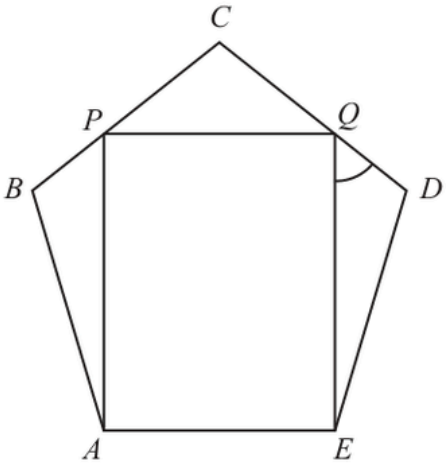


Diagram **NOT** accurately drawn

BPC and *DQC* are straight lines.

Work out the size of angle *EQD*
Show your working clearly.

.....°

(Total for Question 7 is 4 marks)

Question 12

4 marks | Angles in Polygons & Parallel Lines

12

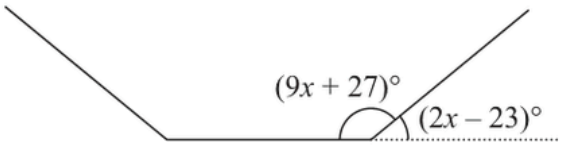


Diagram **NOT** accurately drawn

The diagram shows part of a regular n-sided polygon with

an interior angle of $(9x + 27)°$
an exterior angle of $(2x – 23)°$

Work out the value of n

$n =$ .....

(Total for Question 12 is 4 marks)

Question 6

3 marks | Angles in Polygons & Parallel Lines

6 *ABCDE* is a pentagon.

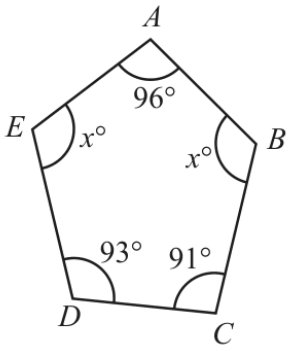


Diagram **NOT** accurately drawn

angle $EAB = 96°$ angle $BCD = 91°$ angle $CDE = 93°$ angle DEA = angle $ABC = x°$

Work out the value of x

$x =$ .....

(Total for Question 6 is 3 marks)

Question 15

3 marks | Angles in Polygons & Parallel Lines

15

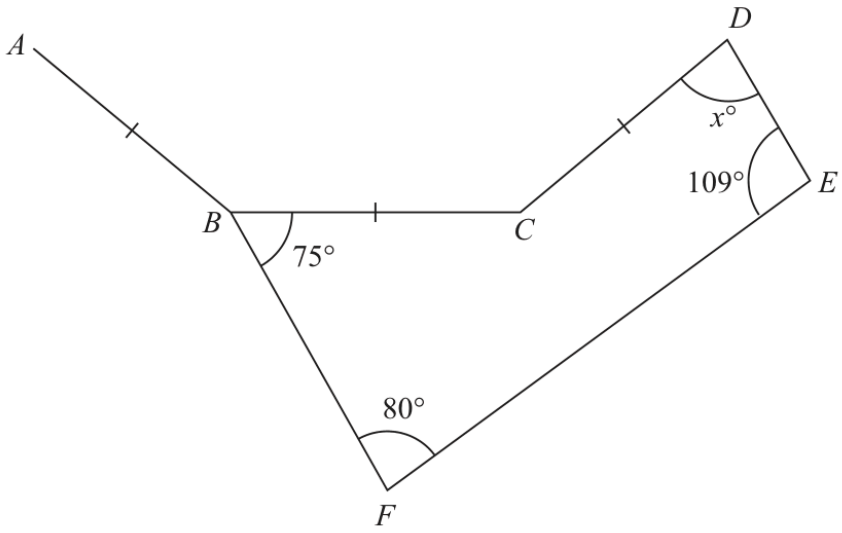


Diagram **NOT** accurately drawn

BCDEF is a pentagon.
AB, *BC* and *CD* are three sides of a regular 10-sided polygon.

Find the value of x

$x =$ .....

(Total for Question 15 is 3 marks)

Question 24

4 marks | Angles in Polygons & Parallel Lines

24

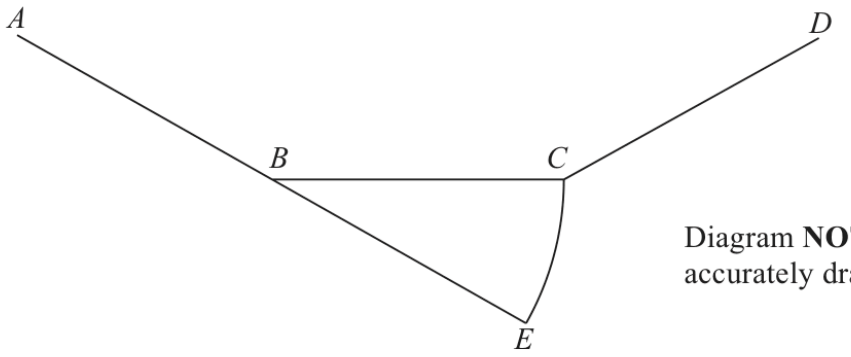


Diagram **NOT** accurately drawn

AB, *BC* and *CD* are three sides of a regular polygon.
ABE is a straight line.

BCE is a sector of a circle with centre *B* and radius 4.5 cm

The length of arc *CE* is $\frac{3}{10}\pi$ cm

Work out the sum of the interior angles of the regular polygon.

.....°

(Total for Question 24 is 4 marks)

TOPIC

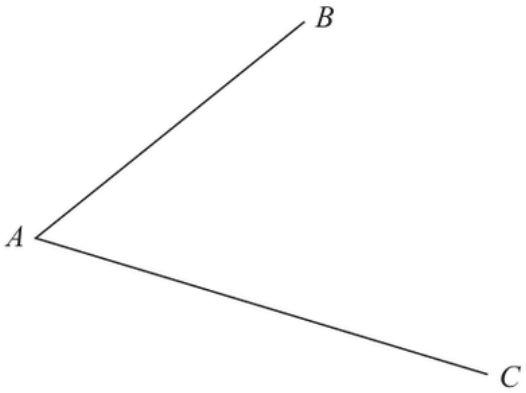
Constructions & Loci

Every past-paper question on this topic, 2020 to 2026.

Question 5

2 marks | Constructions & Loci

5 Use ruler and compasses to construct the bisector of angle BAC.
You must show all your construction lines.

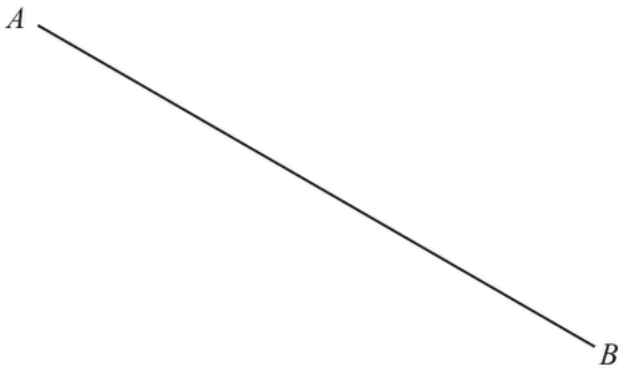


(Total for Question 5 is 2 marks)

Question 6

2 marks | Constructions & Loci

6 Use ruler and compasses only to construct the perpendicular bisector of the line AB.
You must show all your construction lines.

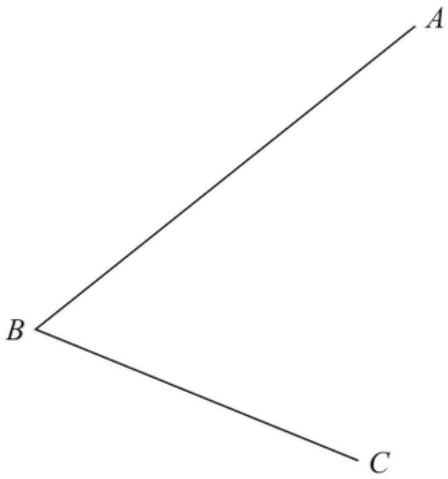


(Total for Question 6 is 2 marks)

Question 2

2 marks | Constructions & Loci

2 Using ruler and compasses only, construct the bisector of angle ABC.
You must show all your construction lines.

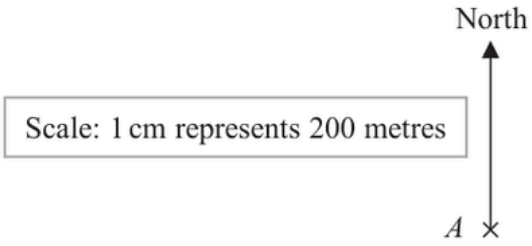


(Total for Question 2 is 2 marks)

Question 5

4 marks | Constructions & Loci

5 The scale diagram shows the position on a map of a house, A



House C is on a bearing of 110° from A
The distance from A to C is 700 m

(a) Mark the position of C on the diagram with a cross (×)
Label your cross C

(3)

(b) Write the scale of the map in the form $1 : n$

1 : .....

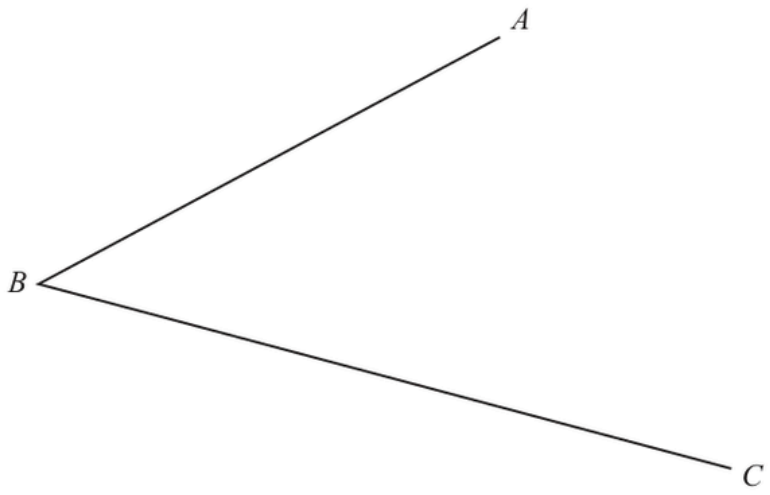
(1)

(Total for Question 5 is 4 marks)

Question 2

2 marks | Constructions & Loci

2 Use ruler and compasses only to construct the bisector of angle ABC
You must show all your construction lines.

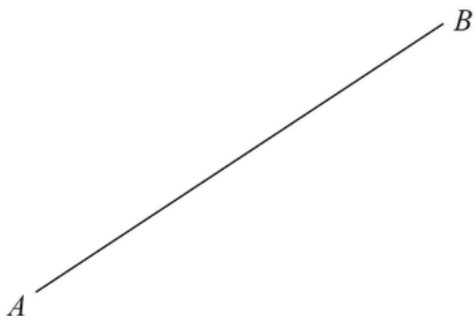


(Total for Question 2 is 2 marks)

Question 4

2 marks | Constructions & Loci

4 Using ruler and compasses only, construct the perpendicular bisector of the line AB
Show all your construction lines.

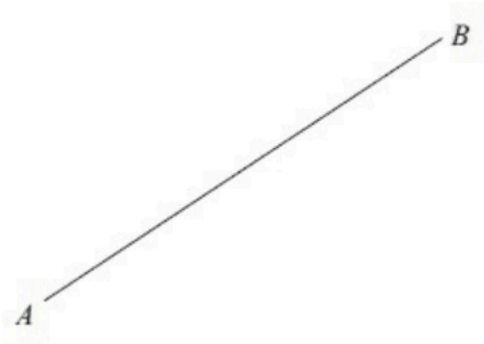


(Total for Question 4 is 2 marks)

Question 4

2 marks | Constructions & Loci

4 Using ruler and compasses only, construct the perpendicular bisector of the line AB
Show all your construction lines.

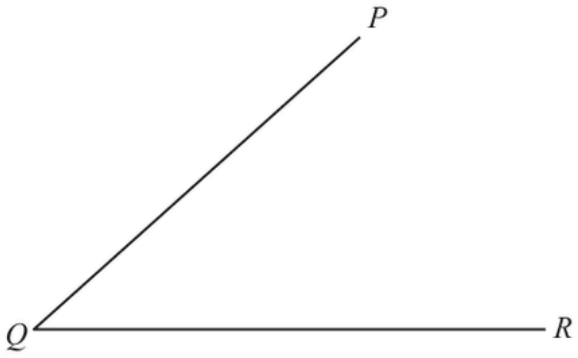


(Total for Question 4 is 2 marks)

Question 1

2 marks | Constructions & Loci

1 Using ruler and compasses only, construct the bisector of angle PQR
You must show all your construction lines.

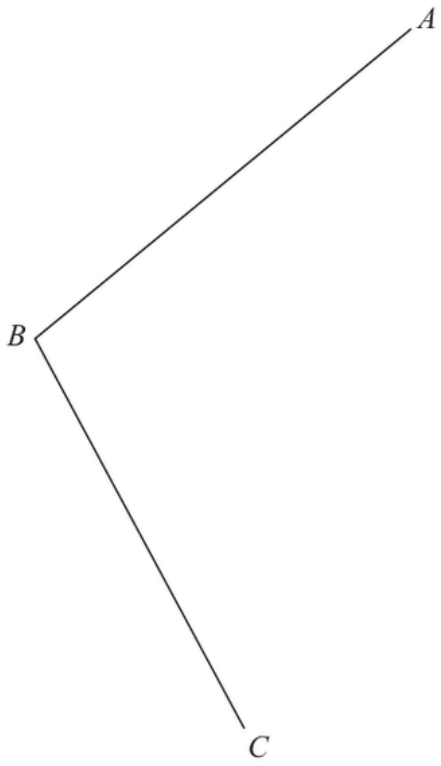


(Total for Question 1 is 2 marks)

Question 3

2 marks | Constructions & Loci

3 Using ruler and compasses only, construct the bisector of angle ABC
Show all your construction lines.



(Total for Question 3 is 2 marks)

TOPIC

Perimeter & Area

Every past-paper question on this topic, 2020 to 2026.

Question 6

4 marks | Perimeter & Area

6 The diagram shows an 8-sided shape *ABCDEFGH*

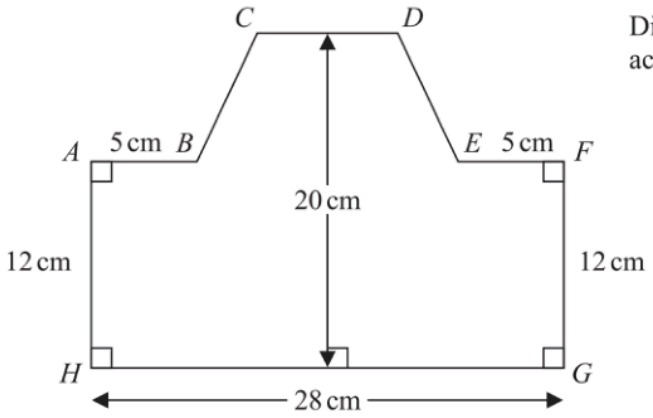


Diagram **NOT** accurately drawn

$HG = 28\,\text{cm}$ $AH = FG = 12\,\text{cm}$ $AB = EF = 5\,\text{cm}$
The height of the shape is 20 cm
CD is parallel to *HG*

The area of shape *ABCDEFGH* is $434\,\text{cm}^2$

Find the length of *CD*

Question 3

4 marks | Perimeter & Area

3 The diagram shows a shape.

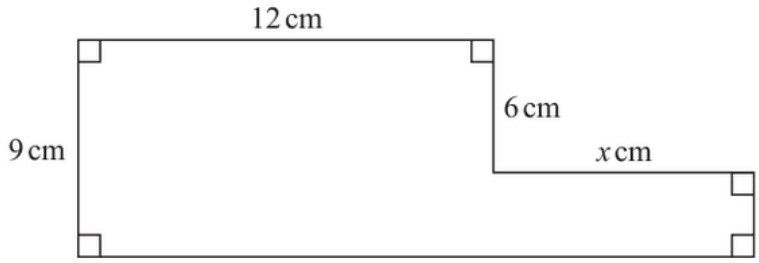


Diagram **NOT** accurately drawn

The shape has area 129 cm^2

Work out the value of x.

$x =$ .....

(Total for Question 3 is 4 marks)

Question 5

3 marks | Perimeter & Area

5 The diagram shows Yuen's garden.

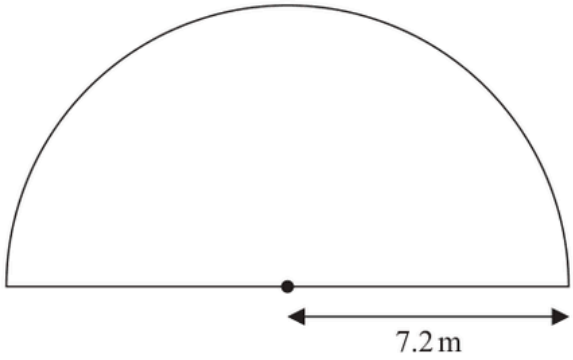


Diagram **NOT** accurately drawn

The garden is in the shape of a semicircle of radius 7.2 m.
Yuen is going to cover his garden with grass seed.

Yuen has 12 boxes of grass seed.
Each box of grass seed contains enough seed to cover 6 m^2 of the garden.

Has Yuen enough grass seed for his garden?
Show your working clearly.

(Total for Question 5 is 3 marks)

Question 10

5 marks | Perimeter & Area

10 The diagram shows a regular hexagon, *ABCDEF*, and an isosceles triangle, *GHJ*.

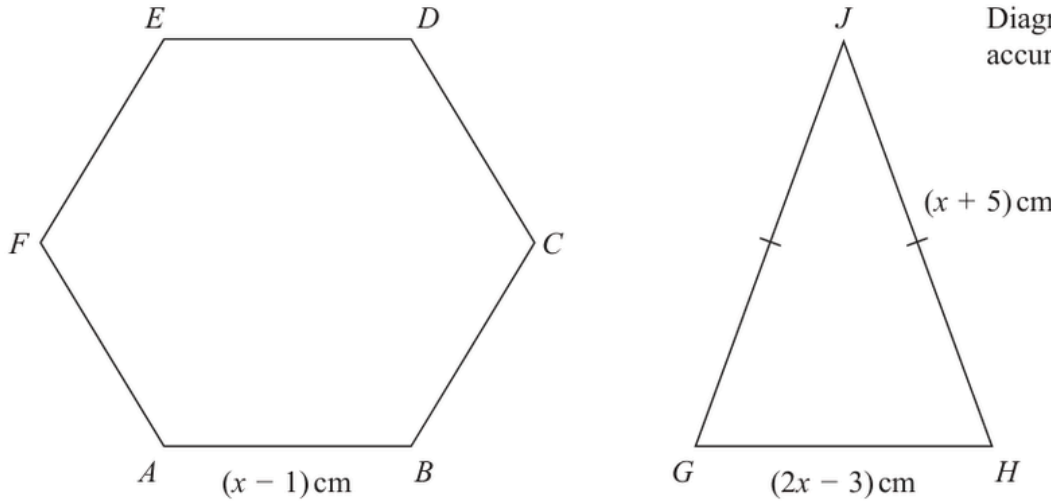


Diagram **NOT** accurately drawn

The perimeter of the hexagon is equal to the perimeter of the triangle.

Find the length of each side of the hexagon.
Show clear algebraic working.

..... cm

(Total for Question 10 is 5 marks)

Question 11

5 marks | Perimeter & Area

11 The diagram shows a shaded shape $ABCD$ made from a semicircle ABC and a right-angled triangle ACD.

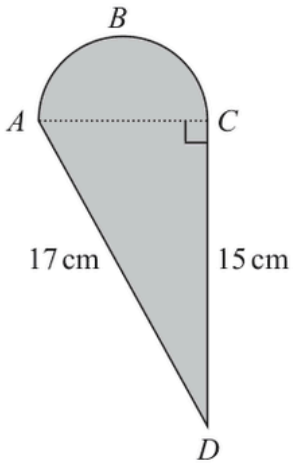


Diagram **NOT** accurately drawn

AC is the diameter of the semicircle ABC.

Work out the perimeter of the shaded shape.
Give your answer correct to 3 significant figures.

..... cm

(Total for Question 11 is 5 marks)

Question 11

6 marks | Perimeter & Area

11 The diagram shows trapezium $ABCD$ in which BC and AD are parallel.

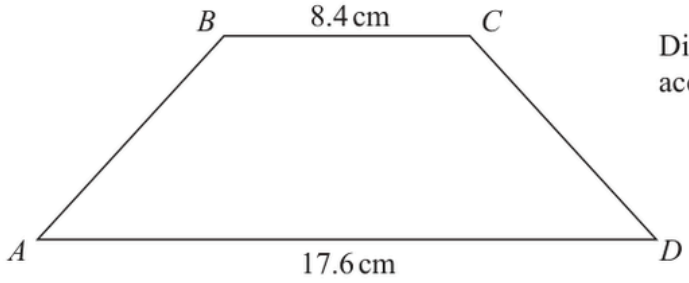


Diagram **NOT** accurately drawn

The trapezium has exactly one line of symmetry.

$BC = 8.4\,\text{cm}$
$AD = 17.6\,\text{cm}$

The trapezium has area $179.4\,\text{cm}^2$

Work out the size of angle ABC.
Give your answer correct to 1 decimal place.

.....°

(Total for Question 11 is 6 marks)

Question 22

6 marks | Perimeter & Area

22 The diagram shows a regular octagon *ABCDEFGH*.

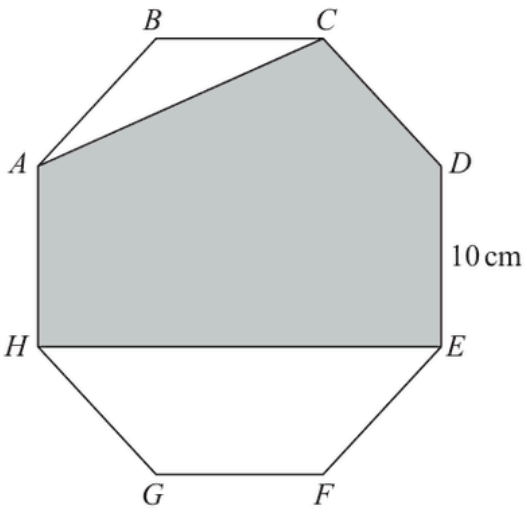


Diagram **NOT** accurately drawn

Each side of the octagon has length 10 cm.

Find the area of the shaded region *ACDEH*.
Give your answer correct to the nearest cm^2

..... cm^2

(Total for Question 22 is 6 marks)

Question 2

3 marks | Perimeter & Area

2 The diagram shows a rectangle $ABCD$ and a semicircle with diameter AB where $AB = 12\,\text{cm}$. The point E lies on DC and also on the semicircle.

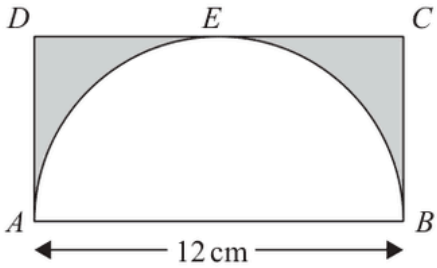


Diagram **NOT** accurately drawn

Work out the area of the shaded region.
Give your answer correct to 3 significant figures.

..... cm^2

(Total for Question 2 is 3 marks)

Question 8

5 marks | Perimeter & Area

8 A, B and C are points on a circle with centre O.

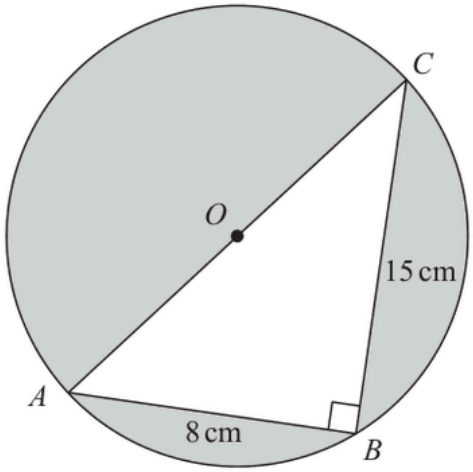


Diagram **NOT** accurately drawn

AOC is a diameter of the circle.

$AB = 8\,\text{cm}$ $BC = 15\,\text{cm}$

Angle $ABC = 90°$

Work out the total area of the regions shown shaded in the diagram.
Give your answer correct to 3 significant figures.

..... cm^2

(Total for Question 8 is 5 marks)

Question 10

5 marks | Perimeter & Area

10 The diagram shows one face of a wall.
This face is in the shape of a pentagon with exactly one line of symmetry.

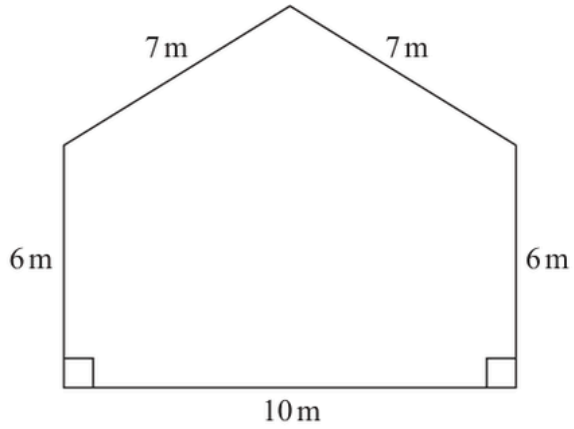


Diagram **NOT** accurately drawn

Omondi is going to paint this face of the wall once.
He has to buy all the paint that he needs to use.

The paint in each tin of paint Omondi is going to buy will cover $16\,m^2$ of the face of the wall.

Work out the least number of tins of paint Omondi will need to buy.
Show your working clearly.

(Total for Question 10 is 5 marks)

Question 20

4 marks | Perimeter & Area

20

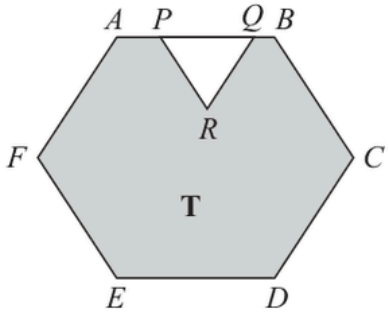


Diagram **NOT** accurately drawn

The diagram shows a shaded region **T** formed by removing an equilateral triangle PQR from a regular hexagon $ABCDEF$.

The points P and Q lie on AB such that $AB = 1.5 \times PQ$

Given that the area of region **T** is $72\sqrt{3}$ cm^2

work out the length of PQ.

..... cm

(Total for Question 20 is 4 marks)

Question 3

4 marks | Perimeter & Area

3

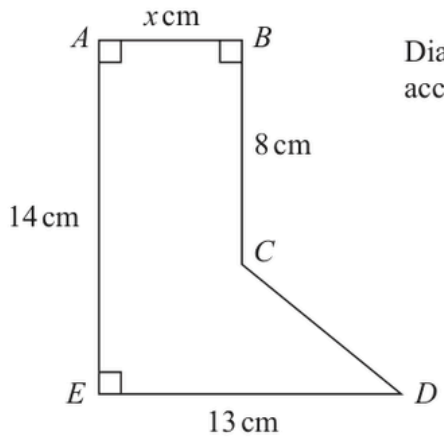


Diagram **NOT** accurately drawn

The diagram shows the shape $ABCDE$.

The area of the shape is $91.8\,cm^2$

Work out the value of x.

$x =$ .....

(Total for Question 3 is 4 marks)

Question 4

5 marks | Perimeter & Area

4 The diagram shows the front of a wooden door with a semicircular glass window.

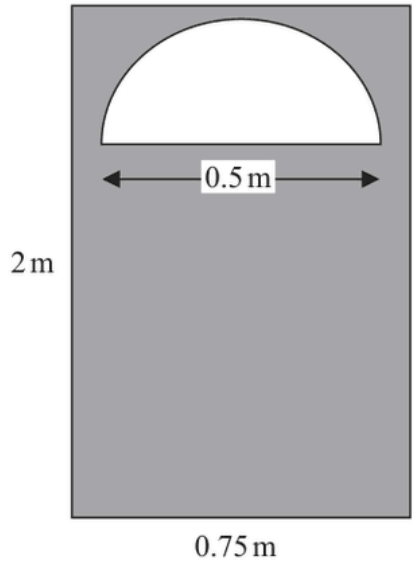


Diagram **NOT** accurately drawn

Julie wants to apply 2 coats of wood varnish to the front of the door, shown shaded in the diagram.

250 millilitres of wood varnish covers 4 m^2 of the wood.

Work out how many millilitres of wood varnish Julie will need.
Give your answer correct to the nearest millilitre.

..... millilitres

(Total for Question 4 is 5 marks)

Question 10

4 marks | Perimeter & Area

10 ABC is an isosceles triangle with $BA = BC$.

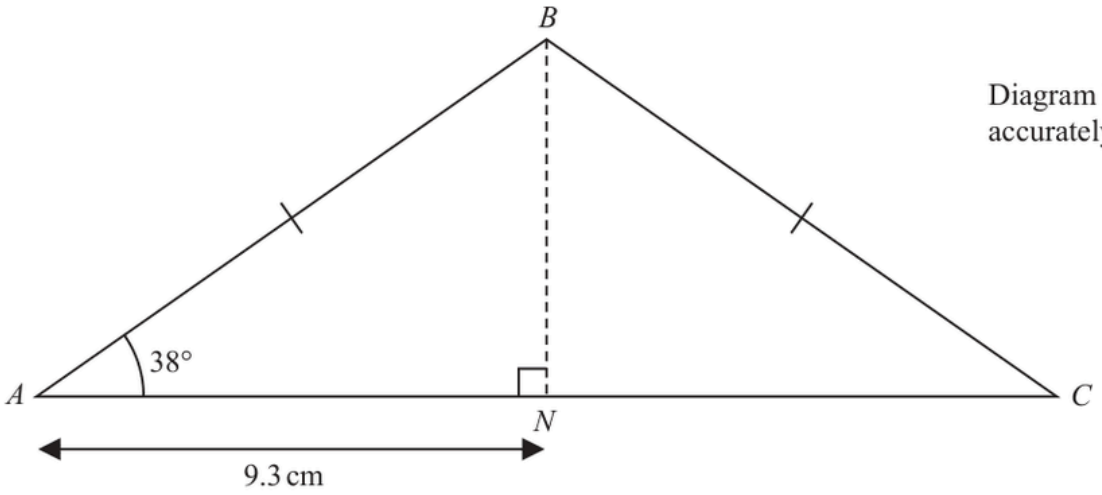


Diagram **NOT** accurately drawn

N is the point on AC such that $AN = 9.3$ cm and BN is perpendicular to AC.

Work out the perimeter of triangle ABC.
Give your answer correct to 3 significant figures.

..... cm

(Total for Question 10 is 4 marks)

Question 5

4 marks | Perimeter & Area

5 The diagram shows an 8-sided shape *ABCDEFGH*.

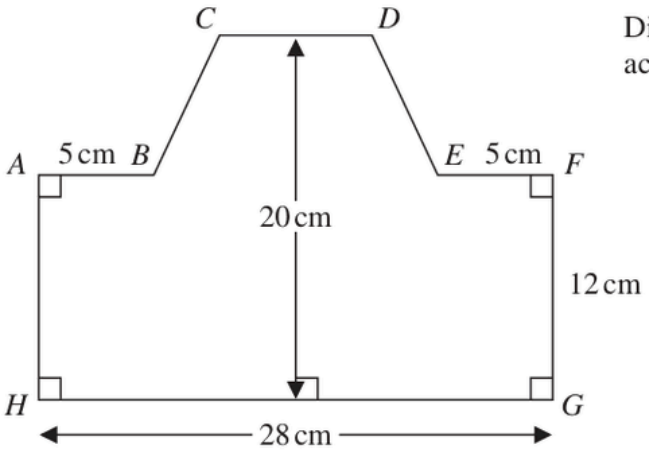


Diagram **NOT** accurately drawn

$HG = 28\,\text{cm}$ $FG = 12\,\text{cm}$ $AB = EF = 5\,\text{cm}$
The height of the shape is 20 cm
CD is parallel to *HG*

The area of shape *ABCDEFGH* is $434\,\text{cm}^2$

Find the length of *CD*.

..... cm

(Total for Question 5 is 4 marks)

Question 5

4 marks | Perimeter & Area

5 The diagram shows a shape made from a square $ABCD$ and 4 identical semicircles.

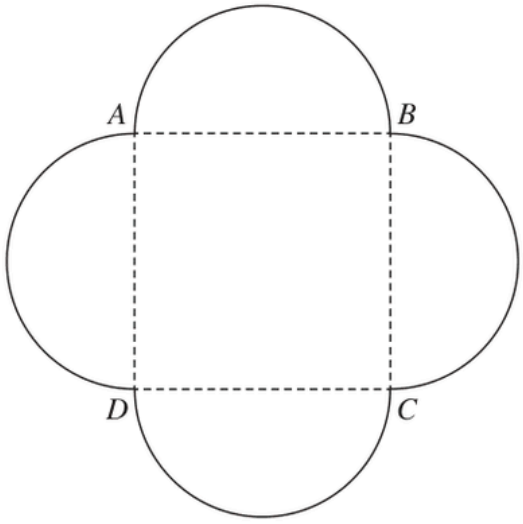


Diagram **NOT** accurately drawn

As shown in the diagram, the semicircles have AB, BC, CD and DA as diameters.

The area of the square is $36\,\text{cm}^2$

Calculate the total area of the shape.
Give your answer correct to one decimal place.

..... cm^2

(Total for Question 5 is 4 marks)

Question 11

6 marks | Perimeter & Area

11 The diagram shows a quadrilateral $ABCD$

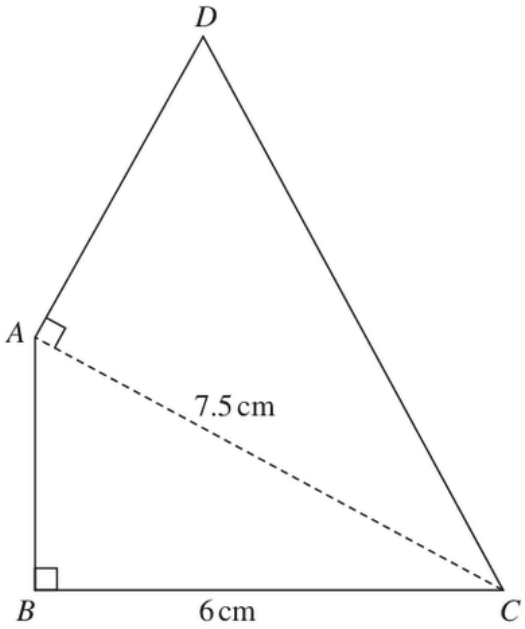


Diagram **NOT** accurately drawn

In the diagram, ABC and DAC are right-angled triangles.

$BC = 6\,\text{cm}$ $AC = 7.5\,\text{cm}$

The area of quadrilateral $ABCD$ is $31.5\,\text{cm}^2$

Work out the length of AD

Question 11 continued.

..... cm

(Total for Question 11 is 6 marks)

Question 5

4 marks | Perimeter & Area

5 A field is in the shape of a trapezium.

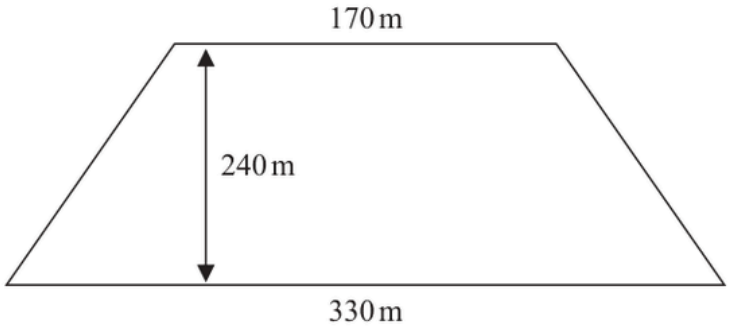


Diagram **NOT** accurately drawn

The field is sold for a price of \$49 650

Given that 1 hectare = 10 000 m^2

work out the average price of the field per hectare.

\$.....

(Total for Question 5 is 4 marks)

Question 10

5 marks | Perimeter & Area

10 The diagram shows a hexagon $ABCDEF$

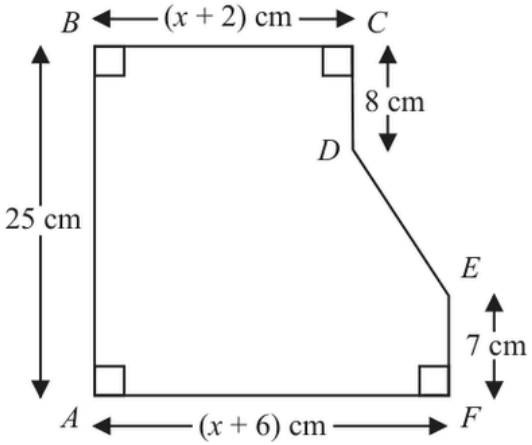


Diagram **NOT** accurately drawn

$AB = 25$ cm $\quad BC = (x + 2)$ cm $\quad CD = 8$ cm $\quad EF = 7$ cm $\quad AF = (x + 6)$ cm

The area of hexagon $ABCDEF$ is 258 cm²

Work out the value of x

$x =$ .....

(Total for Question 10 is 5 marks)

Question 7

4 marks | Perimeter & Area

7 The diagram shows a 6-sided shape $ABCDEF$

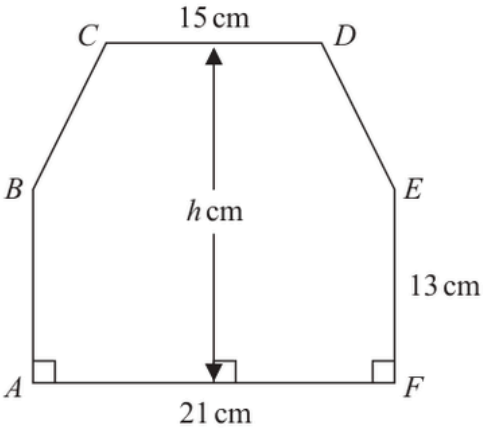


Diagram **NOT** accurately drawn

$AF = 21$ cm $\quad CD = 15$ cm $\quad AB = FE = 13$ cm

The perpendicular height of the shape is h cm
CD is parallel to AF

The area of the shape is $390\,\text{cm}^2$

Work out the value of h

$h =$ .....

(Total for Question 7 is 4 marks)

Question 8

6 marks | Perimeter & Area

8 The diagram shows a trapezium, $ABCD$

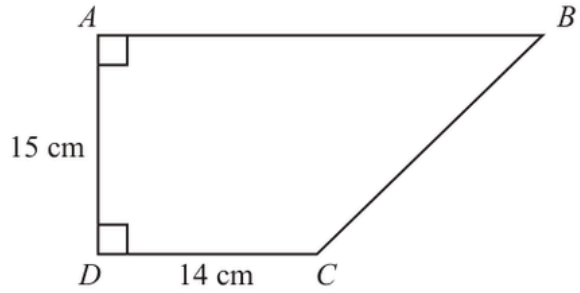


Diagram **NOT** accurately drawn

DAB and ADC are right angles.

$AD = 15$ cm $DC = 14$ cm

The area of the trapezium is 360 cm²

Work out the perimeter of the trapezium.

..... cm

(Total for Question 8 is 6 marks)

Question 10

5 marks | Perimeter & Area

10 The diagram shows a hexagon $ABCDEF$

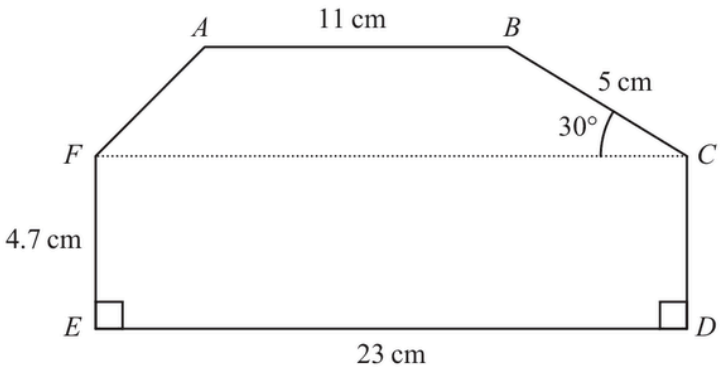


Diagram **NOT** accurately drawn

Angle $BCF = 30°$
AB, FC and ED are parallel.

Calculate the area of $ABCDEF$
Show your working clearly.

..... cm^2

(Total for Question 10 is 5 marks)

Question 4

3 marks | Perimeter & Area

4 The diagram shows triangle ABC and a semicircle.

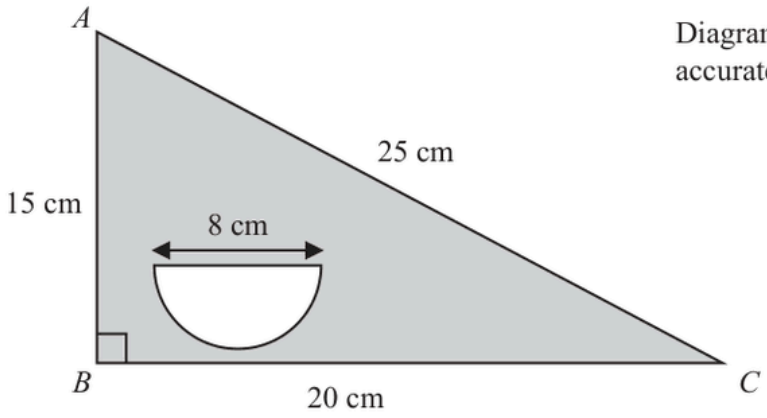


Diagram **NOT** accurately drawn

$AB = 15$ cm $\quad BC = 20$ cm $\quad AC = 25$ cm $\quad$ angle $ABC = 90°$

The diameter of the semicircle is 8 cm

Work out the area of the region shown shaded in the diagram.
Give your answer correct to 3 significant figures.

..... cm^2

(Total for Question 4 is 3 marks)

Question 9

5 marks | Perimeter & Area

9

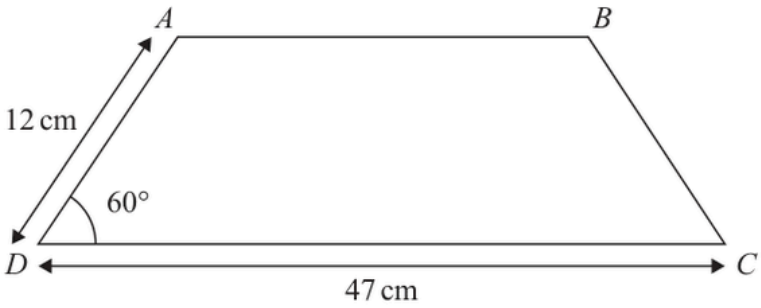


Diagram **NOT** accurately drawn

ABCD is a trapezium with one line of symmetry.

angle $ADC = 60°$ $AD = 12\,\text{cm}$ $DC = 47\,\text{cm}$

Work out the area of the trapezium.
Give your answer correct to 3 significant figures.
Show your working clearly.

..... cm^2

(Total for Question 9 is 5 marks)

Question 10

5 marks | Perimeter & Area

10

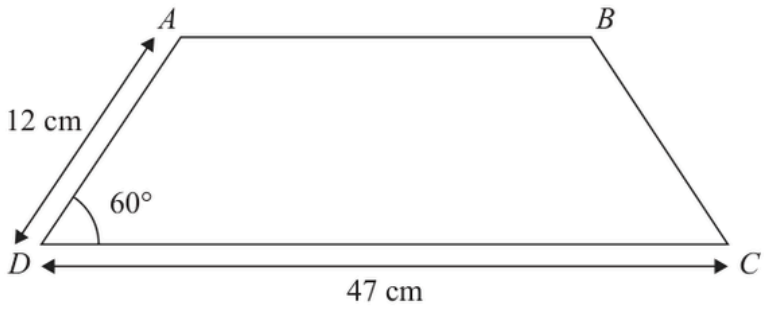


Diagram **NOT** accurately drawn

ABCD is a trapezium with one line of symmetry.

angle $ADC = 60°$ $AD = 12\,\text{cm}$ $DC = 47\,\text{cm}$

Work out the area of the trapezium.
Give your answer correct to 3 significant figures.
Show your working clearly.

..... cm^2

(Total for Question 10 is 5 marks)

Question 19

5 marks | Perimeter & Area

19 The diagram shows a pentagon $ABCDE$

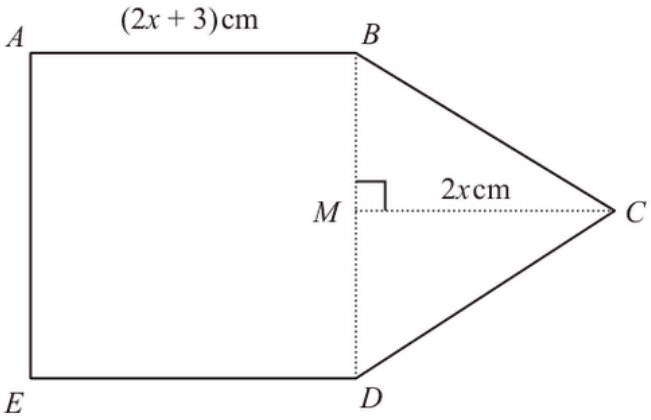


Diagram **NOT** accurately drawn

$ABCDE$ is made from a square $ABDE$ and a triangle BCD
M is the midpoint of BD

$AB = (2x + 3)$ cm $MC = 2x$ cm angle $BMC = 90°$

The area of pentagon $ABCDE$ is 84 cm^2

Work out the area of square $ABDE$
Show clear algebraic working.

..... cm^2

(Total for Question 19 is 5 marks)

Question 1

2 marks | Perimeter & Area

1 The diagram shows a semicircle.

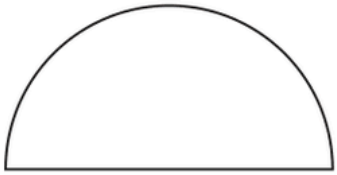


Diagram **NOT** accurately drawn

The semicircle has diameter 12 cm

Work out the perimeter of the semicircle.
Give your answer correct to 3 significant figures.

..... cm

(Total for Question 1 is 2 marks)

Question 18

4 marks | Perimeter & Area

18 The diagram shows a rectangle.

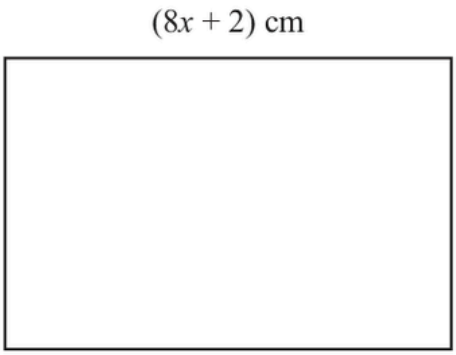


Diagram **NOT** accurately drawn

The rectangle has length $(8x + 2)$ cm and width $(3x - 2)$ cm
The area of the rectangle is $500\ \text{cm}^2$

(a) Show that $12x^2 - 5x - 252 = 0$

(1)

(b) Hence find the value of x
Give your answer correct to 3 significant figures.

$x =$ .....

(3)

(Total for Question 18 is 4 marks)

Question 21

4 marks | Perimeter & Area

21 The diagram shows an equilateral triangle and a circle.

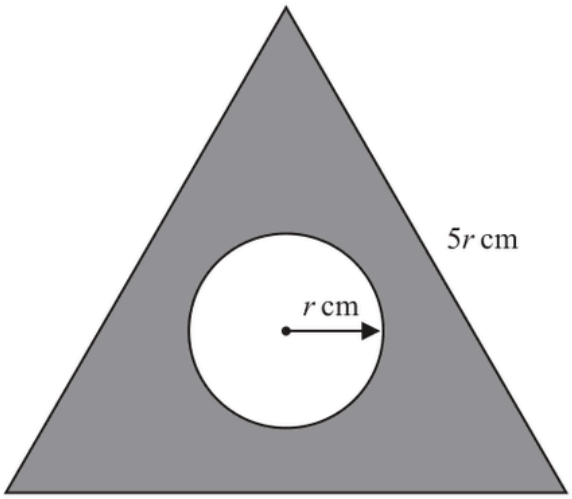


Diagram **NOT** accurately drawn

The equilateral triangle has sides of length $5r$ cm
The circle has radius r cm

The area of the shaded region is 610π cm^2
Work out the value of r

Give your answer correct to 3 significant figures.

$r =$ .....

(Total for Question 21 is 4 marks)

Question 4

5 marks | Perimeter & Area

4 The diagram shows a shaded shape $ABCD$ made from a right-angled triangle ABD and a semicircle BCD

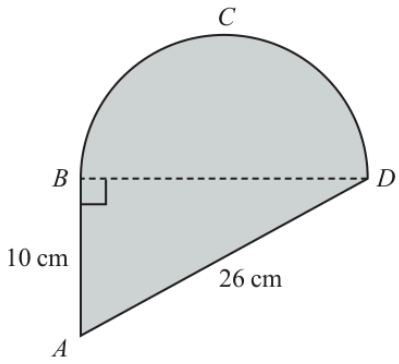


Diagram **NOT** accurately drawn

$AB = 10$ cm $AD = 26$ cm angle $ABD = 90°$

Work out the perimeter of the shaded shape.
Give your answer correct to 3 significant figures.

..... cm

(Total for Question 4 is 5 marks)

Question 11

5 marks | Perimeter & Area

11 The diagram shows a shaded shape $ABCDEO$ made from a semicircle BCD and two identical right-angled triangles ABO and EDO

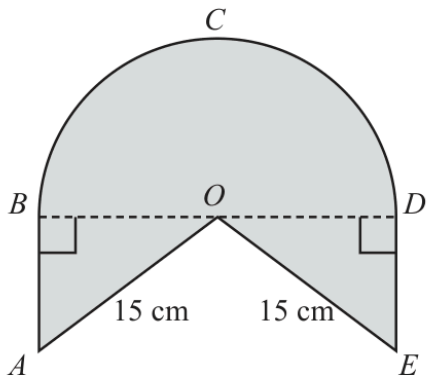


Diagram **NOT** accurately drawn

BD is the diameter of the semicircle.
O is the midpoint of BD

angle ABO = angle EDO = 90° $AO = EO = 15$ cm

The area of semicircle BCD is 227 cm^2

Work out the perimeter of the shaded shape.
Show your working clearly.
Give your answer correct to one decimal place.

..... cm

(Total for Question 11 is 5 marks)

TOPIC

Circles, Arcs & Sectors

Every past-paper question on this topic, 2020 to 2026.

Question 18

4 marks | Circles, Arcs & Sectors

18 The diagram shows two identical circles drawn inside a rectangle.

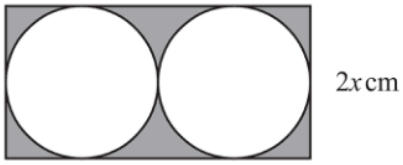


Diagram **NOT** accurately drawn

The length of the rectangle is $4x$ cm and the width of the rectangle is $2x$ cm
Each circle has a radius of x cm

The circles touch each other and each circle touches three sides of the rectangle.

The region inside the rectangle that is outside the circles, shown shaded in the diagram, has a total area of $20\,\text{cm}^2$

Work out the perimeter of the rectangle.
Give your answer correct to 3 significant figures.

..... cm

Question 8

3 marks | Circles, Arcs & Sectors

8 The region, shown shaded in the diagram, is a path.

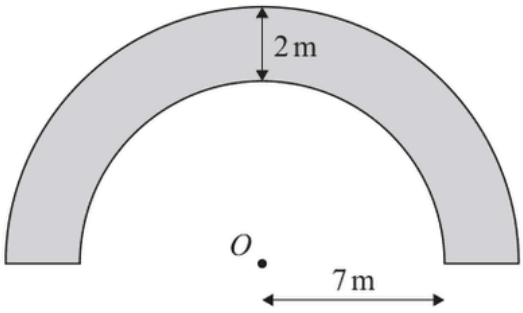


Diagram **NOT** accurately drawn

The boundary of the path is formed by two semicircles, with the same centre O, and two straight lines.

The inner semicircle has a radius of 7 metres.
The path has a width of 2 metres.

Work out the perimeter of the path.
Give your answer correct to one decimal place.

..... m

(Total for Question 8 is 3 marks)

Question 11

4 marks | Circles, Arcs & Sectors

11 A circle centre O has radius 9 cm.

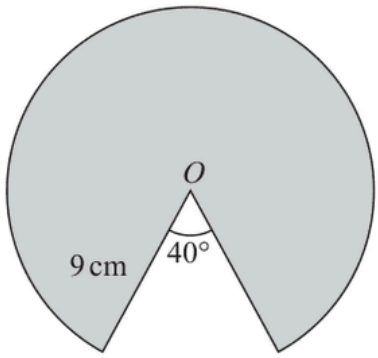


Diagram **NOT** accurately drawn

Calculate the perimeter of the shaded sector of the circle.
Give your answer correct to 3 significant figures.

..... cm

(Total for Question 11 is 4 marks)

Question 20

5 marks | Circles, Arcs & Sectors

20 A, B and C are points on a circle with centre O.

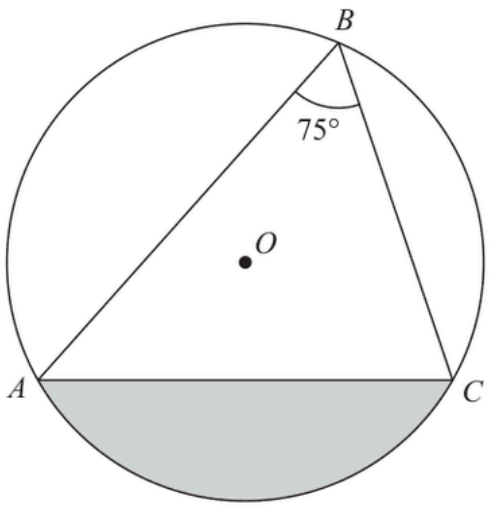


Diagram **NOT** accurately drawn

Angle $ABC = 75°$

The area of the shaded segment is $200\,\text{cm}^2$

Calculate the radius of the circle.
Give your answer correct to 3 significant figures.

..... cm

(Total for Question 20 is 5 marks)

Question 22

6 marks | Circles, Arcs & Sectors

22 The diagram shows a sector OBC of a circle with centre O and radius $(6 + x)$ cm.

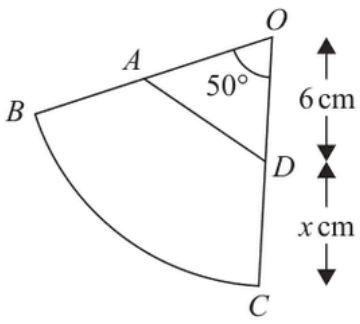


Diagram **NOT** accurately drawn

A is the point on OB and D is the point on OC such that $OA = OD = 6$ cm

Angle $BOC = 50°$

Given that

the perimeter of sector $OBC = 2 \times$ the perimeter of triangle OAD

find the value of x.
Give your answer correct to 3 significant figures.

$x =$ .....

(Total for Question 22 is 6 marks)

Question 12

2 marks | Circles, Arcs & Sectors

12 The diagram shows a sector of a circle with radius 7 cm.

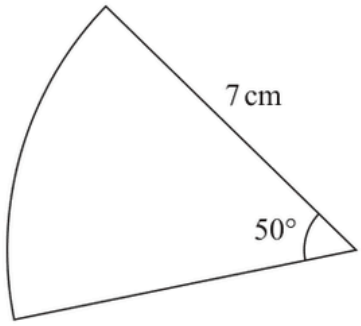


Diagram **NOT** accurately drawn

Work out the length of the arc of the sector.
Give your answer correct to one decimal place.

..... cm

(Total for Question 12 is 2 marks)

Question 25

6 marks | Circles, Arcs & Sectors

25 The diagram shows two circles such that the region **R**, shown shaded in the diagram, is the region common to both circles.

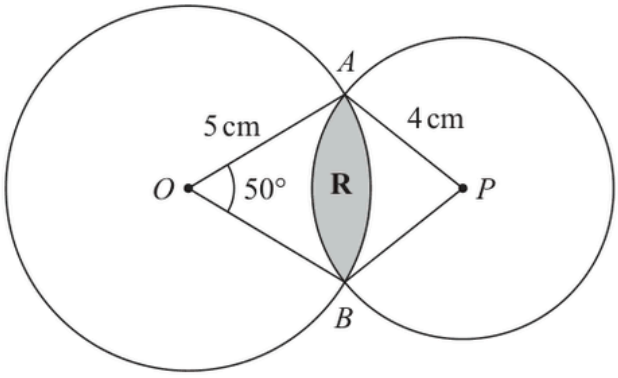


Diagram **NOT** accurately drawn

One of the circles has centre O and radius 5 cm.
The other circle has centre P and radius 4 cm.
Angle $AOB = 50°$

Calculate the area of region **R**.
Give your answer correct to 3 significant figures.

..... cm^2

(Total for Question 25 is 6 marks)

Question 9

5 marks | Circles, Arcs & Sectors

9 In the diagram, ABC is a right-angled triangle and DEF is a semicircular arc.

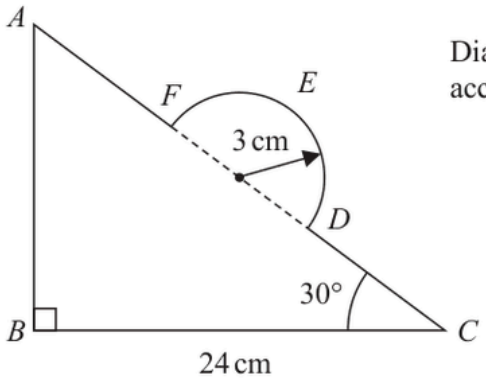


Diagram **NOT** accurately drawn

In triangle ABC

$BC = 24$ cm angle $ABC = 90°$ angle $BCA = 30°$

The points D and F lie on AC so that DF is the diameter of the semicircular arc DEF
The radius of the semicircular arc is 3 cm.

Work out the length of $AFEDC$
Give your answer correct to 2 significant figures.

..... cm

(Total for Question 9 is 5 marks)

Question 11

2 marks | Circles, Arcs & Sectors

11 The diagram shows sector OPQ of a circle, centre O

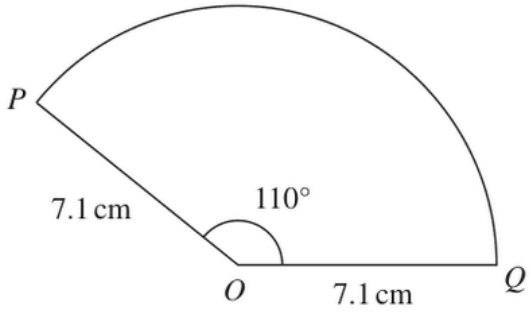


Diagram **NOT** accurately drawn

$OP = OQ = 7.1$ cm
Angle $POQ = 110°$

Calculate the area of sector OPQ
Give your answer correct to one decimal place.

..... cm^2

(Total for Question 11 is 2 marks)

Question 16

4 marks | Circles, Arcs & Sectors

16 The diagram shows a circle with centre O

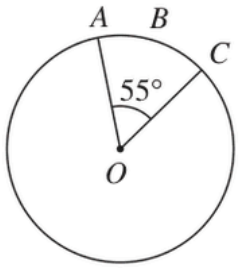


Diagram **NOT** accurately drawn

A, B and C are points on the circle so that the length of the arc ABC is 5 cm.

Given that angle $AOC = 55°$

work out the area of the circle.
Give your answer correct to one decimal place.

..... cm^2

(Total for Question 16 is 4 marks)

Question 13

3 marks | Circles, Arcs & Sectors

13 The diagram shows a sector AOB of a circle with centre O

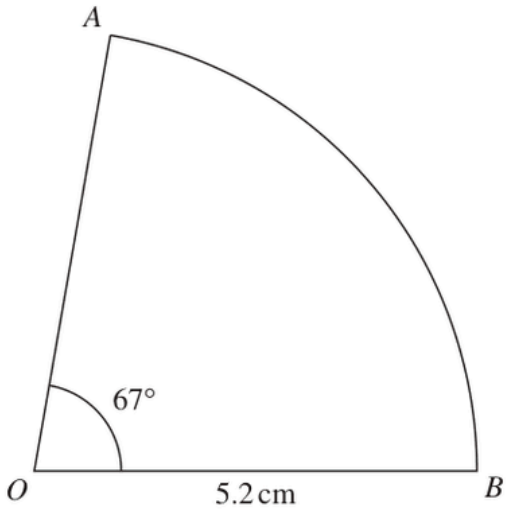


Diagram **NOT** accurately drawn

Angle $AOB = 67°$
$OA = OB = 5.2\,\text{cm}$

Calculate the perimeter of the sector.
Give your answer correct to 3 significant figures.

..... cm

(Total for Question 13 is 3 marks)

Question 19

5 marks | Circles, Arcs & Sectors

19

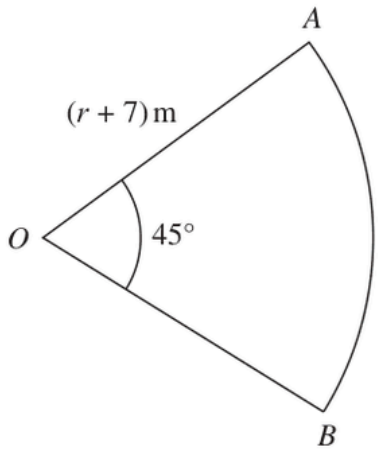


Diagram **NOT** accurately drawn

OAB is a sector **S** of a circle with centre *O* and radius $(r + 7)$ metres.
Angle $AOB = 45°$

A circle **C** has radius $(r - 2)$ metres.

The area of sector **S** is twice the area of circle **C**

Find the value of r
Show your working clearly.

Question 19 continued.

$r =$ .....

(Total for Question 19 is 5 marks)

Question 20

4 marks | Circles, Arcs & Sectors

20 The diagram shows four identical circles drawn inside a square.

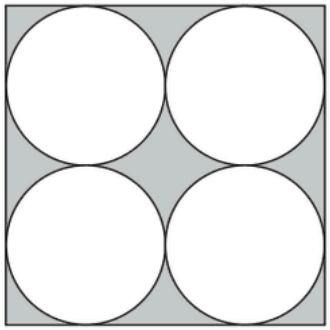


Diagram **NOT** accurately drawn

Each circle touches two other circles and two sides of the square.

The region inside the square that is outside the circles, shown shaded in the diagram, has a total area of $40\,cm^2$

Work out the perimeter of the square.
Give your answer correct to 3 significant figures.

..... cm

(Total for Question 20 is 4 marks)

Question 4

5 marks | Circles, Arcs & Sectors

4 The diagram shows a shape made up of three semicircles, enclosing a right-angled triangle.

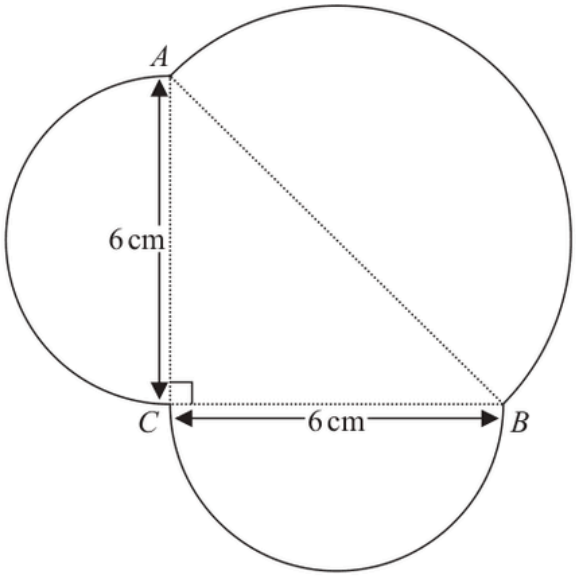


Diagram **NOT** accurately drawn

AB, BC and CA are each the diameter of a semicircle.

$BC = CA = 6$ cm.

Work out the perimeter of the shape.
Give your answer correct to one decimal place.

..... cm

(Total for Question 4 is 5 marks)

Question 22

6 marks | Circles, Arcs & Sectors

22 The diagram shows two circles with centre O and a regular pentagon $ABCDE$

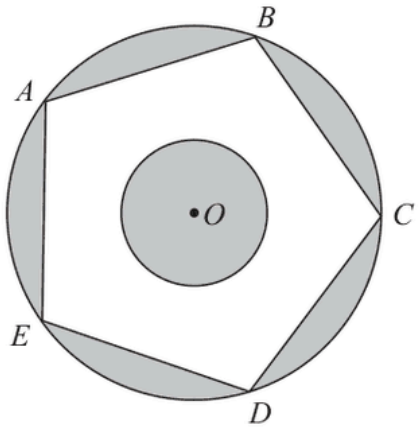


Diagram **NOT** accurately drawn

A, B, C, D and E are points on the larger circle.
The pentagon has sides of length 8 cm.

The diagram is shaded such that

shaded area = unshaded area

Work out the radius of the smaller circle.
Give your answer correct to 3 significant figures.

..... cm

(Total for Question 22 is 6 marks)

Question 5

3 marks | Circles, Arcs & Sectors

5 The diagram shows a shaded shape made from three identical semicircles, ***X***, ***Y*** and ***Z***

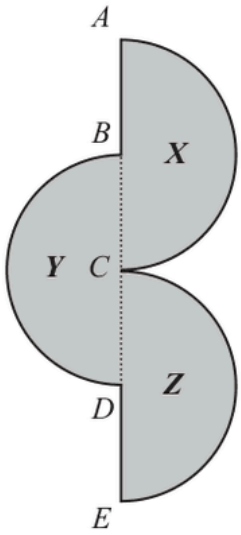


Diagram **NOT** accurately drawn

ABCDE is a straight line.

AC is the diameter of semicircle ***X*** and *B* is the centre of semicircle ***X***
BD is the diameter of semicircle ***Y*** and *C* is the centre of semicircle ***Y***
CE is the diameter of semicircle ***Z*** and *D* is the centre of semicircle ***Z***

$AC = BD = CE = 20$ cm

Work out the perimeter of the shaded shape.
Give your answer correct to the nearest whole number.

..... cm

(Total for Question 5 is 3 marks)

Question 20

4 marks | Circles, Arcs & Sectors

20 The diagram shows equilateral triangle ABC with sides of length 10 cm.
A circle is drawn inside the triangle.

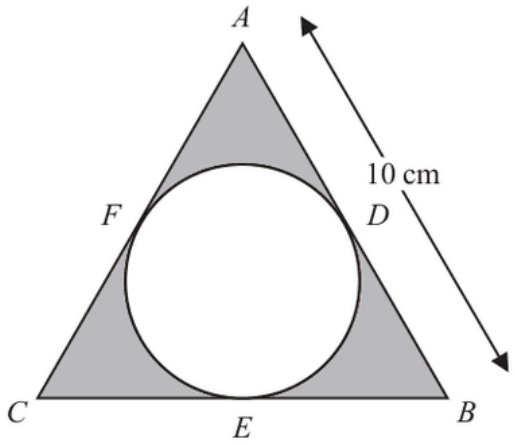


Diagram **NOT** accurately drawn

D, E and F are points on the circle.

ADB, BEC and CFA are tangents to the circle.

Calculate the total area of the regions shown shaded in the diagram.
Give your answer correct to 3 significant figures.

..... cm^2

(Total for Question 20 is 4 marks)

Question 5

4 marks | Circles, Arcs & Sectors

5 The diagram shows the design for a badge, which will be made using wire.
The design is a circle inside a square $ABCD$

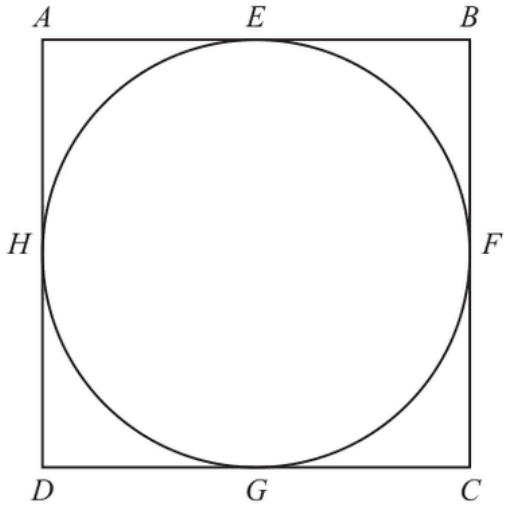


Diagram **NOT** accurately drawn

The circle touches the square at the points E, F, G and H

The area of the square is $81\ \text{cm}^2$

Calculate the total length of wire that will be needed to make the square and the circle.
Give your answer correct to 3 significant figures.

..... cm

(Total for Question 5 is 4 marks)

Question 13

3 marks | Circles, Arcs & Sectors

13 OAB is a sector of a circle with centre O and radius r cm.

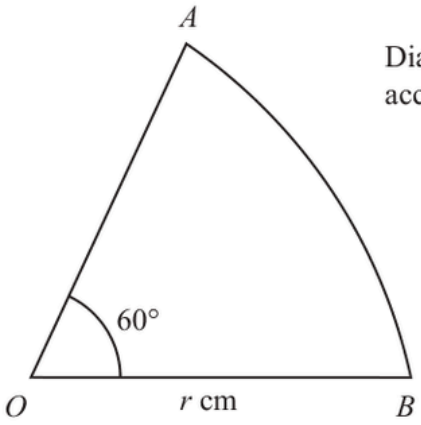


Diagram **NOT** accurately drawn

Angle $AOB = 60°$
The perimeter of the sector is P cm.

Find a formula for P in terms of r
Give your answer in the form $P = r(c\pi + k)$ where c and k are values to be found.

(Total for Question 13 is 3 marks)

Question 20

4 marks | Circles, Arcs & Sectors

20 The diagram shows a sector $OABC$ of a circle centre O

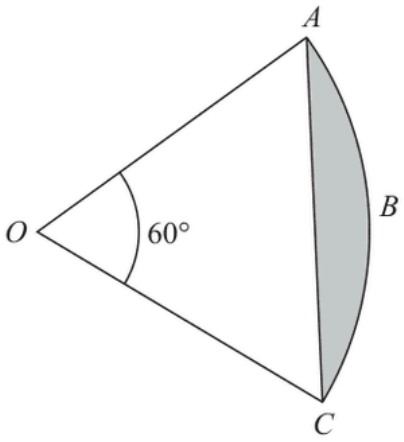


Diagram **NOT** accurately drawn

Angle $AOC = 60°$

The area of the shaded segment ABC is $38\,cm^2$

Work out the perimeter of the shaded segment ABC
Give your answer correct to one decimal place.

..... cm

(Total for Question 20 is 4 marks)

Question 21

5 marks | Circles, Arcs & Sectors

21 The diagram shows a square $ABCD$ and a circle.

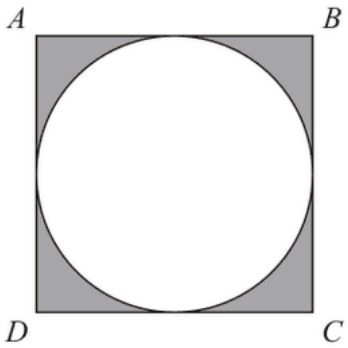


Diagram **NOT** accurately drawn

The sides of the square are tangents to the circle.

The total area of the shaded regions is $80\,\text{cm}^2$

Work out the length of AC
Give your answer correct to 3 significant figures.

..... cm

(Total for Question 21 is 5 marks)

Question 16

4 marks | Circles, Arcs & Sectors

16 $OAPB$ is a sector of a circle, centre O

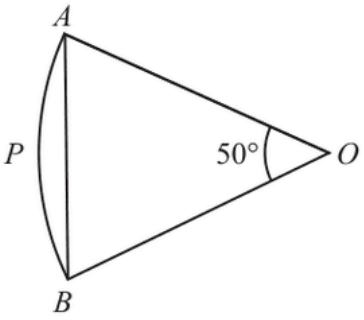


Diagram **NOT** accurately drawn

Angle $AOB = 50°$

Area of triangle $OAB = 120\ \text{cm}^2$

Work out the area of the sector $OAPB$
Give your answer correct to 3 significant figures.

..... cm^2

(Total for Question 16 is 4 marks)

Question 25

5 marks | Circles, Arcs & Sectors

25 The diagram shows an equilateral triangle ABC and a circle with centre O

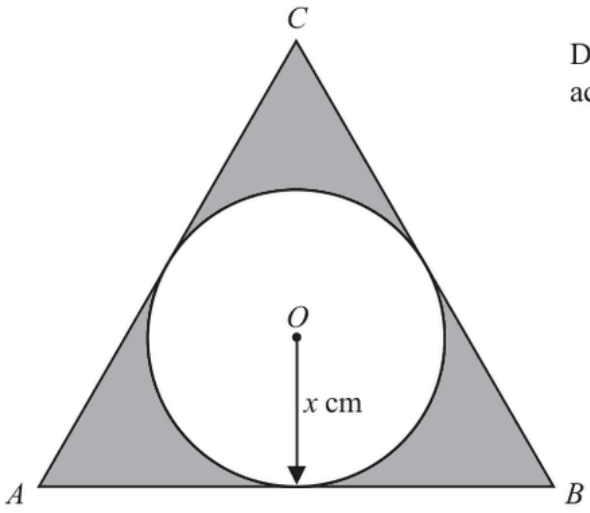


Diagram **NOT** accurately drawn

AB, BC and CA are tangents to the circle.

The radius of the circle is x cm

The total area, in cm^2, of the regions shown shaded in the diagram is nx^2

Find the value of n
Give your answer correct to 3 significant figures.

$n =$ .....

(Total for Question 25 is 5 marks)

Question 11

2 marks | Circles, Arcs & Sectors

11 $OABC$ is a sector of a circle, centre O

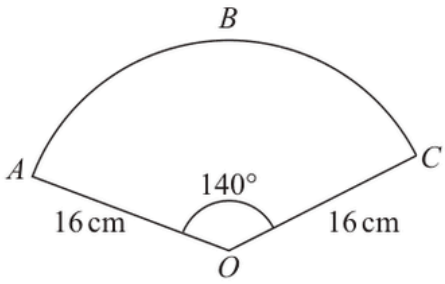


Diagram **NOT** accurately drawn

angle $AOC = 140°$
$OA = OC = 16\,\text{cm}$

Calculate the area of the sector.
Give your answer correct to 3 significant figures.

..... cm^2

(Total for Question 11 is 2 marks)

Question 14

4 marks | Circles, Arcs & Sectors

14 The diagram shows sector OAB of a circle, centre O

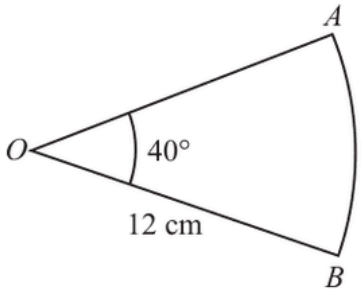


Diagram **NOT** accurately drawn

$OA = OB = 12$ cm angle $AOB = 40°$

(a) Work out the area of the sector.
Give your answer correct to 3 significant figures.

..... cm^2

(2)

The diagram shows triangle XYZ

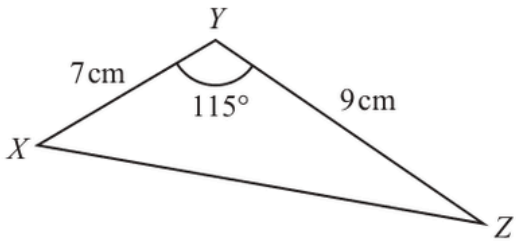


Diagram **NOT** accurately drawn

$XY = 7$ cm $YZ = 9$ cm angle $XYZ = 115°$

(b) Work out the area of the triangle.
Give your answer correct to 3 significant figures.

..... cm^2

(2)

(Total for Question 14 is 4 marks)

Question 22

6 marks | Circles, Arcs & Sectors

22

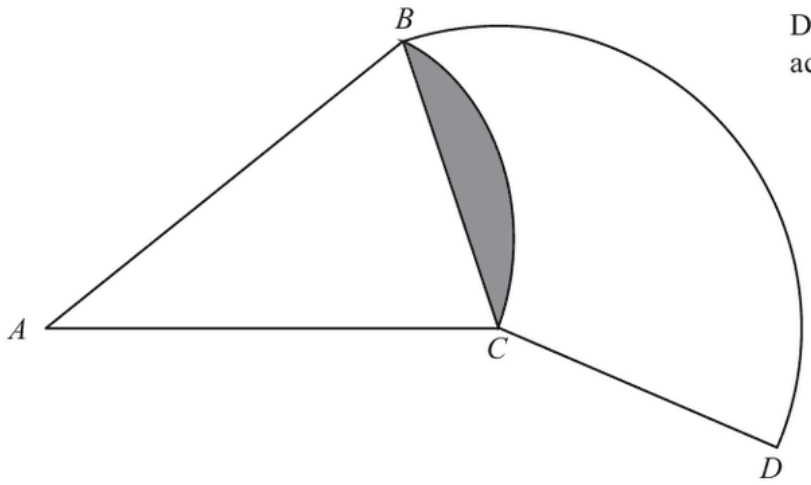


Diagram **NOT** accurately drawn

BAC is a sector of a circle, centre *A*

BCD is a sector of a circle, centre *C*

Angle *BAC* = 40°
Angle *BCD* = 130°
Area of shaded segment = 28 cm^2

Find the length of the arc *BD*
Give your answer correct to 3 significant figures.

..... cm

(Total for Question 22 is 6 marks)

Question 25

6 marks | Circles, Arcs & Sectors

25

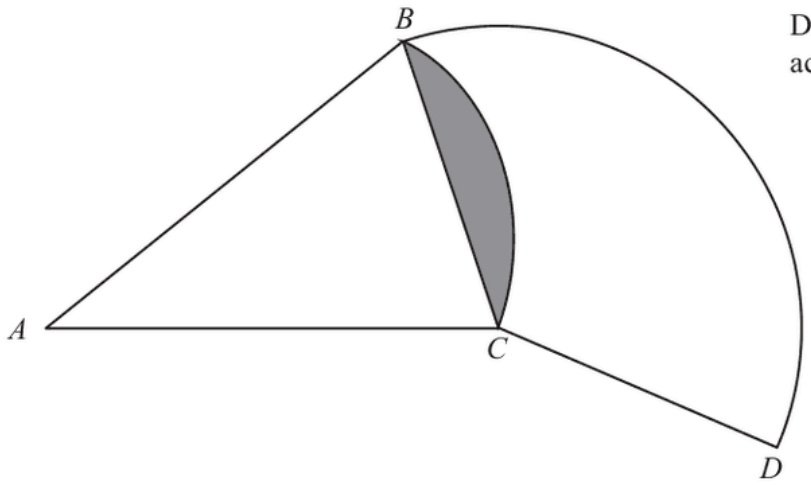


Diagram **NOT** accurately drawn

BAC is a sector of a circle, centre *A*

BCD is a sector of a circle, centre *C*

Angle *BAC* = 40°
Angle *BCD* = 130°
Area of shaded segment = 28 cm^2

Find the length of the arc *BD*
Give your answer correct to 3 significant figures.

..... cm

(Total for Question 25 is 6 marks)

Question 6

5 marks | Circles, Arcs & Sectors

6 A large circle with centre O contains 3 identical small circles.
Each circle touches two other circles.

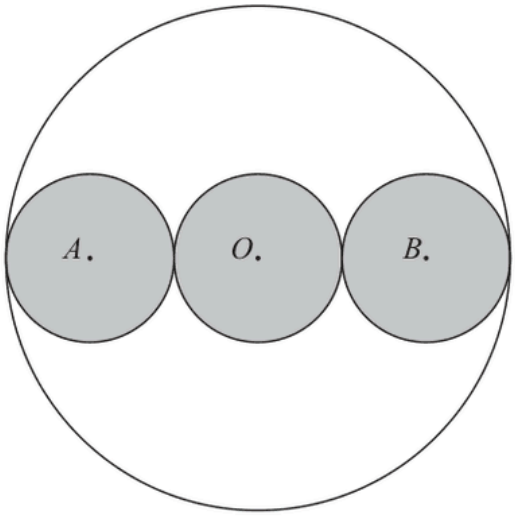


Diagram **NOT** accurately drawn

A, O and B are the centres of the small circles.
AOB is a straight line.

The circumference of the large circle is 160 cm

Work out the area of one small circle.
Give your answer correct to 3 significant figures.

..... cm^2

(Total for Question 6 is 5 marks)

Question 14

2 marks | Circles, Arcs & Sectors

14 AOB is a sector of a circle with centre O and radius 12 cm

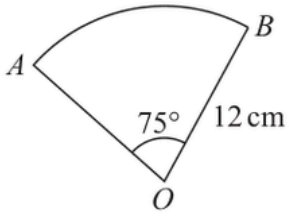


Diagram **NOT** accurately drawn

Work out the area of the sector.
Give your answer correct to 3 significant figures.

..... cm^2

(Total for Question 14 is 2 marks)

Question 15

2 marks | Circles, Arcs & Sectors

15 AOB is a sector of a circle with centre O and radius 12 cm

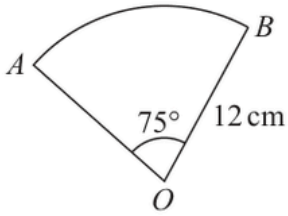


Diagram **NOT** accurately drawn

Work out the area of the sector.
Give your answer correct to 3 significant figures.

..... cm^2

(Total for Question 15 is 2 marks)

Question 15

4 marks | Circles, Arcs & Sectors

15 The diagram shows a sector $OABC$ of a circle, centre O

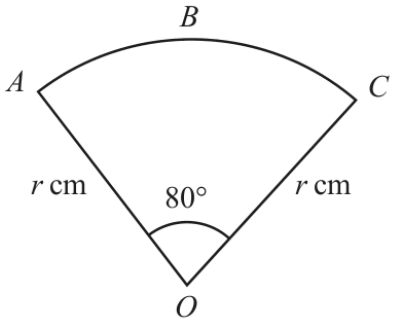


Diagram **NOT** accurately drawn

$OA = OC = r$ cm angle $AOC = 80^\circ$

The area of the sector $OABC$ is 32π cm^2

Work out the perimeter of the sector $OABC$
Give your answer correct to one decimal place.

..... cm

(Total for Question 15 is 4 marks)

Question 23

6 marks | Circles, Arcs & Sectors

23 OPQ and OAB are sectors of a circle, centre O

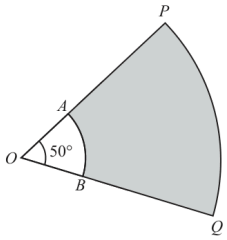


Diagram **NOT** accurately drawn

Angle $POQ = 50°$

A is the point on OP such that $OA = \frac{1}{4}OP$

The area of the shaded region is $\frac{243}{16}\pi\ \text{cm}^2$

Work out the perimeter of the shaded region.
Give your answer in the form $a\pi + b$ where a and b are constants.
Show your working clearly.

.....cm

(Total for Question 23 is 6 marks)

TOPIC

Volume & Surface Area

Every past-paper question on this topic, 2020 to 2026.

Question 22

5 marks | Volume & Surface Area

22 A solid is made from a cone and a hemisphere.

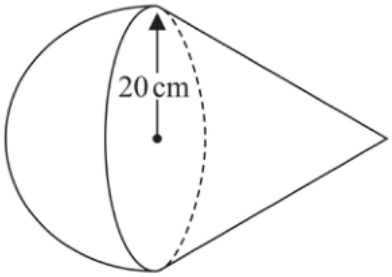


Diagram **NOT** accurately drawn

The circular plane face of the hemisphere coincides with the circular base of the cone.
The radius of the hemisphere and the radius of the circular base of the cone are both 20 cm

The curved surface area of the cone is $580\pi\,\text{cm}^2$

The volume of the solid is $k\pi\,\text{cm}^3$

Work out the exact value of k

$k =$ .....

(Total for Question 22 is 5 marks)

Question 13

3 marks | Volume & Surface Area

13

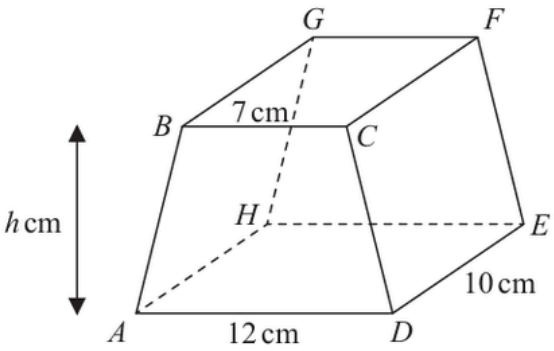


Diagram **NOT** accurately drawn

The diagram shows a prism $ABCDEFGH$ in which $ABCD$ is a trapezium with BC parallel to AD and $CDEF$ is a rectangle.

$BC = 7\,\text{cm}$ $AD = 12\,\text{cm}$ $DE = 10\,\text{cm}$

The height of trapezium $ABCD$ is $h\,\text{cm}$
The volume of the prism is $608\,\text{cm}^3$

Work out the value of h.

$h =$ .....

(Total for Question 13 is 3 marks)

Question 26

6 marks | Volume & Surface Area

26 Here is a sector, AOB, of a circle with centre O and angle $AOB = x°$

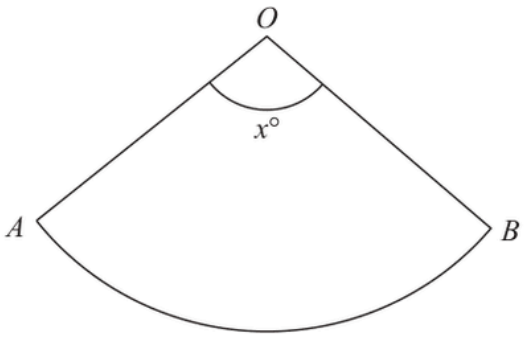


Diagram **NOT** accurately drawn

The sector can form the curved surface of a cone by joining OA to OB.

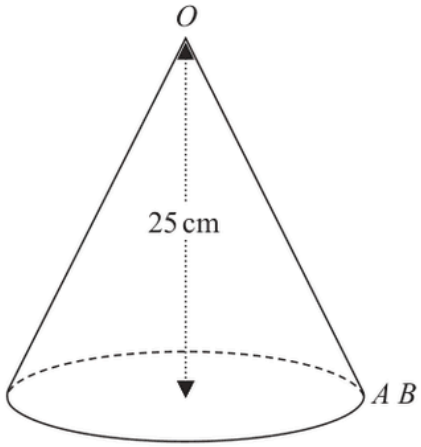


Diagram **NOT** accurately drawn

The height of the cone is 25 cm.
The volume of the cone is 1600 cm^3

Work out the value of x.
Give your answer correct to the nearest whole number.

$x =$ .....

(Total for Question 26 is 6 marks)

Question 3

4 marks | Volume & Surface Area

3 The diagram shows a container for water in the shape of a prism.

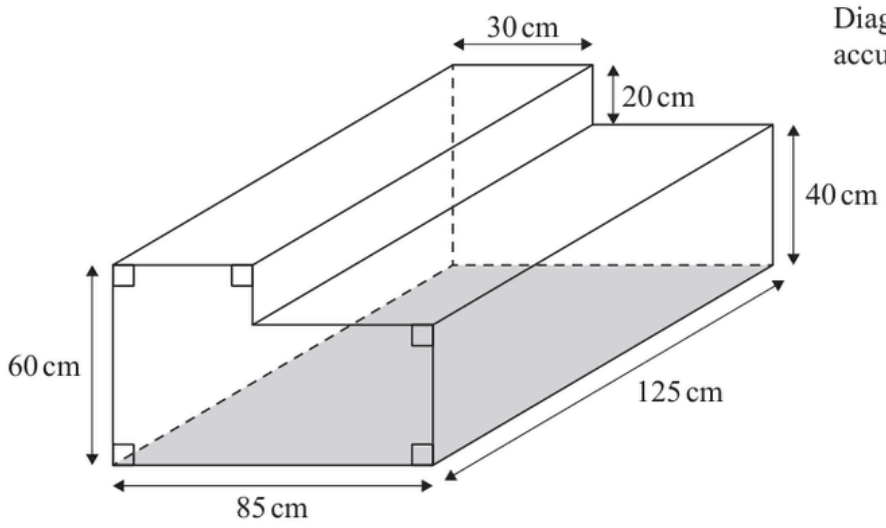


Diagram **NOT** accurately drawn

The rectangular base of the prism, shown shaded in the diagram, is horizontal.
The container is completely full of water.

Tuah is going to use a pump to empty the water from the container so that the volume of water in the container decreases at a constant rate.

The pump starts to empty water from the container at 10 30 and at 12 00 the water level in the container has dropped by 20 cm.

Find the time at which all the water has been pumped out of the container.

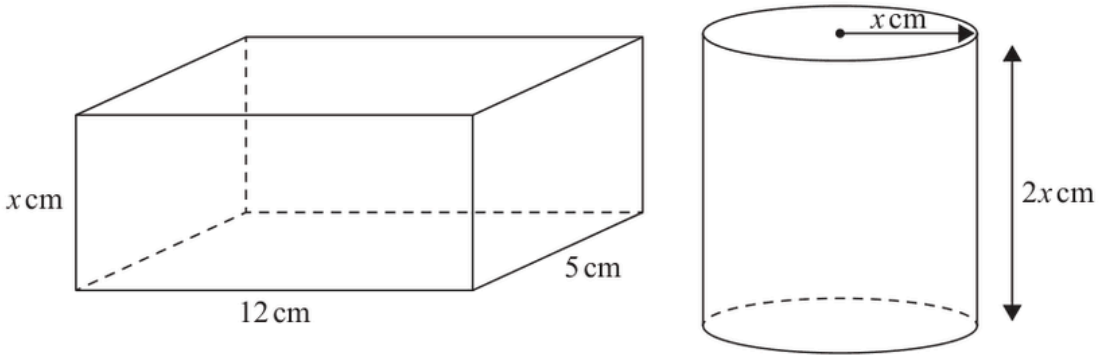
(Total for Question 3 is 4 marks)

Question 5

4 marks | Volume & Surface Area

5 The diagram shows a cuboid and a cylinder.

Diagram **NOT** accurately drawn



The dimensions of the cuboid are x cm by 12 cm by 5 cm.
The volume of the cuboid is 270 cm^3

The radius of the cylinder is x cm.
The height of the cylinder is $2x$ cm.

(a) Work out the volume of the cylinder.
Give your answer correct to the nearest whole number.

..... cm^3

(3)

(b) Change 1 m^3 to cm^3

..... cm^3

(1)

(Total for Question 5 is 4 marks)

Question 17

7 marks | Volume & Surface Area

17 The diagram shows a solid prism *ABCDEFGH*.

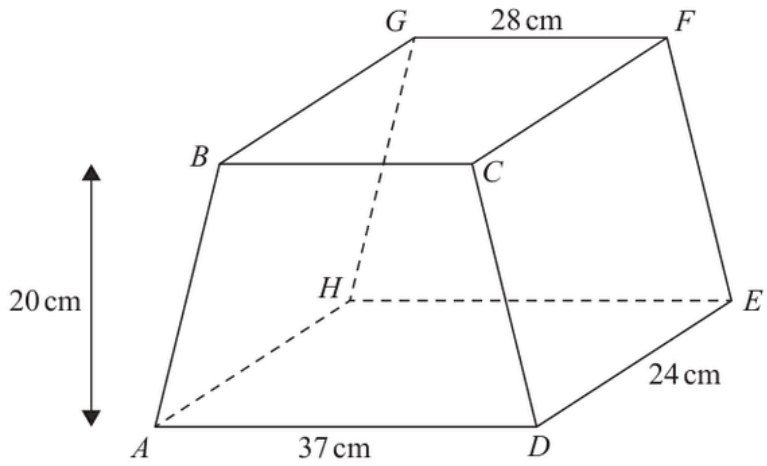


Diagram **NOT** accurately drawn

The trapezium *ABCD*, in which *AD* is parallel to *BC*, is a cross section of the prism.
The base *ADEH* of the prism is a horizontal plane.
ADEH and *BCFG* are rectangles.
The midpoint of *BC* is vertically above the midpoint of *AD* so that $BA = CD$.

$AD = 37$ cm $GF = 28$ cm $DE = 24$ cm

The perpendicular distance between edges *AD* and *BC* is 20 cm.

(a) Work out the total surface area of the prism.

..... cm^2

(4)

(b) Calculate the size of the angle between *AF* and the plane *ADEH*.
Give your answer correct to one decimal place.

.....°

(3)

(Total for Question 17 is 7 marks)

Question 10

5 marks | Volume & Surface Area

10 Here is a triangular prism.

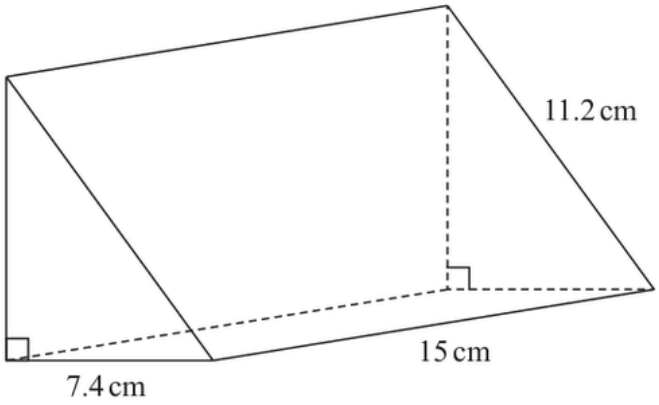


Diagram **NOT** accurately drawn

Work out the volume of the prism.
Give your answer correct to 3 significant figures.

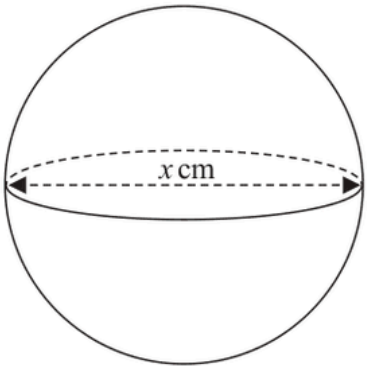
..... cm^3

(Total for Question 10 is 5 marks)

Question 22

6 marks | Volume & Surface Area

22 The diagram shows a sphere of diameter x cm and a pyramid $ABCDE$ with a horizontal rectangular base $BCDE$.



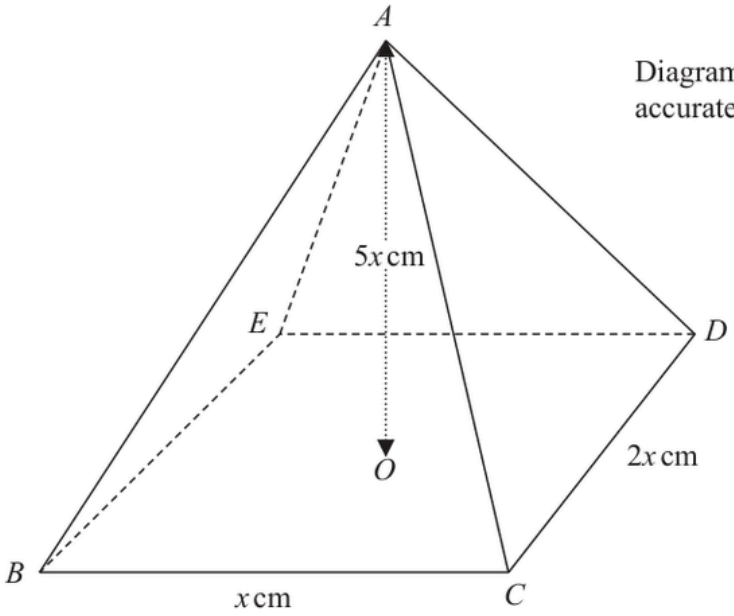


Diagram **NOT** accurately drawn

The vertex A of the pyramid is vertically above the centre O of the base so that $AB = AC = AD = AE$.

$BC = x$ cm, $CD = 2x$ cm and $AO = 5x$ cm.

The volume of the sphere is 288π cm^3

Calculate the total surface area of the pyramid.
Give your answer correct to the nearest cm^2

..... cm^2

(Total for Question 22 is 6 marks)

Question 10

6 marks | Volume & Surface Area

10 Jonty has a storage container in the shape of a cuboid, as shown in the diagram.

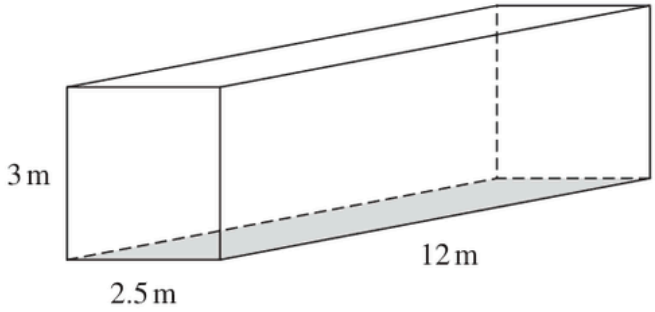


Diagram **NOT** accurately drawn

Jonty is going to paint the outside of his storage container, apart from the base which is shown shaded in the diagram.
He needs enough paint to cover the four sides and the top.

Each tin of paint covers an area of $15\,m^2$

The cost of each tin of paint recently increased by 10%
After the increase, the cost of each tin of paint is £26.95

Jonty says

"**Before** the increase, I could have bought enough paint for less than £200"

Show that Jonty is correct.
Show your working clearly.

(Total for Question 10 is 6 marks)

Question 22

5 marks | Volume & Surface Area

22 A solid is made from a cone and a hemisphere.

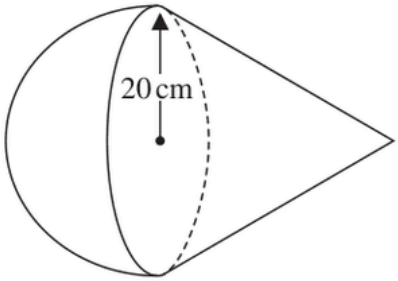


Diagram **NOT** accurately drawn

The circular plane face of the hemisphere coincides with the circular base of the cone.
The radius of the hemisphere and the radius of the circular base of the cone are both 20 cm.

The curved surface area of the cone is $580\pi \text{ cm}^2$

The volume of the solid is $k\pi \text{ cm}^3$

Work out the exact value of k

$k =$ .....

(Total for Question 22 is 5 marks)

Question 9

6 marks | Volume & Surface Area

9 The diagram shows a rectangular sheet of metal $ABCD$

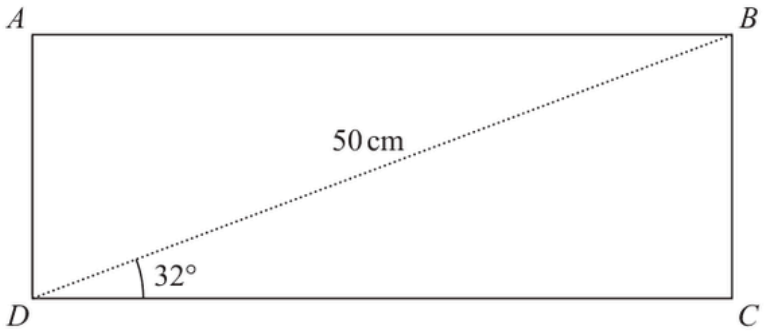


Diagram **NOT** accurately drawn

$BD = 50\,\text{cm}$ and angle $BDC = 32°$

Nasser joins side AD to side BC to form a cylinder.

BC is the height of the cylinder.
DC is the circumference of the cross section of the cylinder.

Work out the volume, in cm^3, of the cylinder.
Give your answer correct to 3 significant figures.

..... cm^3

(Total for Question 9 is 6 marks)

Question 24

5 marks | Volume & Surface Area

24 The surface area of sphere **A** is nine times the surface area of sphere **B**
The difference between the volume of sphere **A** and the volume of sphere **B** is 117π cm^3

Find the radius of the smaller sphere.
Show your working clearly.

..... cm

(Total for Question 24 is 5 marks)

Question 21

5 marks | Volume & Surface Area

21 Here is a triangular prism $ABCDEF$

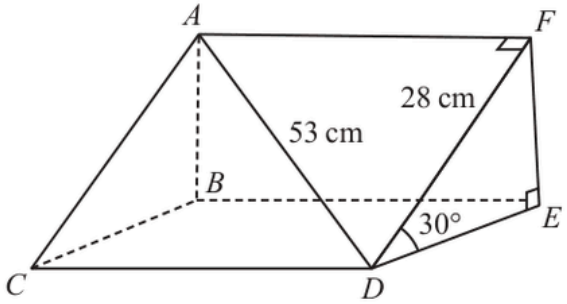


Diagram **NOT** accurately drawn

$AD = 53$ cm
$DF = 28$ cm
Angle $FDE = 30°$

Work out the volume of the triangular prism.
Give your answer correct to the nearest whole number.

..... cm^3

(Total for Question 21 is 5 marks)

Question 23

5 marks | Volume & Surface Area

23 A solid shape is made by removing a hemisphere, shown shaded, from a cone as shown in the diagram.

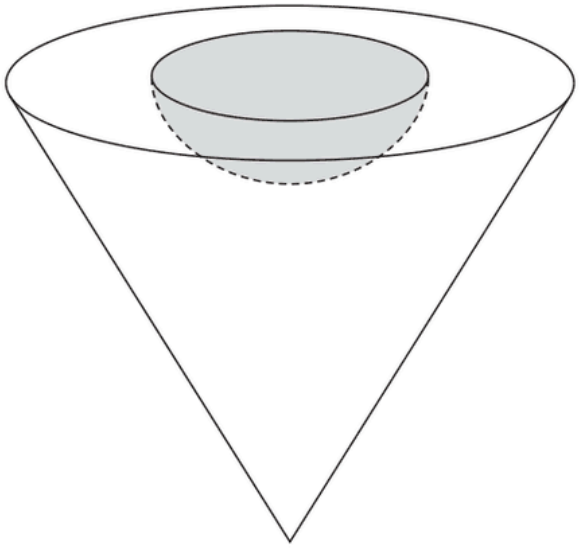


Diagram **NOT** accurately drawn

The radius of the hemisphere is $2x$ cm
The radius of the base of the cone is $5x$ cm
The vertical height of the cone is $6x$ cm

The volume of the solid shape is 6948π cm^3

Work out the **total** surface area of the solid hemisphere that has been removed from the cone.
Give your answer correct to the nearest integer.

..... cm^2

(Total for Question 23 is 5 marks)

Question 5

4 marks | Volume & Surface Area

5 The diagram shows a cylinder.

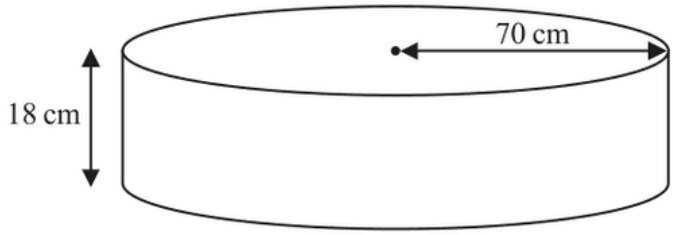


Diagram **NOT** accurately drawn

The radius of the cylinder is 70 cm
The height of the cylinder is 18 cm

Work out the volume of the cylinder.
Give your answer in litres correct to the nearest litre.

..... litres

(Total for Question 5 is 4 marks)

Question 6

3 marks | Volume & Surface Area

6 The diagram shows a solid triangular prism.

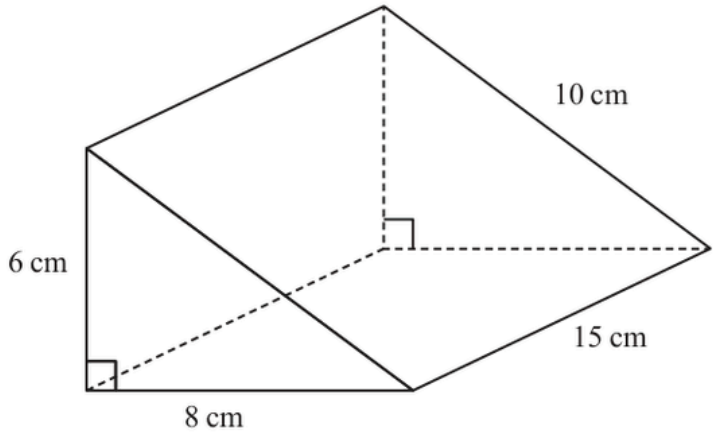


Diagram **NOT** accurately drawn

Work out the **total** surface area of the triangular prism.

..... cm^2

(Total for Question 6 is 3 marks)

Question 22

3 marks | Volume & Surface Area

22 The diagram shows a bowl in the shape of a hemisphere.
The bowl is made from metal.

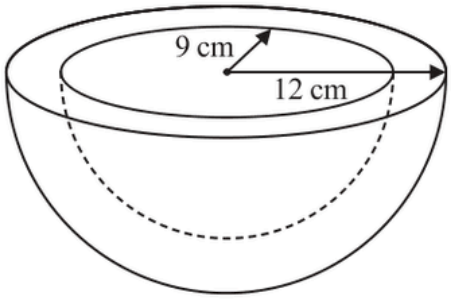


Diagram **NOT** accurately drawn

The outer radius of the bowl is 12 cm
The inner radius of the bowl is 9 cm

The thickness of the bowl is uniform.

Work out the volume of the metal.
Give your answer correct to the nearest whole number.

..... cm^3

(Total for Question 22 is 3 marks)

Question 2

3 marks | Volume & Surface Area

2 The diagram shows a solid prism with a cross section in the shape of a trapezium.

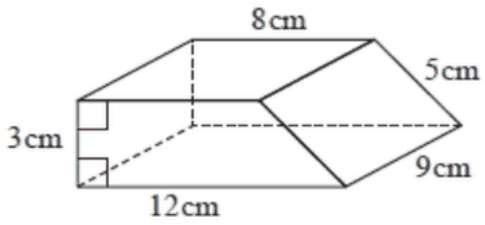


Diagram **NOT** accurately drawn

Work out the total surface area of the prism.

..... cm^2

(Total for Question 2 is 3 marks)

Question 7

3 marks | Volume & Surface Area

7 Here is a solid cylinder.

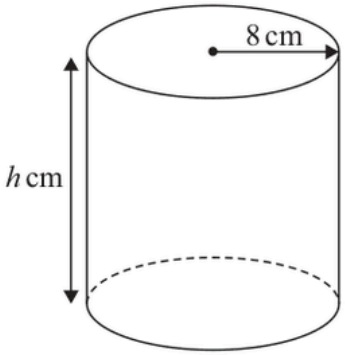


Diagram **NOT** accurately drawn

The radius of the cylinder is 8 cm
The height of the cylinder is h cm

The volume of the cylinder is $3892\,\text{cm}^3$

Work out the value of h
Give your answer correct to one decimal place.

$h =$ .....

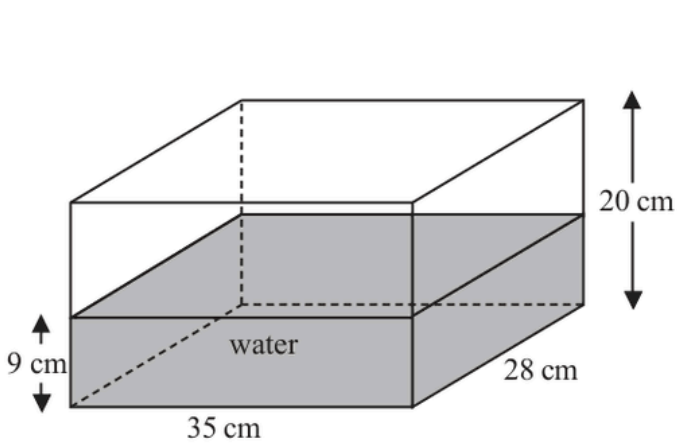
(Total for Question 7 is 3 marks)

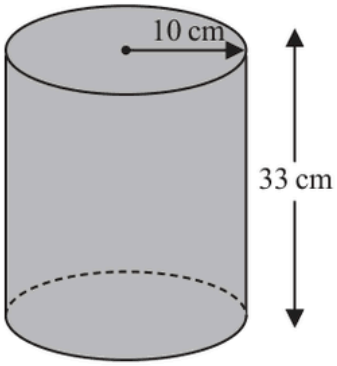
Question 10

3 marks | Volume & Surface Area

10 The diagram shows two water containers.
One is a cuboid and one is a cylinder.

Diagram **NOT** accurately drawn





The cuboid measures 35 cm by 28 cm by 20 cm
The surface of the water in the cuboid is 9 cm above the base of the cuboid.

The cylinder has a radius of 10 cm and a height of 33 cm
The cylinder is completely full of water.

Izzy is going to pour all the water from the cylinder into the cuboid.

Show that the cuboid will not be completely full of water.

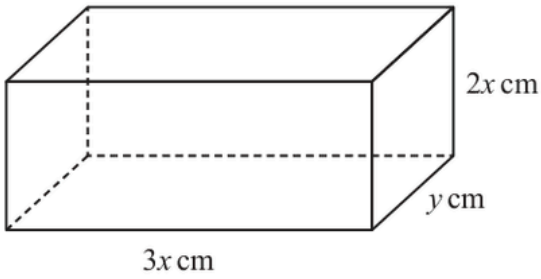
(Total for Question 10 is 3 marks)

Question 21

3 marks | Volume & Surface Area

21 The diagram shows a cuboid.

Diagram **NOT** accurately drawn



The cuboid measures $3x$ cm by $2x$ cm by y cm

The volume of the cuboid is $1014\,\text{cm}^3$
The total surface area of the cuboid is $A\,\text{cm}^2$

Show that $A = 12x^2 + \frac{1690}{x}$

You must show all the stages of your working.

(Total for Question 21 is 3 marks)

Question 21

5 marks | Volume & Surface Area

21 The diagram shows a solid cuboid.

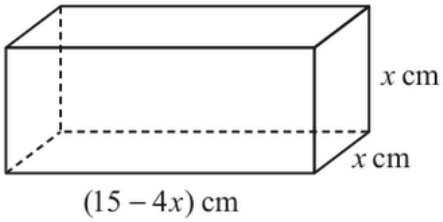


Diagram **NOT** accurately drawn

The volume of the cuboid is V cm^3

Find the maximum value of V

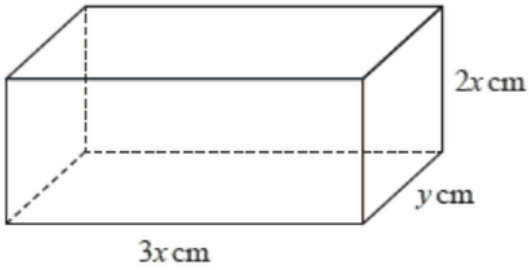
(Total for Question 21 is 5 marks)

Question 23

3 marks | Volume & Surface Area

23 The diagram shows a cuboid.

Diagram **NOT** accurately drawn



The cuboid measures $3x$ cm by $2x$ cm by y cm

The volume of the cuboid is 1014 cm^3
The total surface area of the cuboid is A cm^2

Show that $A = 12x^2 + \frac{1690}{x}$

You must show all the stages of your working.

(Total for Question 23 is 3 marks)

Question 25

5 marks | Volume & Surface Area

25 The diagram shows a solid hemisphere, H

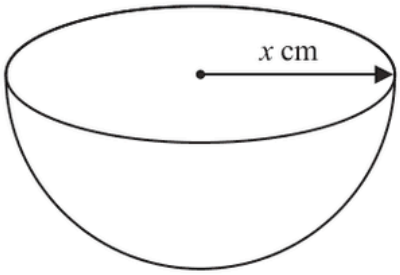


Diagram **NOT** accurately drawn

The radius of H is x cm
The volume of H is 6174π cm^3

A bowl is made by removing a solid hemisphere from H such that the uniform thickness of the bowl is 2 cm

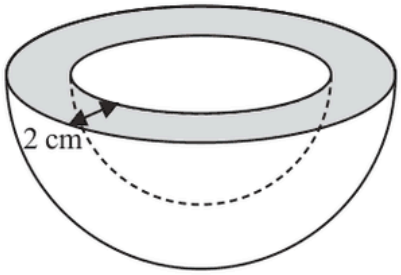


Diagram **NOT** accurately drawn

Work out the **total** surface area of the bowl.
Give your answer in terms of π

..... cm^2

(Total for Question 25 is 5 marks)

Question 26

5 marks | Volume & Surface Area

26 The diagram shows a solid hemisphere, H

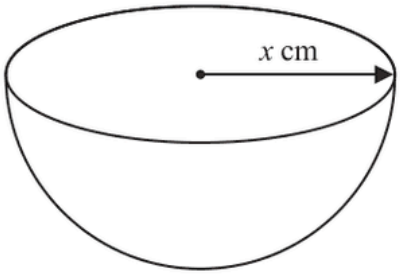


Diagram **NOT** accurately drawn

The radius of H is x cm
The volume of H is 6174π cm^3

A bowl is made by removing a solid hemisphere from H such that the uniform thickness of the bowl is 2 cm

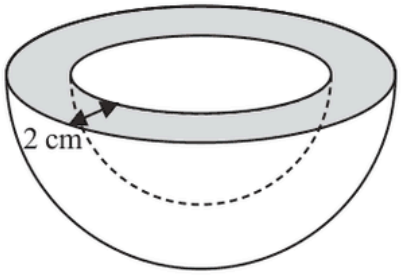


Diagram **NOT** accurately drawn

Work out the **total** surface area of the bowl.
Give your answer in terms of π

..... cm^2

(Total for Question 26 is 5 marks)

Question 19

2 marks | Volume & Surface Area

19 A sphere has a diameter of 24 cm

Find the surface area of the sphere.
Give your answer correct to 3 significant figures.

..... cm^2

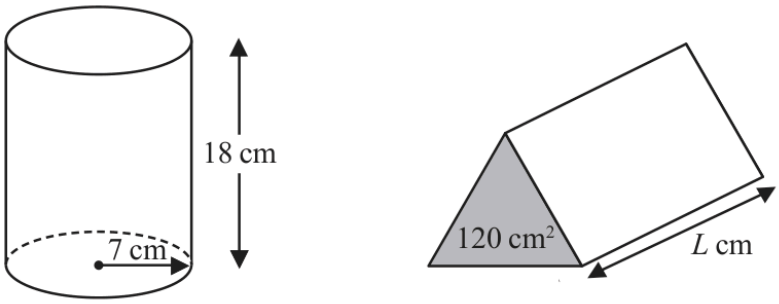
(Total for Question 19 is 2 marks)

Question 7

3 marks | Volume & Surface Area

7 The diagram shows a cylinder and a prism.

Diagram **NOT** accurately drawn



The radius of the cylinder is 7 cm
The height of the cylinder is 18 cm

The area of the cross section of the prism, shown shaded in the diagram, is $120\ \text{cm}^2$
The length of the prism is L cm

The volume of the cylinder is equal to the volume of the prism.

Work out the value of L
Give your answer correct to 3 significant figures.

$L =$ .....

(Total for Question 7 is 3 marks)

Question 11

4 marks | Volume & Surface Area

11 Here is a solid cylinder.

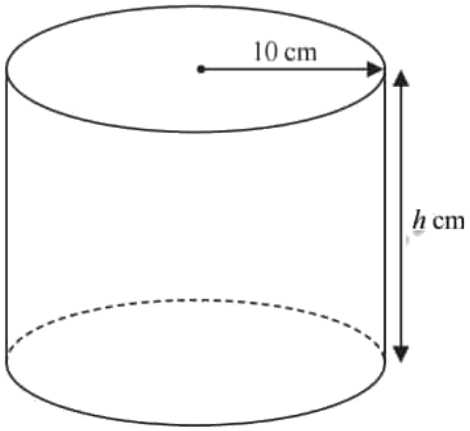


Diagram **NOT** accurately drawn

The radius of the cylinder is 10 cm
The height of the cylinder is h cm

The volume of the cylinder is 5341 cm^3

Work out the **total** surface area of the cylinder.
Give your answer correct to the nearest whole number.

..... cm^2

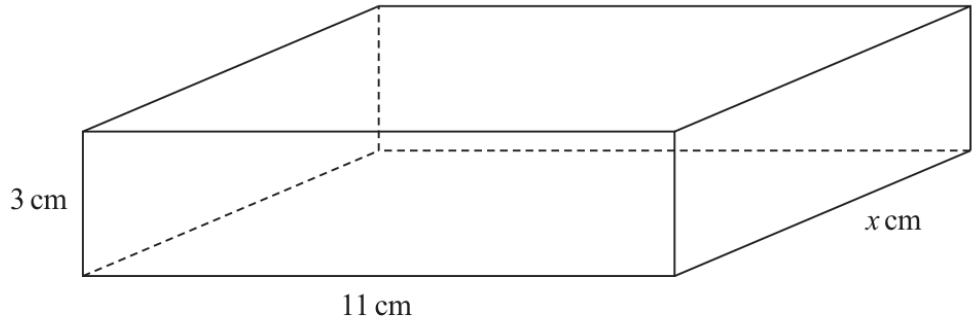
(Total for Question 11 is 4 marks)

Question 11

4 marks | Volume & Surface Area

11 The diagram shows a solid cuboid.

Diagram **NOT** accurately drawn



The cuboid measures 3 cm by 11 cm by x cm

The volume of the cuboid is 264 cm^3

Work out the total surface area of the cuboid.

..... cm^2

(Total for Question 11 is 4 marks)

Question 20

5 marks | Volume & Surface Area

20 The diagram shows a solid shape.

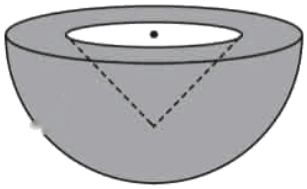


Diagram **NOT** accurately drawn

The solid shape is made by removing a cone from a hemisphere.

The radius of the cone is x cm
The height of the cone is x cm

The radius of the hemisphere is $2x$ cm

The volume of the solid shape is $\frac{3645}{8}\pi$ cm^3

Find the outer curved surface area of the solid shape.
Give your answer correct to the nearest whole number.

..... cm^2

(Total for Question 20 is 5 marks)

TOPIC

Right-Angled Triangles - Pythagoras & Trigonometry

Every past-paper question on this topic, 2020 to 2026.

Question 10

6 marks | Right-Angled Triangles - Pythagoras & Trigonometry

10 The diagram shows a quadrilateral $ABCD$

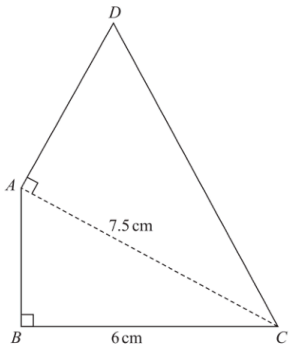


Diagram **NOT** accurately drawn

In the diagram, ABC and DAC are right-angled triangles.

$BC = 6$ cm $\quad AC = 7.5$ cm

The area of quadrilateral $ABCD$ is $31.5\,\text{cm}^2$

(a) Work out the length of AB

..... cm

(2)

(b) Work out the length of AD

..... cm

(4)

(Total for Question 10 is 6 marks)

Question 4

3 marks

Right-Angled Triangles - Pythagoras & Trigonometry

4 The diagram shows a rectangle and a diagonal of the rectangle.

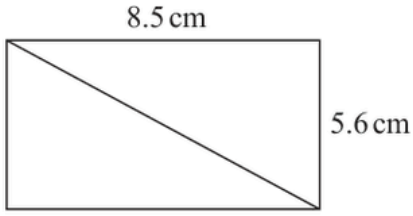


Diagram **NOT** accurately drawn

Work out the length of the diagonal of the rectangle.
Give your answer correct to 1 decimal place.

..... cm

(Total for Question 4 is 3 marks)

Question 9

3 marks

Right-Angled Triangles - Pythagoras & Trigonometry

9 Here is a right-angled triangle.

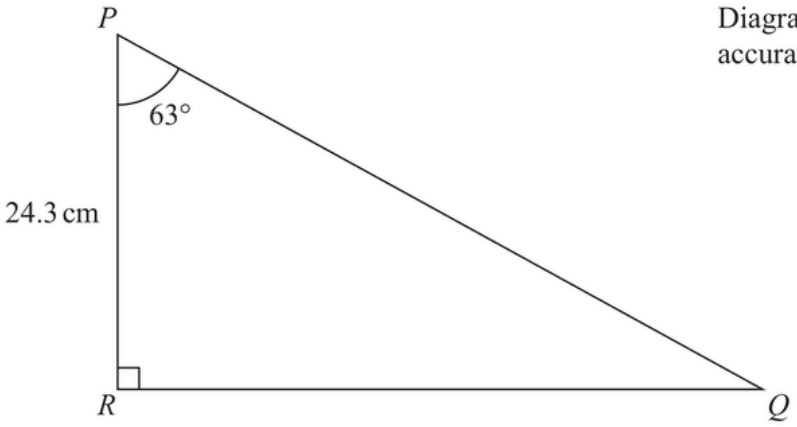


Diagram **NOT** accurately drawn

Calculate the length of PQ.
Give your answer correct to 3 significant figures.

..... cm

(Total for Question 9 is 3 marks)

Question 15

4 marks | Right-Angled Triangles - Pythagoras & Trigonometry

15 The diagram shows two right-angled triangles, *DEF* and *EFG*.

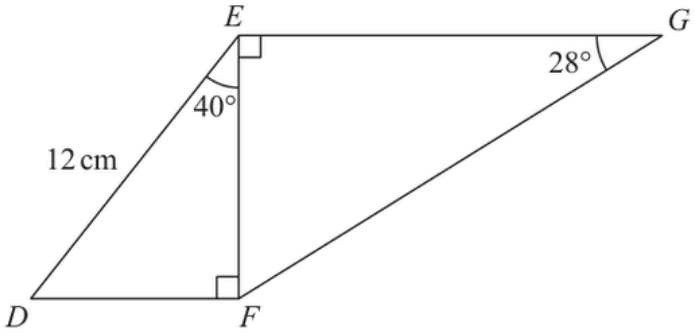


Diagram **NOT** accurately drawn

Work out the length of *EG*.
Give your answer correct to 3 significant figures.

..... cm

(Total for Question 15 is 4 marks)

Question 10

4 marks | Right-Angled Triangles - Pythagoras & Trigonometry

10 Here is isosceles triangle ABC.

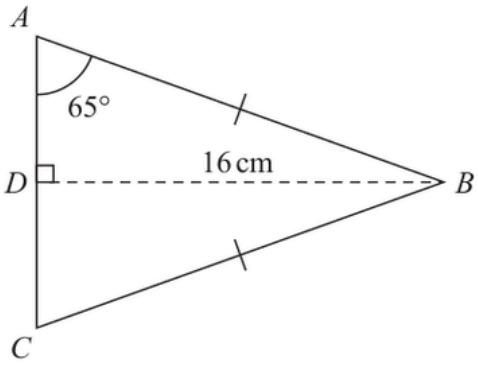


Diagram **NOT** accurately drawn

D is the midpoint of AC and $DB = 16$ cm.

Angle $DAB = 65°$

Work out the perimeter of triangle ABC.
Give your answer correct to one decimal place.

..... cm

(Total for Question 10 is 4 marks)

Question 13

3 marks | Right-Angled Triangles - Pythagoras & Trigonometry

13 The diagram shows two hot air balloons.
A is a point on the base of one of the balloons and B is a point on the base of the other balloon.

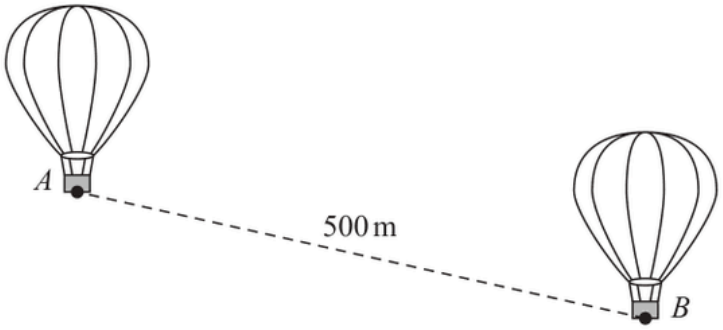


Diagram **NOT** accurately drawn

The distance between A and B is 500 metres.
The angle of depression of B from A is 23°

Calculate the vertical height of A above B.
Give your answer correct to one decimal place.

..... metres

(Total for Question 13 is 3 marks)

Question 7

3 marks

Right-Angled Triangles - Pythagoras & Trigonometry

7 Here is a right-angled triangle.

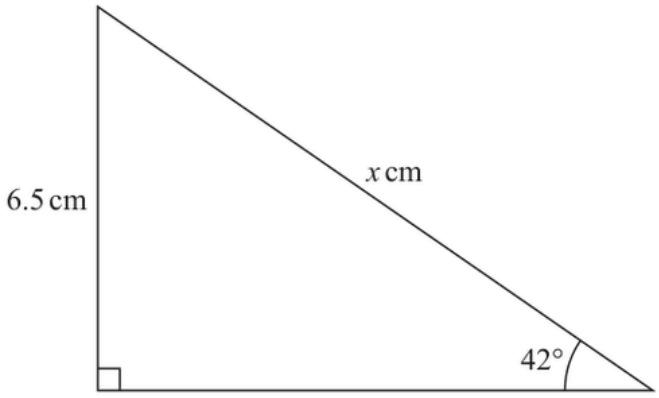


Diagram **NOT** accurately drawn

Work out the value of x.
Give your answer correct to one decimal place.

$x =$ .....

(Total for Question 7 is 3 marks)

Question 2

3 marks

Right-Angled Triangles - Pythagoras & Trigonometry

2 Here is a right-angled triangle.

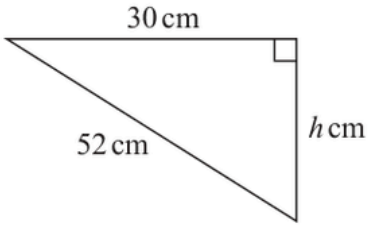


Diagram **NOT** accurately drawn

Calculate the value of h.
Give your answer correct to 3 significant figures.

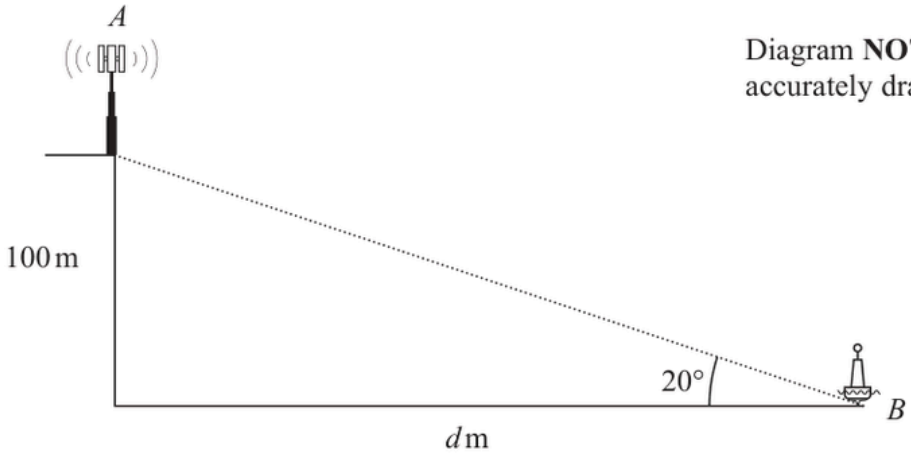
h = ...

(Total for Question 2 is 3 marks)

Question 12

6 marks | Right-Angled Triangles - Pythagoras & Trigonometry

12 The diagram shows a vertical cliff with a vertical radio mast on top of the cliff and a buoy in the sea.



The height of the cliff is 100 metres.
The buoy is at the point B that is d metres from the base of the cliff.
The angle of elevation from B to the top of the cliff is 20°

(a) Calculate the value of d.
Give your answer correct to 3 significant figures.

$d =$ .....

(3)

The point A at the top of the radio mast is vertically above the top of the cliff.
The angle of elevation from B to A is 25°

(b) Calculate the height of the radio mast.
Give your answer correct to 3 significant figures.

..... m

(3)

(Total for Question 12 is 6 marks)

Question 3

3 marks | Right-Angled Triangles - Pythagoras & Trigonometry

3 The diagram shows triangle ABC

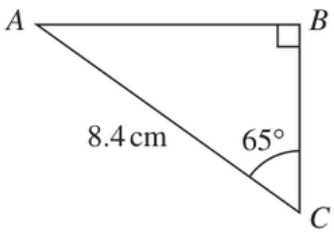


Diagram **NOT** accurately drawn

Work out the length of the side AB
Give your answer correct to 3 significant figures.

..... cm

(Total for Question 3 is 3 marks)

Question 3

4 marks | Right-Angled Triangles - Pythagoras & Trigonometry

3 The shaded shape is made using three identical right-angled triangles and a square.

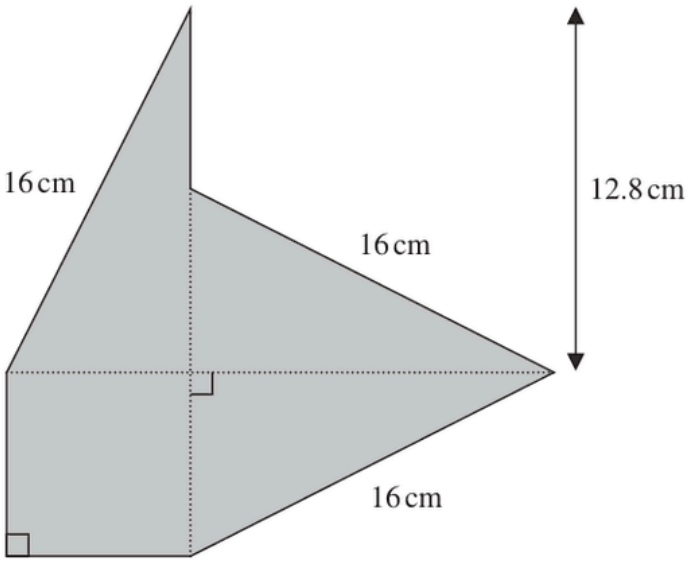


Diagram **NOT** accurately drawn

Work out the perimeter of the shaded shape.

..... cm

(Total for Question 3 is 4 marks)

Question 12

3 marks | Right-Angled Triangles - Pythagoras & Trigonometry

12 The diagram shows two vertical phone masts, AB and CD, on horizontal ground.

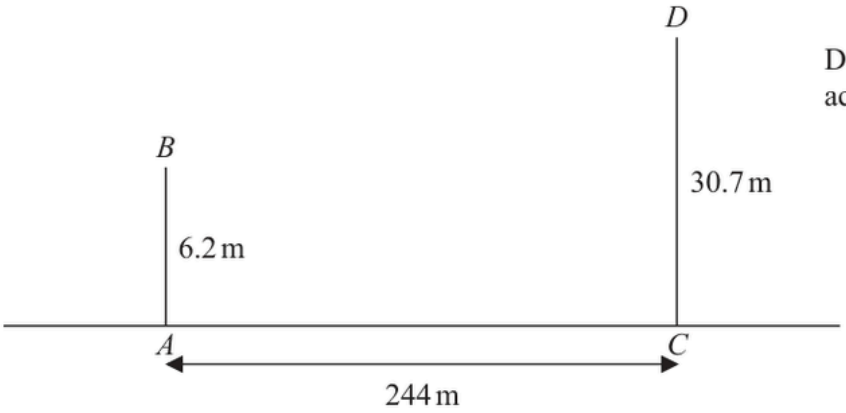


Diagram **NOT** accurately drawn

$AB = 6.2\,\text{m}$ $AC = 244\,\text{m}$ $CD = 30.7\,\text{m}$

Work out the size of the angle of depression of B from D
Give your answer correct to one decimal place.

.....°

(Total for Question 12 is 3 marks)

Question 14

3 marks | Right-Angled Triangles - Pythagoras & Trigonometry

14 A zip wire is shown as the dashed line AC in the diagram.

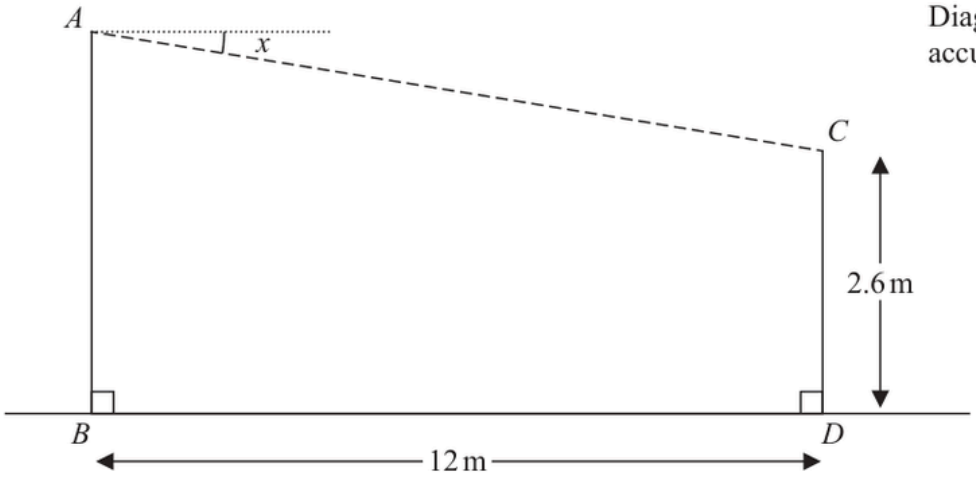


Diagram **NOT** accurately drawn

The zip wire is supported by two vertical posts AB and CD standing on horizontal ground.

$CD = 2.6\,\text{m}$ $BD = 12\,\text{m}$

The zip wire makes an angle x with the horizontal, as shown in the diagram.
The design of the zip wire requires the angle x to be at least $5°$

Work out the least possible height of the post AB
Give your answer correct to 3 significant figures.

..... m

(Total for Question 14 is 3 marks)

Question 6

3 marks | Right-Angled Triangles - Pythagoras & Trigonometry

6 The diagram shows triangle PQR.

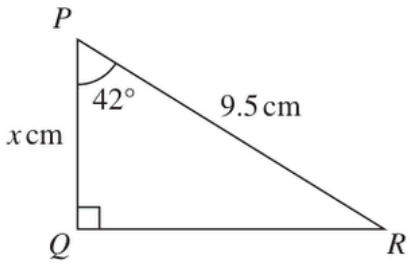


Diagram **NOT** accurately drawn

Work out the value of x
Give your answer correct to one decimal place.

$x =$ .....

(Total for Question 6 is 3 marks)

Question 10

5 marks | Right-Angled Triangles - Pythagoras & Trigonometry

10 The diagram shows triangle ABP inside the regular hexagon $ABCDEF$

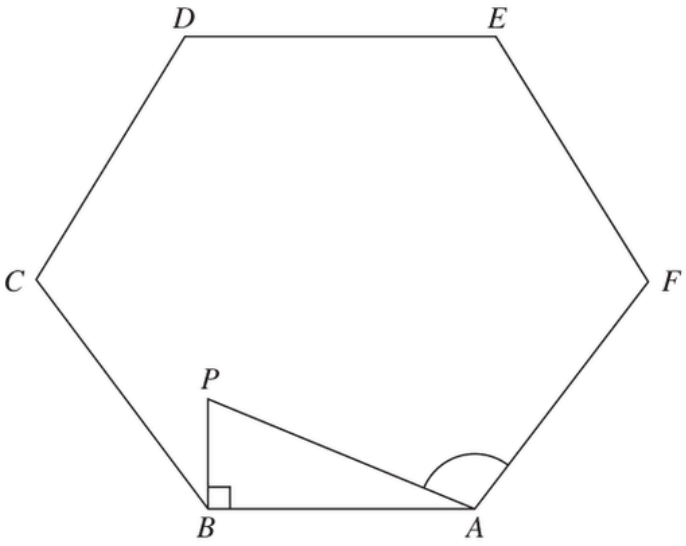


Diagram **NOT** accurately drawn

$AB = 5\,\text{cm}$ $BP = 2\,\text{cm}$ Angle $ABP = 90°$

Work out the size of angle PAF
Give your answer correct to 3 significant figures.

.....°

(Total for Question 10 is 5 marks)

Question 5

4 marks | Right-Angled Triangles - Pythagoras & Trigonometry

5 The diagram shows a shaded shape $AEBCD$ made by removing triangle AEB from rectangle $ABCD$

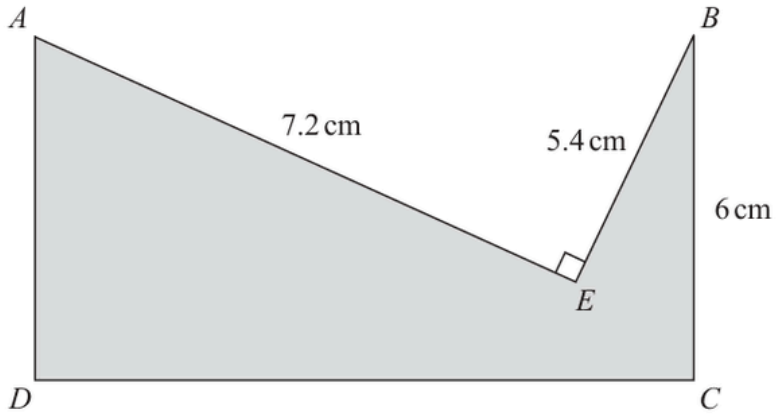


Diagram **NOT** accurately drawn

$AE = 7.2\,\text{cm}$ $BE = 5.4\,\text{cm}$ $BC = 6\,\text{cm}$ angle $AEB = 90°$

Work out the perimeter of the shaded shape.

..... cm

(Total for Question 5 is 4 marks)

Question 12

4 marks | Right-Angled Triangles - Pythagoras & Trigonometry

12 The diagram shows right-angled triangle ABD

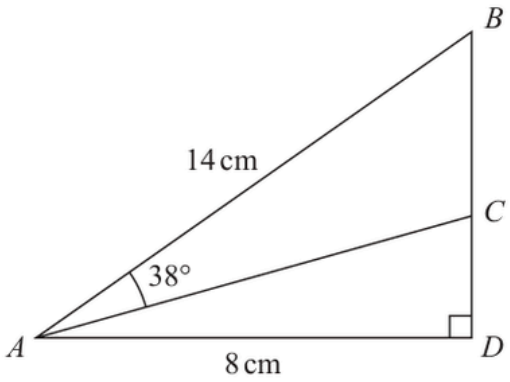


Diagram **NOT** accurately drawn

$AB = 14\,\text{cm}$ $AD = 8\,\text{cm}$

C is the point on BD such that angle $BAC = 38°$

Work out the length of CD
Give your answer correct to 3 significant figures.

..... cm

(Total for Question 12 is 4 marks)

Question 2

4 marks | Right-Angled Triangles - Pythagoras & Trigonometry

2 The diagram shows triangle ABC and triangle ECD

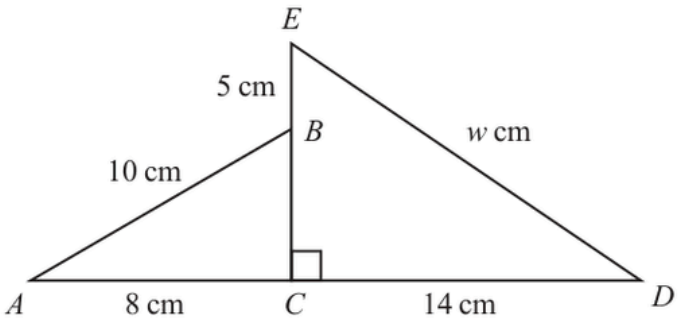


Diagram **NOT** accurately drawn

ACD and EBC are straight lines.

$AB = 10$ cm $\quad AC = 8$ cm $\quad EB = 5$ cm $\quad CD = 14$ cm $\quad ED = w$ cm

Work out the value of w
Give your answer correct to one decimal place.

$w =$ .....

(Total for Question 2 is 4 marks)

Question 10

5 marks | Right-Angled Triangles - Pythagoras & Trigonometry

10 Here is triangle ABC

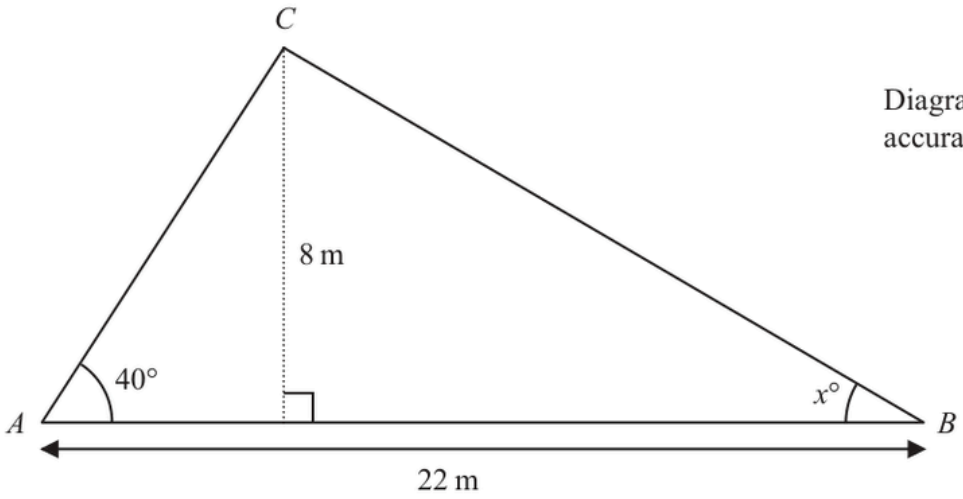


Diagram **NOT** accurately drawn

Work out the value of x
Give your answer correct to one decimal place.
Show your working clearly.

$x =$ .....

(Total for Question 10 is 5 marks)

Question 5

3 marks | Right-Angled Triangles - Pythagoras & Trigonometry

5 The diagram shows triangle ABC

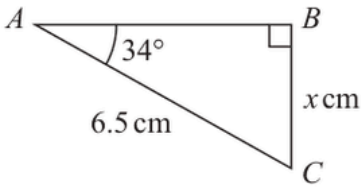


Diagram **NOT** accurately drawn

Work out the value of x
Give your answer correct to one decimal place.

$x =$ .....

(Total for Question 5 is 3 marks)

Question 11

4 marks | Right-Angled Triangles - Pythagoras & Trigonometry

11 The diagram shows a roof support.

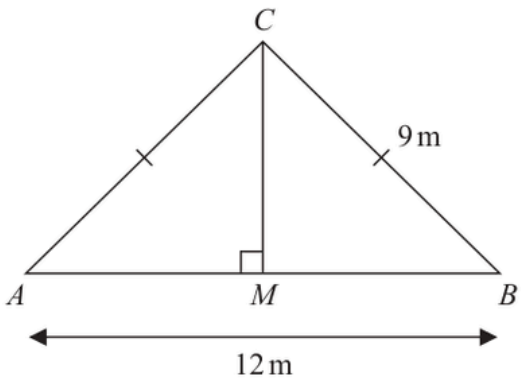


Diagram **NOT** accurately drawn

The roof support is made from four lengths of wood, AB, AC, BC and MC

$AC = BC = 9\,\text{m}$ $AB = 12\,\text{m}$

angle $AMC = 90°$

Lewis is going to buy lengths of wood to make the roof support.

The wood costs 21.50 euros per metre.
Each length of wood he buys has to be a whole number of metres.

Work out the total cost of the wood Lewis needs to buy.
Show your working clearly.

..... euros

(Total for Question 11 is 4 marks)

Question 3

3 marks

Right-Angled Triangles - Pythagoras & Trigonometry

3 The diagram shows triangle PQR

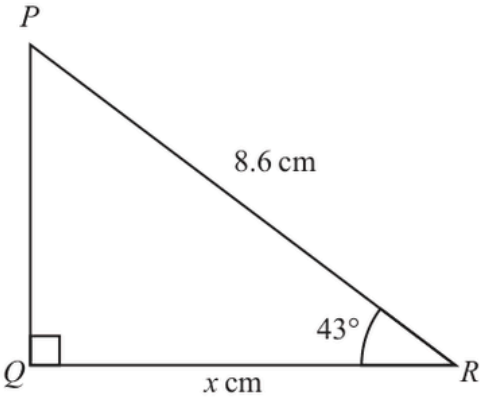


Diagram **NOT** accurately drawn

Work out the value of x
Give your answer correct to one decimal place.

$x =$ .....

(Total for Question 3 is 3 marks)

Question 12

4 marks | Right-Angled Triangles - Pythagoras & Trigonometry

12 ABC is a right-angled triangle.
D is a point on BC

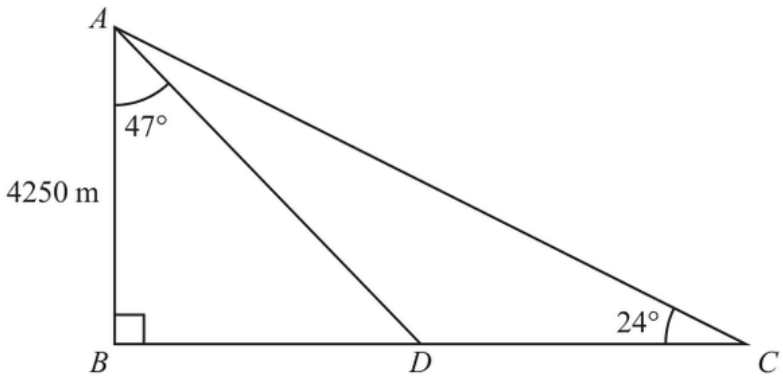


Diagram **NOT** accurately drawn

$AB = 4250$ m angle $BAD = 47°$ angle $BCA = 24°$

Work out the length of DC
Give your answer correct to the nearest integer.

..... m

(Total for Question 12 is 4 marks)

Question 8

4 marks | Right-Angled Triangles - Pythagoras & Trigonometry

8

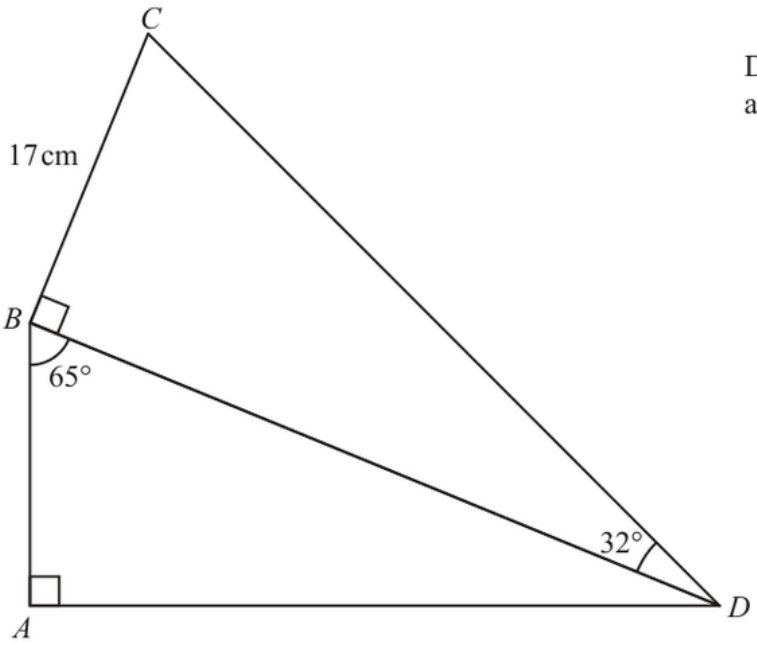


Diagram **NOT** accurately drawn

ABD and *BCD* are right-angled triangles.

angle $ABD = 65°$ angle $CDB = 32°$ $BC = 17$ cm

Work out the length of *AD*
Give your answer correct to 3 significant figures.

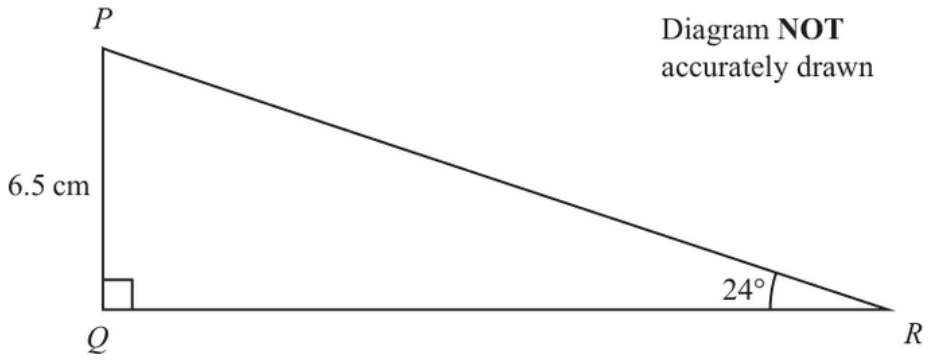
..... cm

(Total for Question 8 is 4 marks)

Question 9

3 marks | Right-Angled Triangles - Pythagoras & Trigonometry

9 The diagram shows triangle PQR



Work out the length of QR
Give your answer correct to 3 significant figures.

..... cm

(Total for Question 9 is 3 marks)

Question 10

5 marks | Right-Angled Triangles - Pythagoras & Trigonometry

10 ABD and ABC are right-angled triangles.

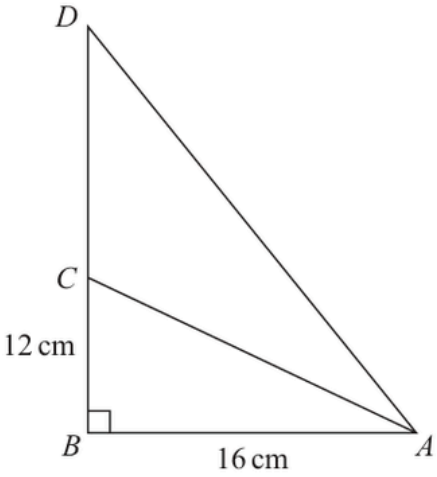


Diagram **NOT** accurately drawn

$AB = 16\,\text{cm}$ $BC = 12\,\text{cm}$ $AD = 1.5 \times AC$

Find the length of CD
Give your answer correct to 3 significant figures.

..... cm

(Total for Question 10 is 5 marks)

Question 11

5 marks | Right-Angled Triangles - Pythagoras & Trigonometry

11 The diagram shows two triangles, ADE and CDB

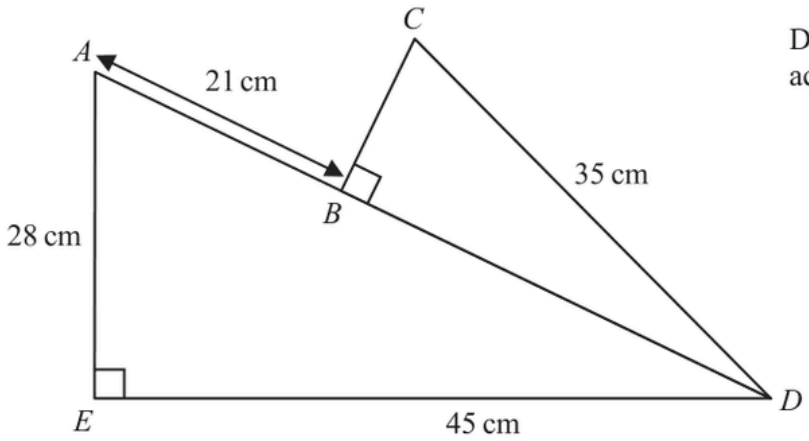


Diagram **NOT** accurately drawn

ABD is a straight line.

$AE = 28\,\text{cm}$ $ED = 45\,\text{cm}$ $AB = 21\,\text{cm}$ $CD = 35\,\text{cm}$

angle AED = angle $CBD = 90°$

Work out the area of triangle CDB
Give your answer correct to 3 significant figures.

..... cm^2

(Total for Question 11 is 5 marks)

Question 13

5 marks | Right-Angled Triangles - Pythagoras & Trigonometry

13 In the diagram, AB represents a vertical tower and CD represents a vertical building.

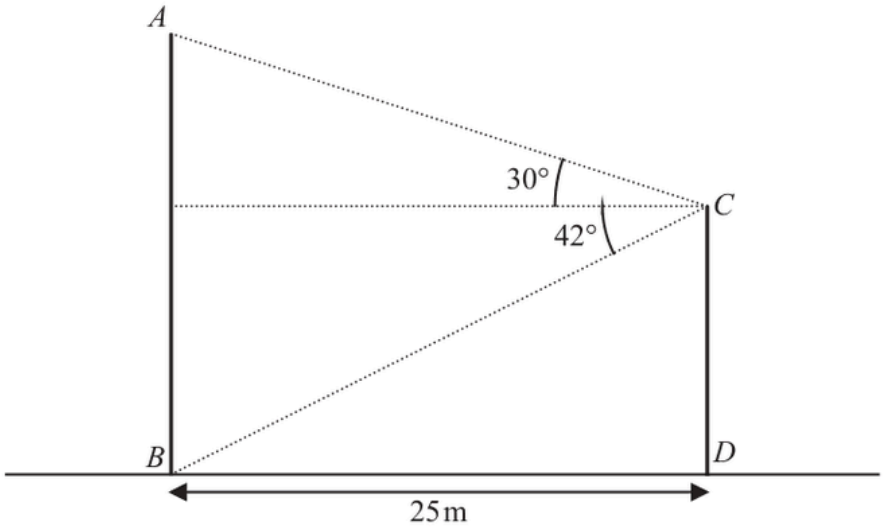


Diagram **NOT** accurately drawn

The bottom of the tower, B, and the bottom of the building, D, are on horizontal ground such that $BD = 25$ m

The angle of elevation of A from C is $30°$
The angle of depression of B from C is $42°$

(a) Work out the height of the tower AB
Give your answer correct to one decimal place.

..... m

(3)

(b) Work out the angle of elevation of A from D
Give your answer correct to one decimal place.

..... °

(2)

(Total for Question 13 is 5 marks)

Question 9

4 marks | Right-Angled Triangles - Pythagoras & Trigonometry

9 The diagram shows a sketch of a right-angled triangle, ABC

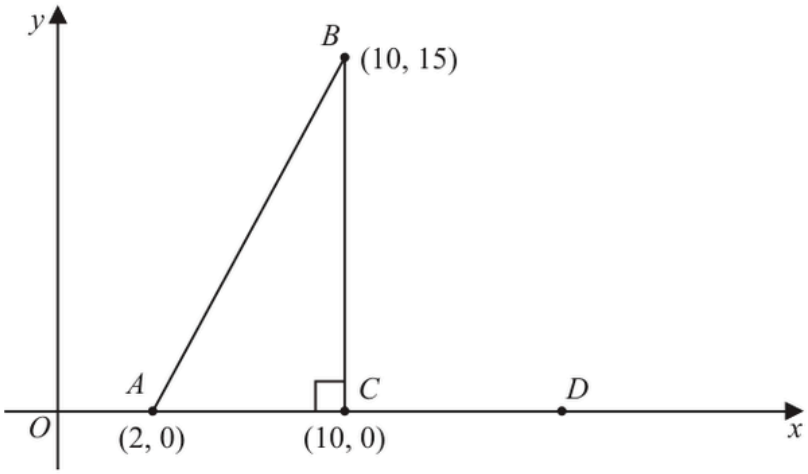


Diagram **NOT** accurately drawn

A is the point with coordinates $(2, 0)$
B is the point with coordinates $(10, 15)$
C is the point with coordinates $(10, 0)$

D is a point on the x-axis such that $AB = AD$

Find the coordinates of D

(..... , ...)

(Total for Question 9 is 4 marks)

Question 11

4 marks | Right-Angled Triangles - Pythagoras & Trigonometry

11 ABC is a right-angled triangle.

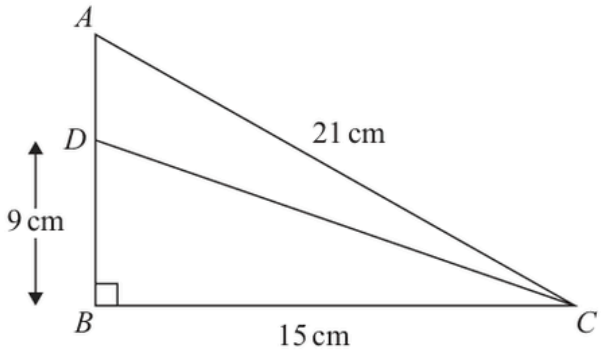


Diagram **NOT** accurately drawn

$AC = 21\,\text{cm}$ $BC = 15\,\text{cm}$ angle $ABC = 90°$

The point D lies on AB such that $DB = 9\,\text{cm}$

Work out the size of angle ACD
Give your answer correct to one decimal place.

.....°

(Total for Question 11 is 4 marks)

Question 11

4 marks | Right-Angled Triangles - Pythagoras & Trigonometry

11 ABC is a right-angled triangle.

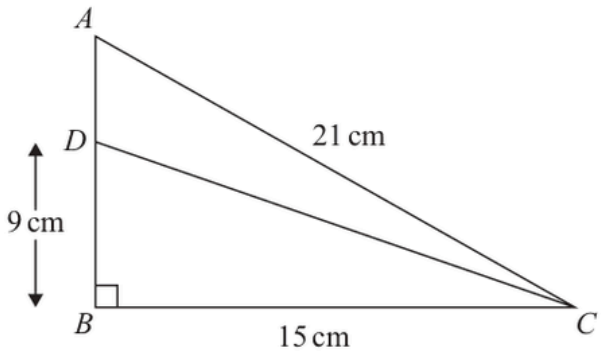


Diagram **NOT** accurately drawn

$AC = 21\,\text{cm}$ $BC = 15\,\text{cm}$ angle $ABC = 90°$

The point D lies on AB such that $DB = 9\,\text{cm}$

Work out the size of angle ACD
Give your answer correct to one decimal place.

.....°

(Total for Question 11 is 4 marks)

Question 11

4 marks | Right-Angled Triangles - Pythagoras & Trigonometry

11 The diagram shows a right-angled triangle ABC

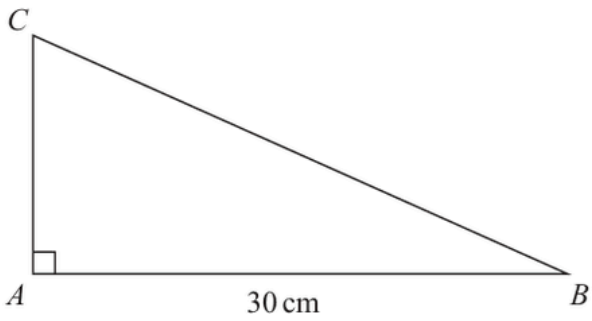


Diagram **NOT** accurately drawn

Area of triangle $ABC = 240\,\text{cm}^2$

Work out the perimeter of triangle ABC

..... cm

(Total for Question 11 is 4 marks)

Question 1

3 marks

Right-Angled Triangles - Pythagoras & Trigonometry

1 The diagram shows a right-angled triangle.

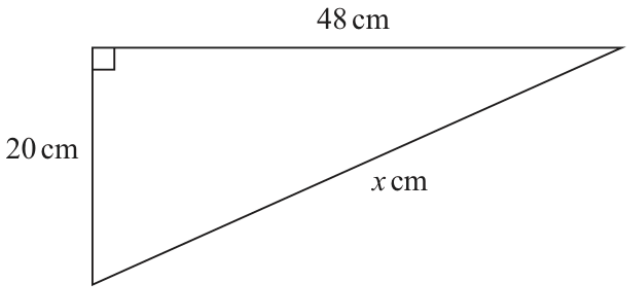


Diagram **NOT** accurately drawn

Work out the value of x

$x =$ .....

(Total for Question 1 is 3 marks)

Question 2

3 marks | Right-Angled Triangles - Pythagoras & Trigonometry

2

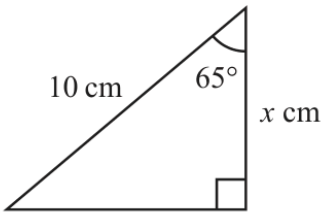


Diagram **NOT** accurately drawn

Work out the value of x
Give your answer correct to 3 significant figures.

$x =$ .....

(Total for Question 2 is 3 marks)

Question 2

3 marks | Right-Angled Triangles - Pythagoras & Trigonometry

2

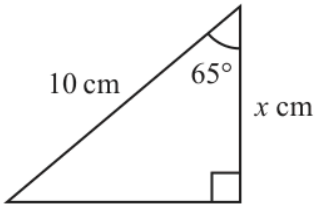


Diagram **NOT** accurately drawn

Work out the value of x
Give your answer correct to 3 significant figures.

$x =$ .....

(Total for Question 2 is 3 marks)

Question 11

5 marks | Right-Angled Triangles - Pythagoras & Trigonometry

11 The diagram shows a square *ABCD* and a right-angled triangle *EFG*

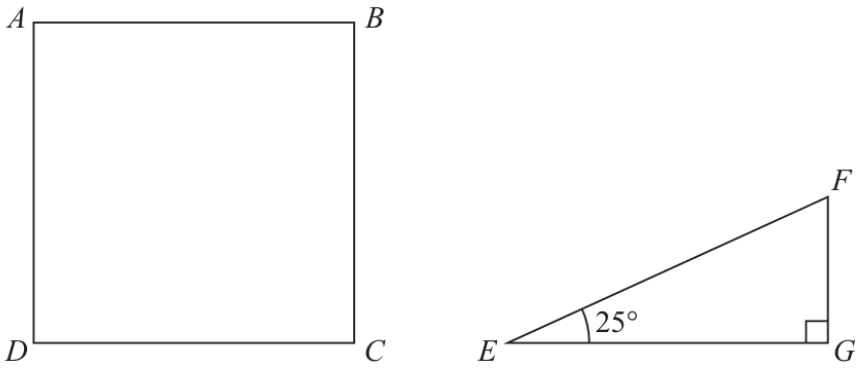


Diagram **NOT** accurately drawn

The area of square *ABCD* is 36 cm^2
DC = *EG*

Work out the area of triangle *EFG*
Give your answer correct to one decimal place.
Show your working clearly.

..... cm^2

(Total for Question 11 is 5 marks)

TOPIC

3D Pythagoras & Trigonometry

Every past-paper question on this topic, 2020 to 2026.

Question 19

4 marks | 3D Pythagoras & Trigonometry

19 The diagram shows a triangular prism, $ABCDEF$, with a rectangular base $ABCD$

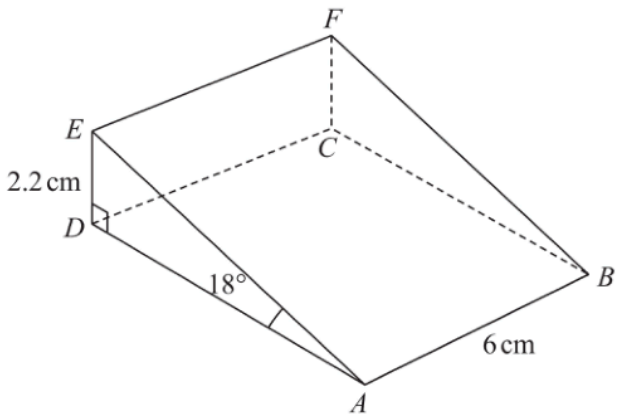


Diagram **NOT** accurately drawn

$AB = 6\,\text{cm}$ $DE = 2.2\,\text{cm}$ angle $DAE = 18°$ angle $ADE = 90°$

Work out the angle that BE makes with the plane $ABCD$
Give your answer correct to one decimal place.

Question 19

4 marks | 3D Pythagoras & Trigonometry

19 The diagram shows a cuboid $ABCDEFGH$.

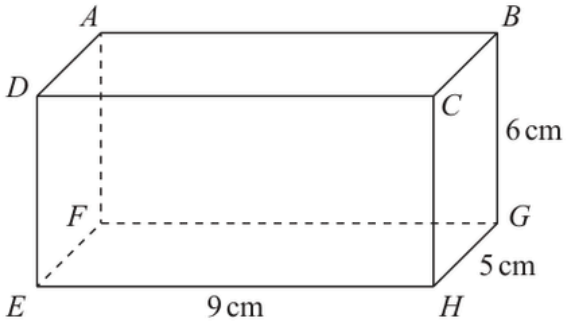


Diagram **NOT** accurately drawn

$EH = 9\,\text{cm}$, $HG = 5\,\text{cm}$ and $GB = 6\,\text{cm}$.

Work out the size of the angle between AH and the plane $EFGH$.
Give your answer correct to 3 significant figures.

.....°

(Total for Question 19 is 4 marks)

Question 17

6 marks | 3D Pythagoras & Trigonometry

17 The diagram shows a prism *ABCDEFGH* with a horizontal base.

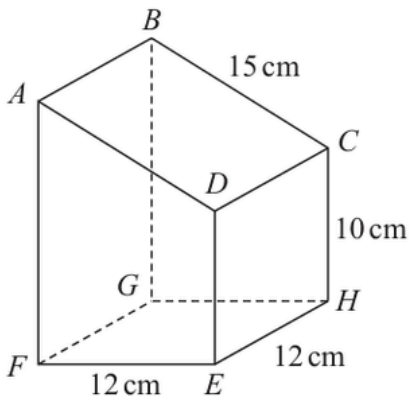


Diagram **NOT** accurately drawn

The base of the prism, *EFGH*, is a square of side 12 cm.
Trapezium *ADEF* is a cross section of the prism where *AF* and *DE* are vertical edges.

$DE = CH = 10$ cm
$AD = BC = 15$ cm

(a) Work out the size of the angle between *CF* and the base *EFGH*.
Give your answer correct to one decimal place.

..... °

(3)

(b) Work out the length of *BE*.
Give your answer correct to one decimal place.

..... cm

(3)

(Total for Question 17 is 6 marks)

Question 22

4 marks | 3D Pythagoras & Trigonometry

22 ABC is an isosceles triangle in a horizontal plane.
The point T is vertically above B.

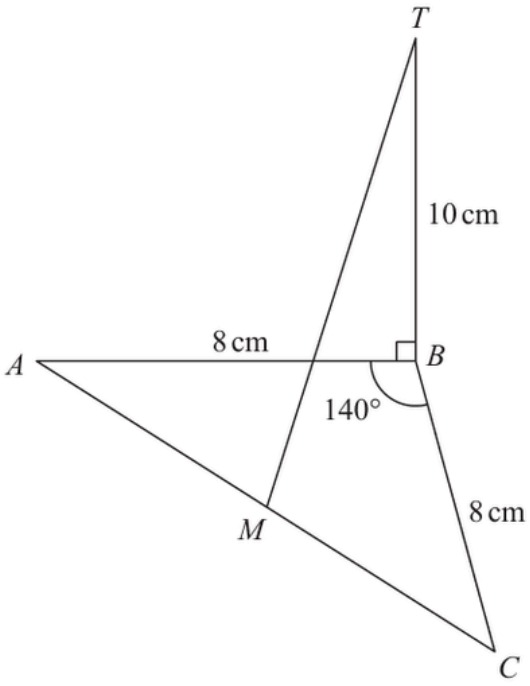


Diagram **NOT** accurately drawn

Angle $ABC = 140°$
$AB = BC = 8$ cm
$TB = 10$ cm
M is the midpoint of AC.

Calculate the size of the angle between MT and the horizontal plane ABC.
Give your answer correct to one decimal place.

.....°

(Total for Question 22 is 4 marks)

Question 22

4 marks | 3D Pythagoras & Trigonometry

22 The diagram shows a triangular prism $ABCDEF$ with a horizontal base $ABEF$.

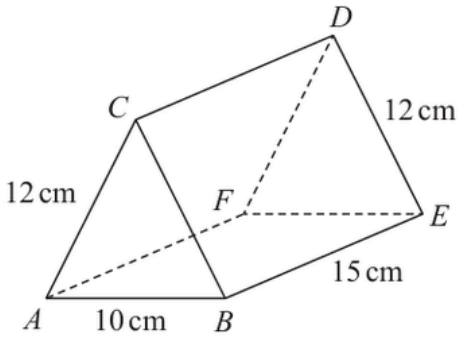


Diagram **NOT** accurately drawn

$AC = BC = FD = ED = 12\,\text{cm}$ $AB = 10\,\text{cm}$ $BE = 15\,\text{cm}$

Calculate the size of the angle between AD and the base $ABEF$.
Give your answer correct to 3 significant figures.

.....°

(Total for Question 22 is 4 marks)

Question 19

3 marks | 3D Pythagoras & Trigonometry

19 $ABCD$ is a horizontal rectangular field.

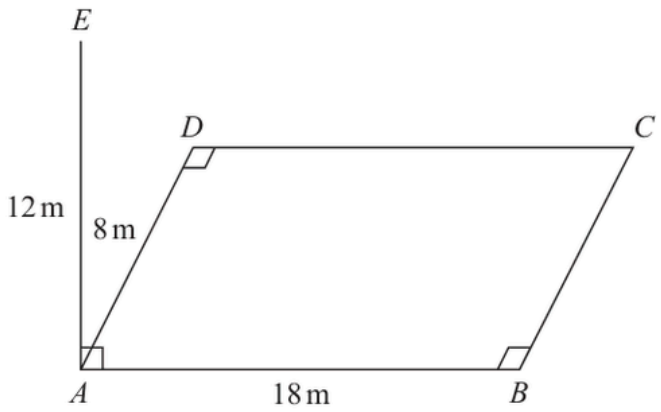


Diagram **NOT** accurately drawn

A vertical pole, AE, is placed at the corner A of the field.

$AE = 12\,\text{m}$ $AB = 18\,\text{m}$ $AD = 8\,\text{m}$

Calculate the size of the angle between EC and the plane $ABCD$
Give your answer correct to one decimal place.

.....°

(Total for Question 19 is 3 marks)

Question 21

5 marks | 3D Pythagoras & Trigonometry

21 The diagram shows the prism $ABCDEFGHJK$ with horizontal base $AEFG$

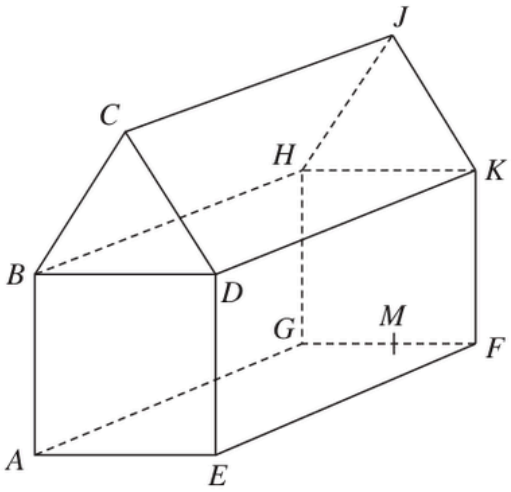


Diagram **NOT** accurately drawn

$ABCDE$ is a cross section of the prism where
$ABDE$ is a square
BCD is an equilateral triangle

$EF = 2 \times AE$
M is the midpoint of GF so that JM is vertical.

Angle $MAJ = y°$

Given that $\tan y° = T$

find the value of T, giving your answer in the form $\frac{\sqrt{p} + \sqrt{q}}{17}$ where p and q are integers.

$T =$ .....

(Total for Question 21 is 5 marks)

Question 18

4 marks | 3D Pythagoras & Trigonometry

18 The diagram shows a cube $ABCDEFGH$ with sides of length 6 cm.

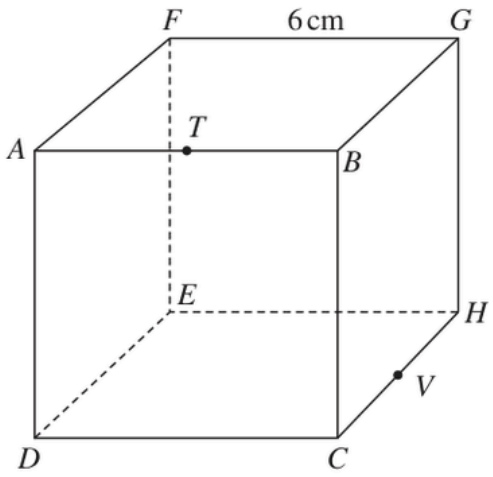


Diagram **NOT** accurately drawn

T is the midpoint of AB and V is the midpoint of CH

Work out the distance from T to V in a straight line through the cube.
Give your answer in the form $\sqrt{a}$ cm where a is an integer.

..... cm

(Total for Question 18 is 4 marks)

Question 22

5 marks | 3D Pythagoras & Trigonometry

22 Here is a cuboid $ABCDEFGH$

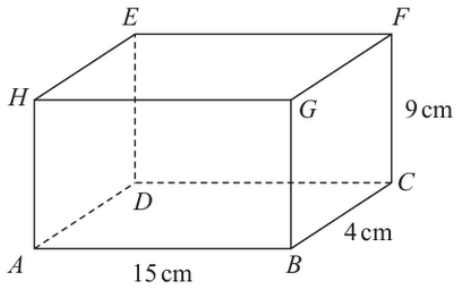


Diagram **NOT** accurately drawn

$AB = 15\,\text{cm}$ $BC = 4\,\text{cm}$ $CF = 9\,\text{cm}$

(a) Work out the length of BE
Give your answer correct to 3 significant figures.

..... cm

(2)

Here is a cuboid $PQRSTUVW$

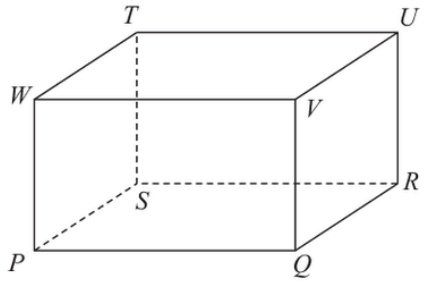


Diagram **NOT** accurately drawn

$PR = 42\,\text{cm}$

The size of the angle between PU and the plane $PQRS$ is 30°

M is the midpoint of PR

(b) Work out the size of angle UMR
Give your answer correct to 3 significant figures.

.....°

(3)

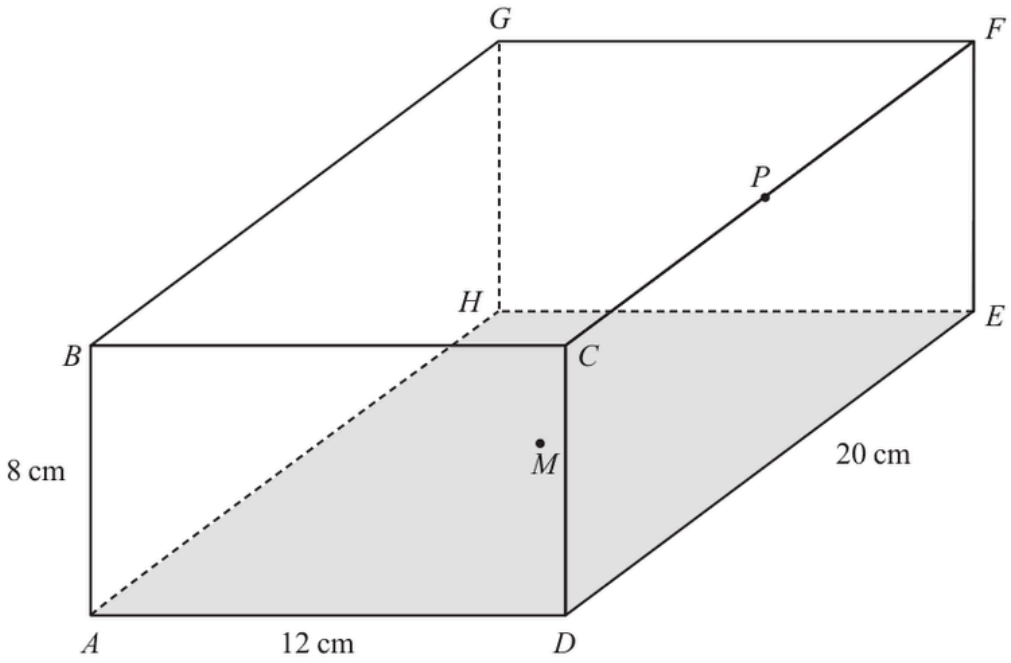
(Total for Question 22 is 5 marks)

Question 22

6 marks | 3D Pythagoras & Trigonometry

22 The diagram shows a cuboid $ABCDEFGH$ with horizontal base $ADEH$

Diagram **NOT** accurately drawn



$AB = 8$ cm $\quad AD = 12$ cm $\quad DE = 20$ cm

M is the midpoint of the base $ADEH$ and P is the midpoint of the edge CF

Work out the size of angle BMP
Give your answer correct to one decimal place.

.....°

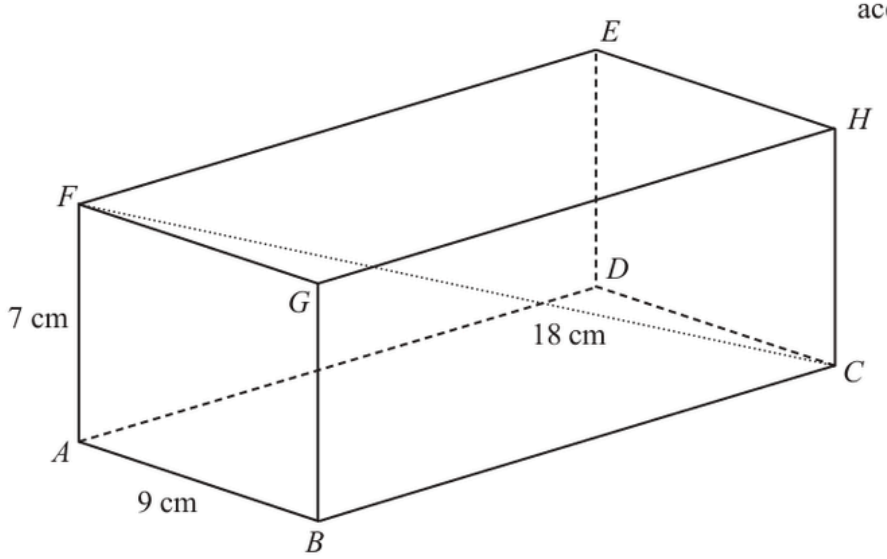
(Total for Question 22 is 6 marks)

Question 20

3 marks | 3D Pythagoras & Trigonometry

20 The diagram shows cuboid $ABCDEFGH$

Diagram **NOT** accurately drawn



$AB = 9\,\text{cm}$ $AF = 7\,\text{cm}$ $FC = 18\,\text{cm}$

Calculate the length of BC
Give your answer correct to 3 significant figures.

..... cm

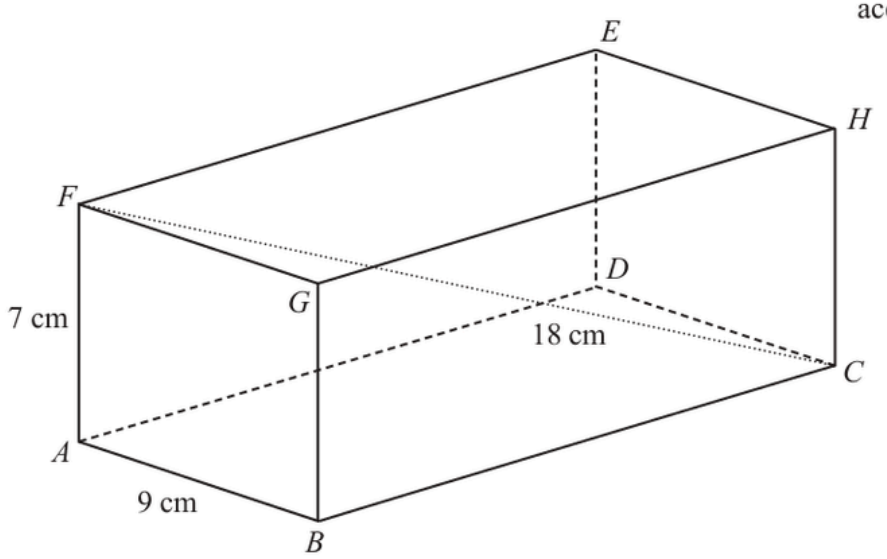
(Total for Question 20 is 3 marks)

Question 20

3 marks | 3D Pythagoras & Trigonometry

20 The diagram shows cuboid $ABCDEFGH$

Diagram **NOT** accurately drawn



$AB = 9\,\text{cm}$ $AF = 7\,\text{cm}$ $FC = 18\,\text{cm}$

Calculate the length of BC
Give your answer correct to 3 significant figures.

..... cm

(Total for Question 20 is 3 marks)

Question 23

3 marks | 3D Pythagoras & Trigonometry

23 The diagram shows a triangular prism, $ABCDEF$, with a horizontal rectangular base $ABCD$

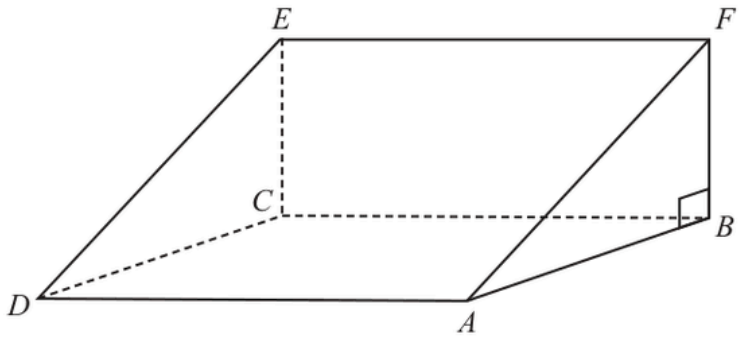


Diagram **NOT** accurately drawn

M is the midpoint of the line AC

$AC = 40\,\text{cm}$ angle $CAE = 35°$ angle $ABF = 90°$

Work out the size of angle CME
Give your answer correct to 3 significant figures.

.....°

(Total for Question 23 is 3 marks)

Question 23

6 marks | 3D Pythagoras & Trigonometry

23 The diagram shows cuboid $ABCDEFGH$

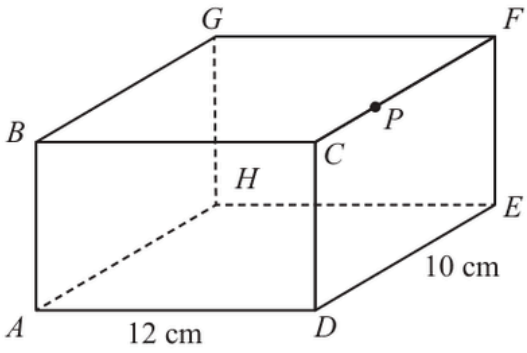


Diagram **NOT** accurately drawn

The point P lies on CF

$AD = 12$ cm $\quad DE = 10$ cm $\quad CP = 3$ cm

The angle of elevation of P from A is $24°$

Calculate the size of angle APG
Give your answer correct to the nearest degree.
Show your working clearly.

.....°

(Total for Question 23 is 6 marks)

Question 24

4 marks | 3D Pythagoras & Trigonometry

24 The diagram shows a square-based pyramid $ABCDE$

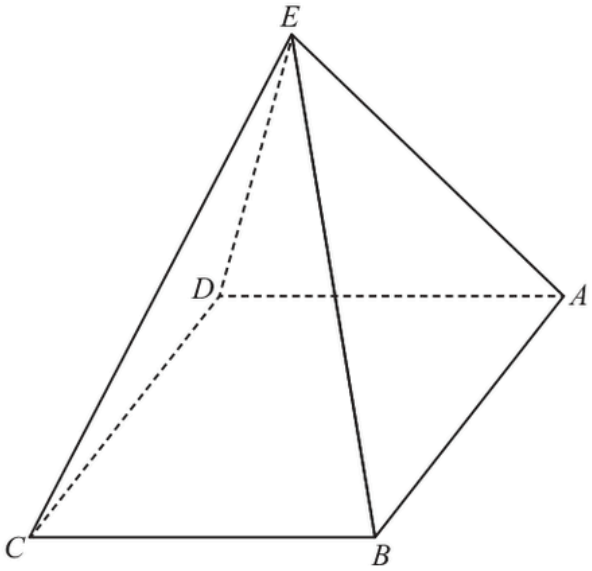


Diagram **NOT** accurately drawn

$EA = EB = EC = ED$

M is the centre of the horizontal square base $ABCD$
Q is the midpoint of AB
Angle $EQM = 80°$

$EA : AB = n : 1$

Find the value of n
Give your answer correct to 3 significant figures.

$n =$ .....

(Total for Question 24 is 4 marks)

Question 26

5 marks | 3D Pythagoras & Trigonometry

26 The diagram shows prism $ABCDEFGH$

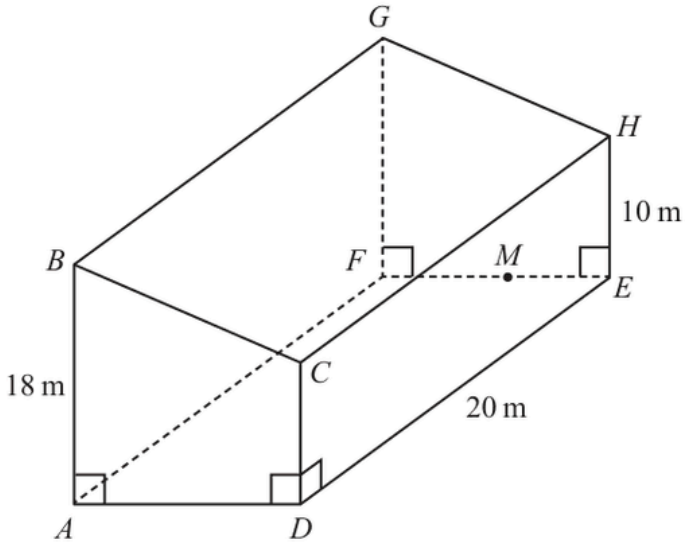


Diagram **NOT** accurately drawn

$$AB = FG = 18\,\text{m} \qquad DC = EH = 10\,\text{m} \qquad AD = FE$$
$$DE = CH = AF = BG = 20\,\text{m}$$
$$\text{angle } BAD = \text{angle } ADC = \text{angle } CDE = 90°$$

M is the point on FE such that $FM = \frac{3}{5}FE$

Given that angle $GMF = 60°$

calculate the angle of elevation of G from D
Give your answer correct to one decimal place.
Show your working clearly.

.....°

(Total for Question 26 is 5 marks)

Question 26

5 marks | 3D Pythagoras & Trigonometry

26 Here is a prism $ABCDEFGH$ with a horizontal, rectangular base $ABGF$

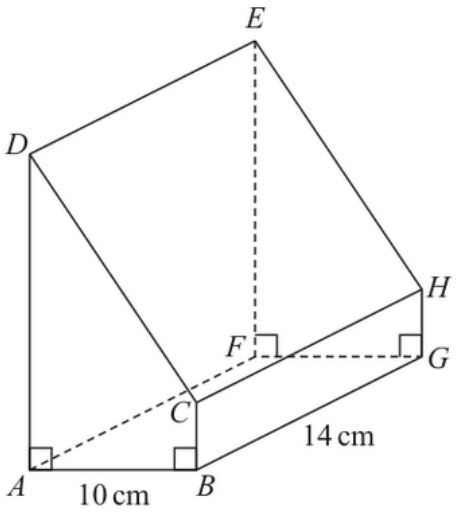


Diagram **NOT** accurately drawn

$AB = 10\,\text{cm}$ $BG = 14\,\text{cm}$

angle DAB = angle ABC = angle EFG = angle $FGH = 90°$

$BC = \frac{1}{5}AD$

The angle of elevation of E from B is $50°$

Calculate the volume of the prism.
Give your answer correct to 3 significant figures.
Show your working clearly.

..... cm^3

(Total for Question 26 is 5 marks)

Question 19

3 marks | 3D Pythagoras & Trigonometry

19 The diagram shows cuboid $PQRSTUVW$

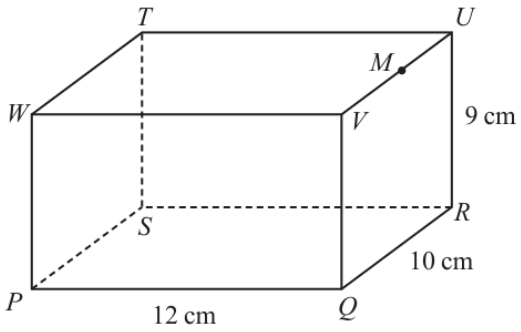


Diagram **NOT** accurately drawn

$PQ = 12$ cm $\quad QR = 10$ cm $\quad RU = 9$ cm

M is the midpoint of VU

Work out the size of the angle between line MP and plane $PQRS$
Give your answer correct to one decimal place.

.....°

(Total for Question 19 is 3 marks)

Question 25

5 marks | 3D Pythagoras & Trigonometry

25 The diagram shows a triangular prism $ABCDEF$ with horizontal rectangular base $ABCD$
F is vertically above A

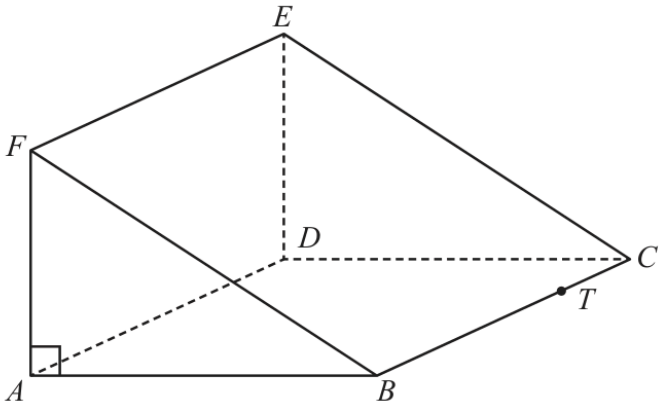


Diagram **NOT** accurately drawn

$AF = 12\,\text{cm}$ angle $ABF = 30°$ angle $BAF = 90°$

T is the point on the line BC such that $BF : BT = 3 : 2$

Work out the size of the angle between the line FT and the plane $ABCD$
Give your answer correct to one decimal place.
Show your working clearly.

..... °

(Total for Question 25 is 5 marks)

TOPIC

Sine & Cosine Rules

Every past-paper question on this topic, 2020 to 2026.

Question 14

5 marks | Sine & Cosine Rules

14 The diagram shows parallelogram $EFGH$.

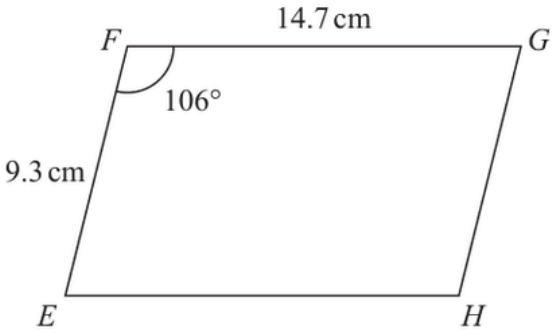


Diagram **NOT** accurately drawn

$EF = 9.3$ cm
$FG = 14.7$ cm
Angle $EFG = 106°$

(a) Work out the area of the parallelogram.
Give your answer correct to 3 significant figures.

..... cm^2
(2)

(b) Work out the length of the diagonal EG of the parallelogram.
Give your answer correct to 3 significant figures.

..... cm
(3)

(Total for Question 14 is 5 marks)

Question 21

6 marks | Sine & Cosine Rules

21 The diagram shows the prism $ABCDEF$ with cross section triangle ABC.

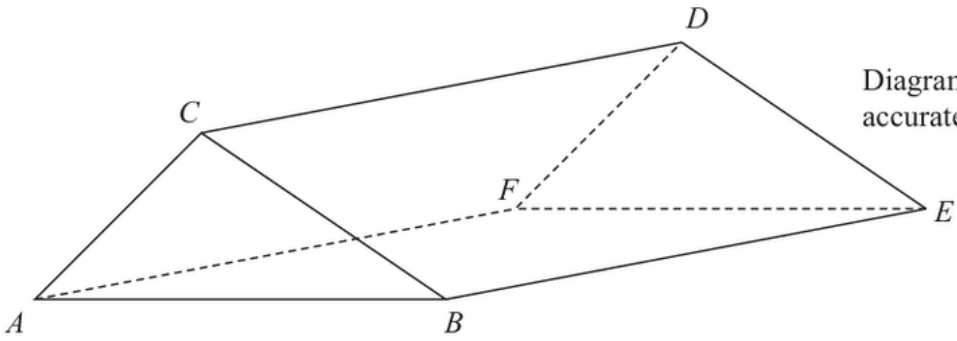


Diagram **NOT** accurately drawn

Angle $BEC = 40°$ and angle ACB is obtuse.
$AC = 6\,\text{cm}$ and $CE = 13\,\text{cm}$

The area of triangle ABC is $22\,\text{cm}^2$

Calculate the length of AB.
Give your answer correct to one decimal place.

..... cm

(Total for Question 21 is 6 marks)

Question 18

5 marks | Sine & Cosine Rules

18 Here is a quadrilateral $ABCD$.

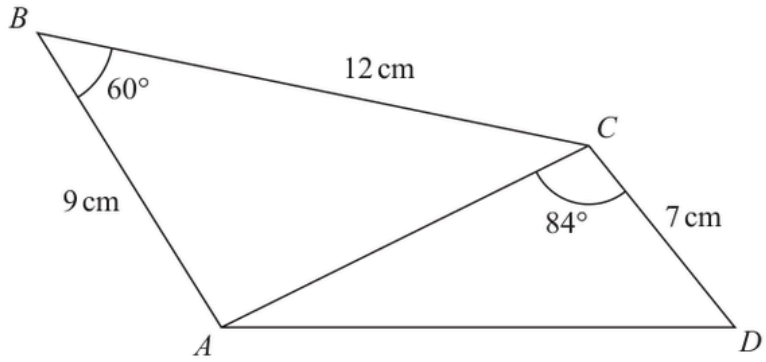


Diagram **NOT** accurately drawn

Calculate the area of quadrilateral $ABCD$.
Give your answer correct to 3 significant figures.
Show your working clearly.

..... cm^2

(Total for Question 18 is 5 marks)

Question 9

4 marks | Sine & Cosine Rules

9 The diagram shows isosceles triangle ABC

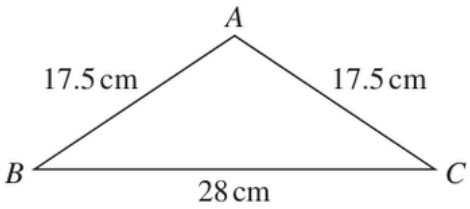


Diagram **NOT** accurately drawn

$AB = AC = 17.5$ cm $\quad\quad$ $BC = 28$ cm

Calculate the area of triangle ABC

..... cm^2

(Total for Question 9 is 4 marks)

Question 16

5 marks | Sine & Cosine Rules

16 The diagram shows quadrilateral $ABCD$

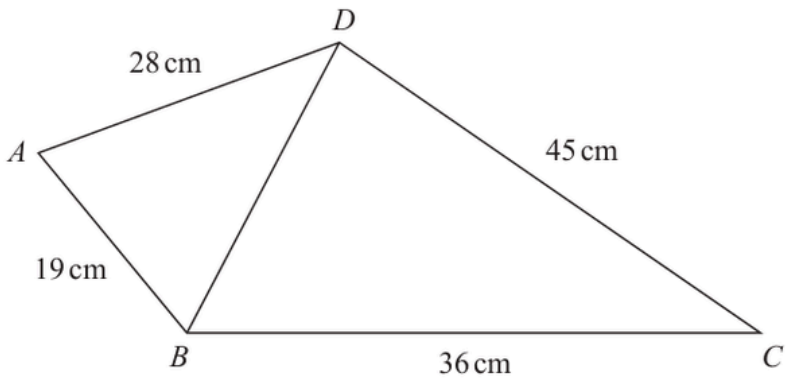


Diagram **NOT** accurately drawn

The angle BCD is acute.

Given that the area of triangle $BCD = 405\,\text{cm}^2$

work out the size of angle ABD
Give your answer correct to one decimal place.

.....°

(Total for Question 16 is 5 marks)

Question 23

6 marks | Sine & Cosine Rules

23 The diagram shows triangle PQR

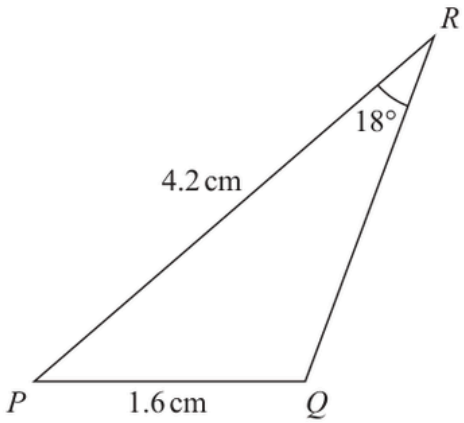


Diagram **NOT** accurately drawn

$PQ = 1.6\,\text{cm}$ $PR = 4.2\,\text{cm}$ Angle $PRQ = 18°$

Given that angle PQR is obtuse,

work out the area of triangle PQR
Give your answer correct to 3 significant figures.

..... cm^2

(Total for Question 23 is 6 marks)

Question 15

3 marks | Sine & Cosine Rules

15 The diagram shows a kite $ABCD$

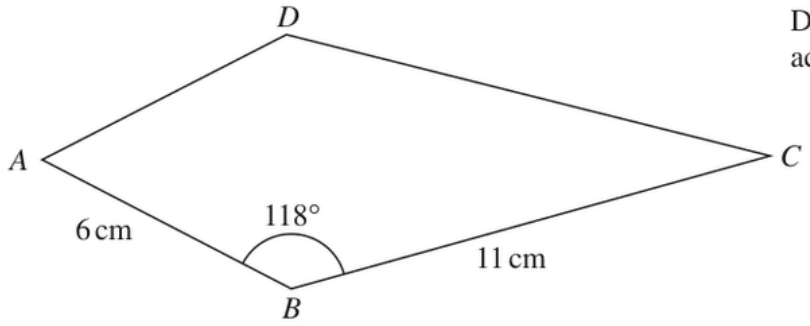


Diagram **NOT** accurately drawn

$AB = 6\,\text{cm}$ $BC = 11\,\text{cm}$ Angle $ABC = 118°$

Calculate the area of the kite.
Give your answer correct to 3 significant figures.

..... cm^2

(Total for Question 15 is 3 marks)

Question 17

5 marks | Sine & Cosine Rules

17 Here is a parallelogram $PQRS$, in which angle SPQ is acute.

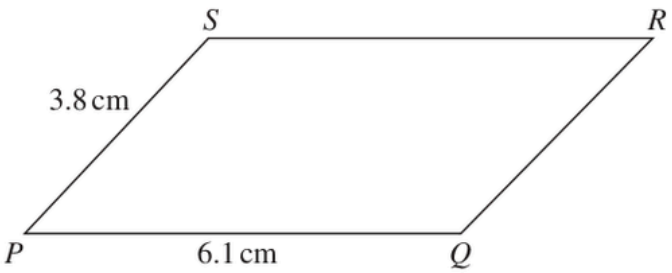


Diagram **NOT** accurately drawn

$PQ = 6.1\,\text{cm}$ $PS = 3.8\,\text{cm}$

The area of the parallelogram is $18\,\text{cm}^2$

Work out the length of QS
Give your answer correct to 3 significant figures.

..... cm

(Total for Question 17 is 5 marks)

Question 18

5 marks | Sine & Cosine Rules

18 Here is triangle ABC

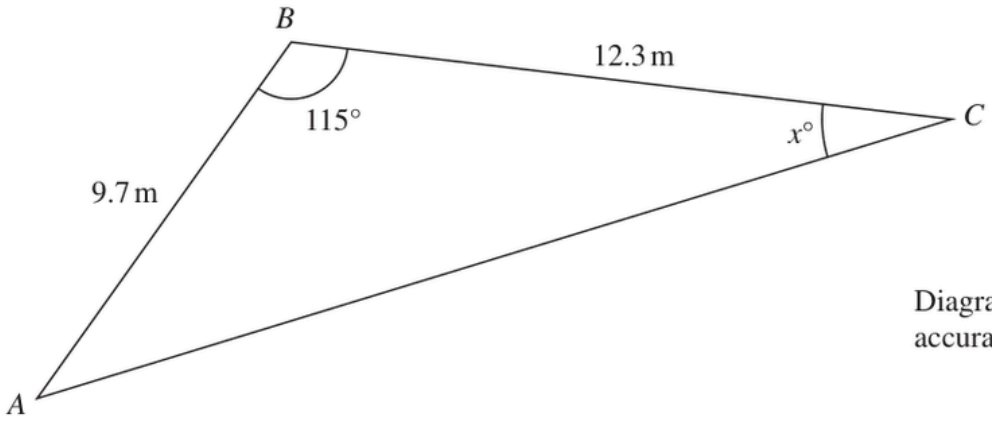


Diagram **NOT** accurately drawn

Work out the value of x
Give your answer correct to 3 significant figures.

$x =$ .....

(Total for Question 18 is 5 marks)

Question 22

5 marks | Sine & Cosine Rules

22 The diagram shows a triangle ABC and a flagpole BF

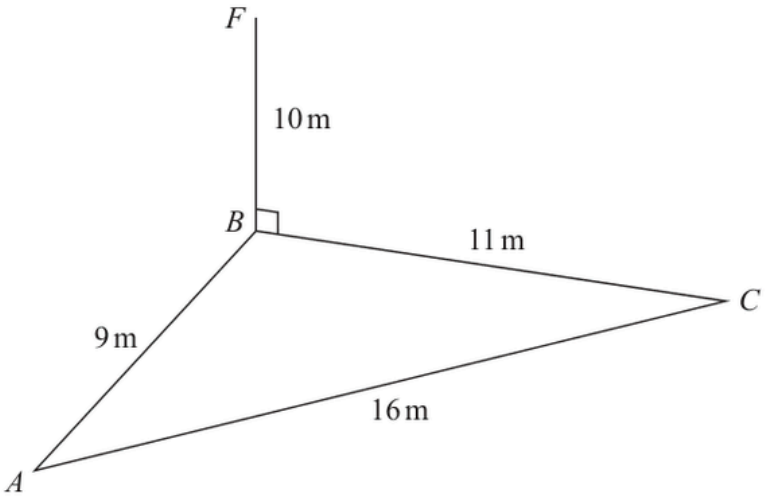


Diagram **NOT** accurately drawn

A, B and C are points on horizontal ground.

BF is vertical.

$AB = 9\,\text{m}$ $BC = 11\,\text{m}$ $AC = 16\,\text{m}$ $BF = 10\,\text{m}$

D is the point on AC such that angle $BDC = 90°$

Work out the size of the angle of elevation of the point F from the point D
Give your answer correct to one decimal place.

.....°

(Total for Question 22 is 5 marks)

Question 25

6 marks | Sine & Cosine Rules

25 Here is a triangle ABC

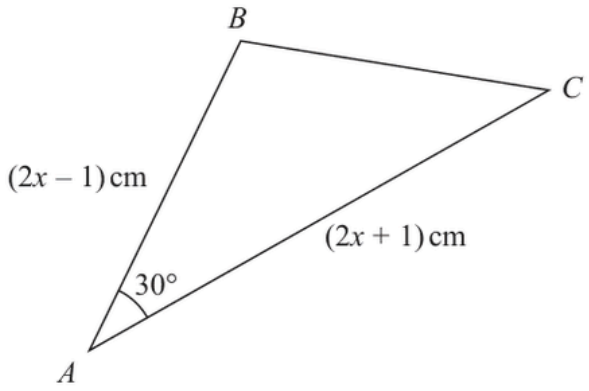


Diagram **NOT** accurately drawn

The area of the triangle is $(x^2 + x - 3.75)\,\text{cm}^2$

Find the size of the largest angle in triangle ABC
Give your answer correct to the nearest degree.

.....°

(Total for Question 25 is 6 marks)

Question 15

3 marks | Sine & Cosine Rules

15

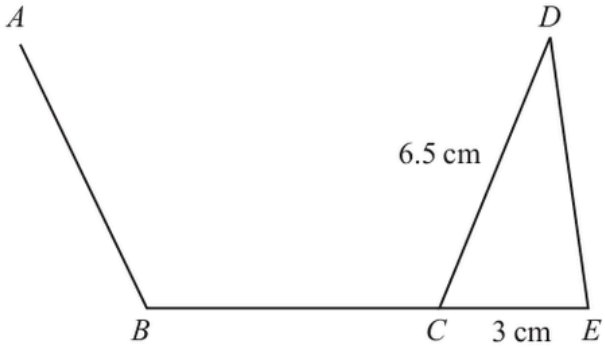


Diagram **NOT** accurately drawn

AB, *BC* and *CD* are three sides of a regular pentagon and *CDE* is a triangle.
BCE is a straight line.

$CD = 6.5\,\text{cm}$ $CE = 3\,\text{cm}$

Work out the area of triangle *CDE*
Give your answer correct to 3 significant figures.

..... cm^2

(Total for Question 15 is 3 marks)

Question 15

3 marks | Sine & Cosine Rules

15 The diagram shows isosceles triangle EFG

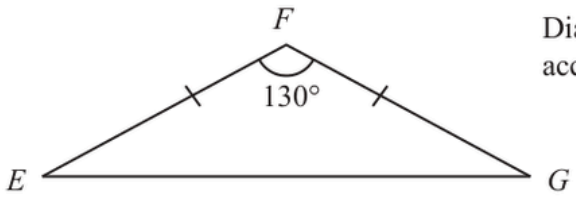


Diagram **NOT** accurately drawn

$EF = GF$
Angle $EFG = 130°$
The area of triangle EFG is 74 cm²

Work out the length of EF
Give your answer correct to 3 significant figures.

..... cm

(Total for Question 15 is 3 marks)

Question 19

5 marks | Sine & Cosine Rules

19 Here is quadrilateral $ABCD$

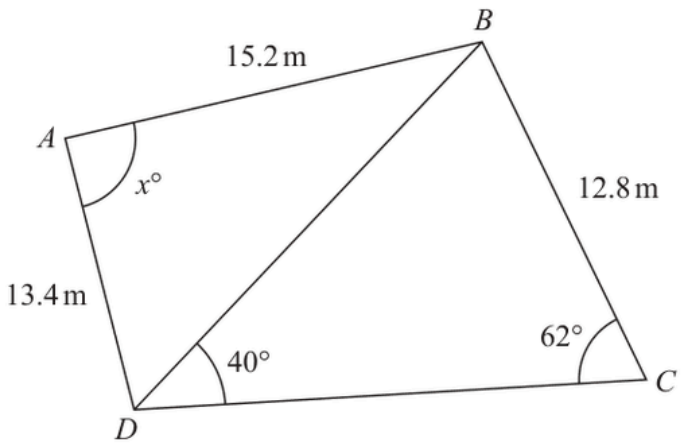


Diagram **NOT** accurately drawn

Work out the value of x
Give your answer correct to 3 significant figures.

$x =$ .....

(Total for Question 19 is 5 marks)

Question 20

5 marks | Sine & Cosine Rules

20

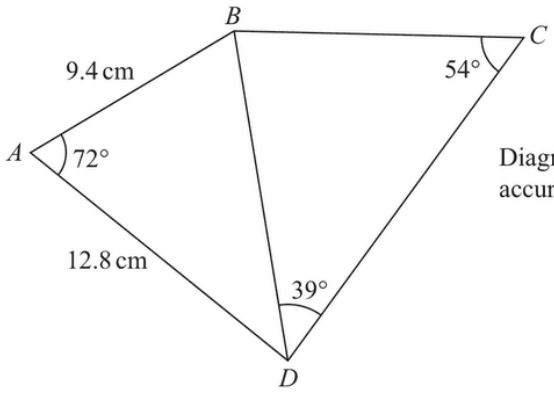


Diagram **NOT** accurately drawn

Work out the length of BC
Give your answer correct to 3 significant figures.

..... cm

(Total for Question 20 is 5 marks)

Question 21

5 marks | Sine & Cosine Rules

21

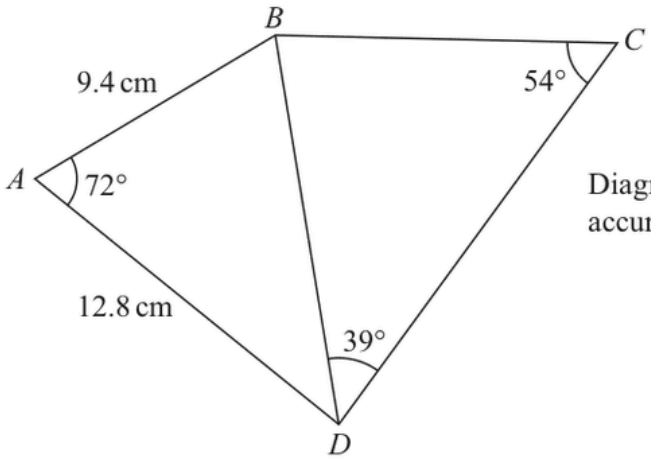


Diagram **NOT** accurately drawn

Work out the length of BC
Give your answer correct to 3 significant figures.

..... cm

(Total for Question 21 is 5 marks)

Question 19

3 marks | Sine & Cosine Rules

19 The diagram shows triangle ABC

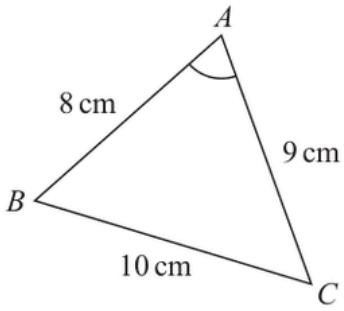


Diagram **NOT** accurately drawn

$AB = 8\,\text{cm}$ $BC = 10\,\text{cm}$ $CA = 9\,\text{cm}$

Work out the size of angle BAC
Give your answer correct to one decimal place.

.....°

(Total for Question 19 is 3 marks)

Question 19

3 marks | Sine & Cosine Rules

19 The diagram shows triangle ABC

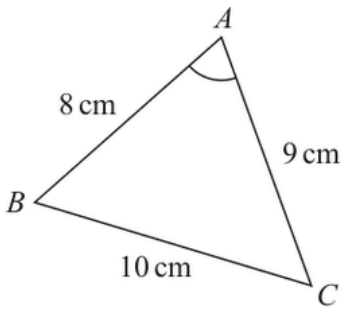


Diagram **NOT** accurately drawn

$AB = 8\,\text{cm}$ $BC = 10\,\text{cm}$ $CA = 9\,\text{cm}$

Work out the size of angle BAC
Give your answer correct to one decimal place.

.....°

(Total for Question 19 is 3 marks)

Question 15

5 marks | Sine & Cosine Rules

15 The diagram shows triangle ABC

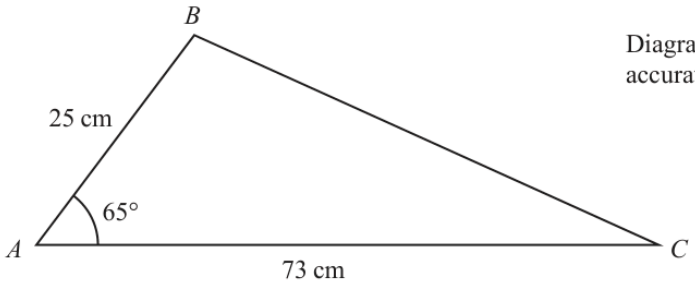


Diagram **NOT** accurately drawn

$AB = 25$ cm $\quad AC = 73$ cm $\quad$ angle $BAC = 65°$

(a) Work out the length of BC
Give your answer correct to 3 significant figures.

..... cm

(3)

(b) Work out the area of the triangle.
Give your answer correct to 3 significant figures.

..... cm^2

(2)

(Total for Question 15 is 5 marks)

Question 16

5 marks | Sine & Cosine Rules

16 The diagram shows triangle ABC

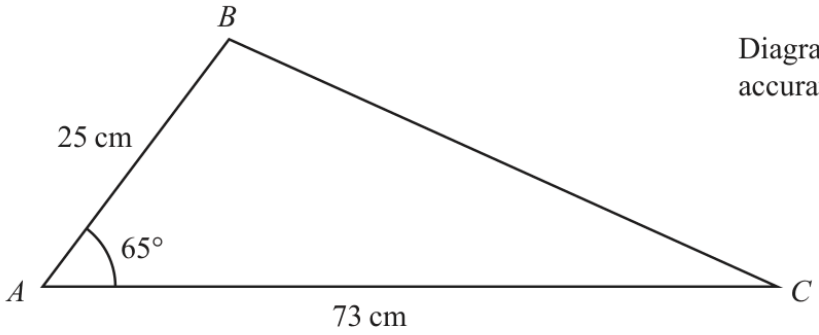


Diagram **NOT** accurately drawn

$AB = 25$ cm $\quad AC = 73$ cm $\quad$ angle $BAC = 65°$

(a) Work out the length of BC
Give your answer correct to 3 significant figures.

..... cm

(3)

(b) Work out the area of the triangle.
Give your answer correct to 3 significant figures.

..... cm^2

(2)

(Total for Question 16 is 5 marks)

Question 22

4 marks | Sine & Cosine Rules

22 The diagram shows triangle ABC

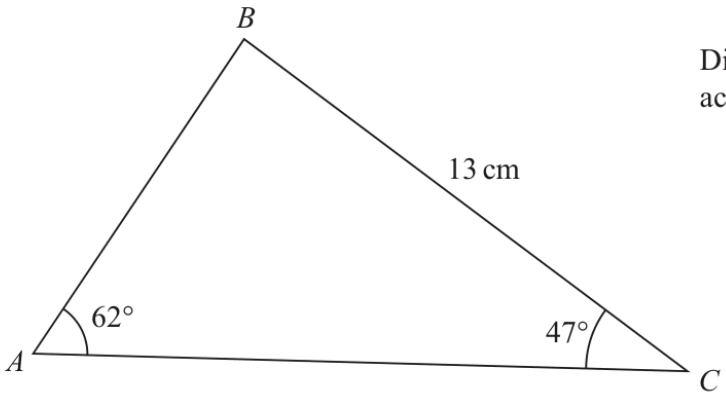


Diagram **NOT** accurately drawn

Calculate the area of the triangle.
Give your answer correct to 3 significant figures.

..... cm^2

(Total for Question 22 is 4 marks)

TOPIC

Congruent Shapes

Every past-paper question on this topic, 2020 to 2026.

Question 12

3 marks | Congruent Shapes

12 The diagram shows two congruent isosceles triangles and parts of two congruent regular polygons, **X** and **Y**.

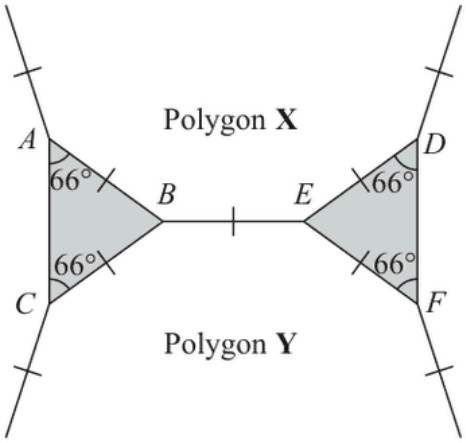


Diagram **NOT** accurately drawn

The two regular polygons each have n sides.

Work out the value of n.

$n =$ .....

(Total for Question 12 is 3 marks)

TOPIC

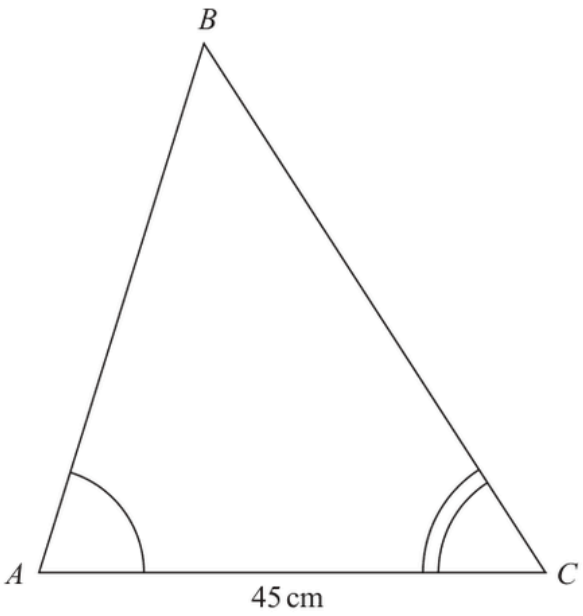
Similar Shapes

Every past-paper question on this topic, 2020 to 2026.

Question 4

4 marks | Similar Shapes

4 *ABC* and *DEF* are similar triangles.



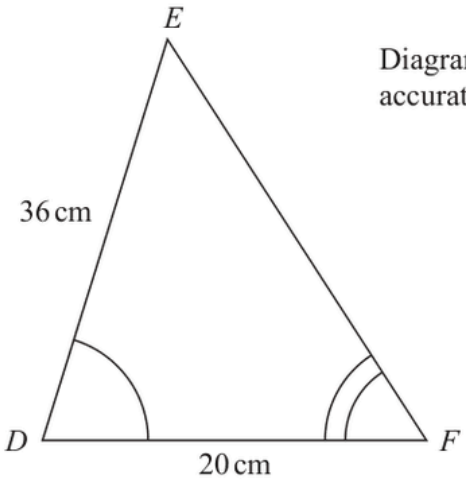


Diagram **NOT** accurately drawn

(a) Work out the length of *AB*.

..... cm

(2)

Given that $BC = 54$ cm,

(b) work out the length of *EF*.

..... cm

(2)

(Total for Question 4 is 4 marks)

Question 3

3 marks | Similar Shapes

3

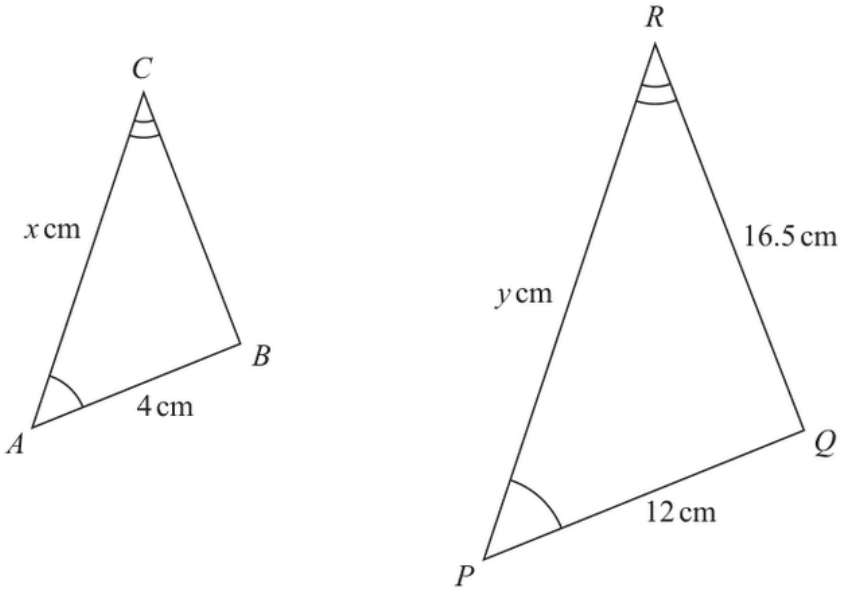


Diagram **NOT** accurately drawn

Triangle ABC is similar to triangle PQR

$AB = 4\,\text{cm}$ $PQ = 12\,\text{cm}$ $RQ = 16.5\,\text{cm}$ $AC = x\,\text{cm}$ $PR = y\,\text{cm}$

(a) Calculate the length of BC

..... cm

(2)

(b) Write down an expression for y in terms of x

$y =$ .....

(1)

(Total for Question 3 is 3 marks)

Question 12

3 marks | Similar Shapes

12

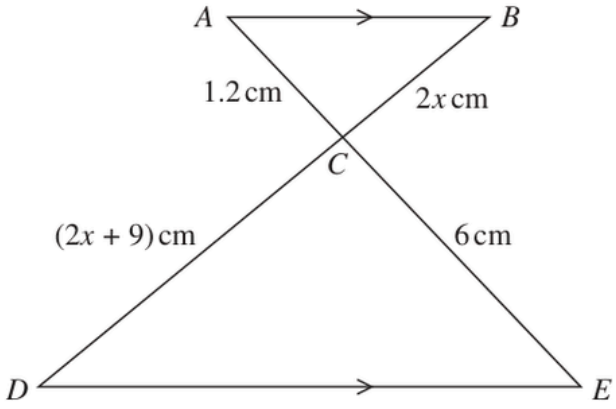


Diagram **NOT** accurately drawn

ACE and *BCD* are straight lines.
AB is parallel to *DE*

Work out the value of x

$x =$ .....

(Total for Question 12 is 3 marks)

Question 3

4 marks | Similar Shapes

3 *ABCD* and *EFGH* are similar quadrilaterals.

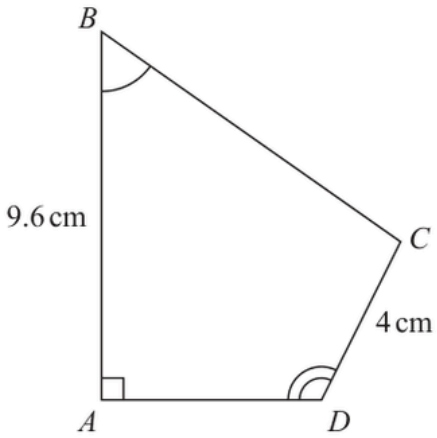
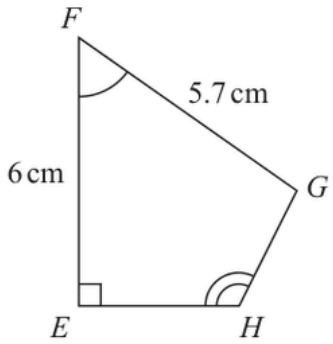


Diagram **NOT** accurately drawn



(a) Work out the length of *GH*

..... cm

(2)

(b) Work out the length of *BC*

..... cm

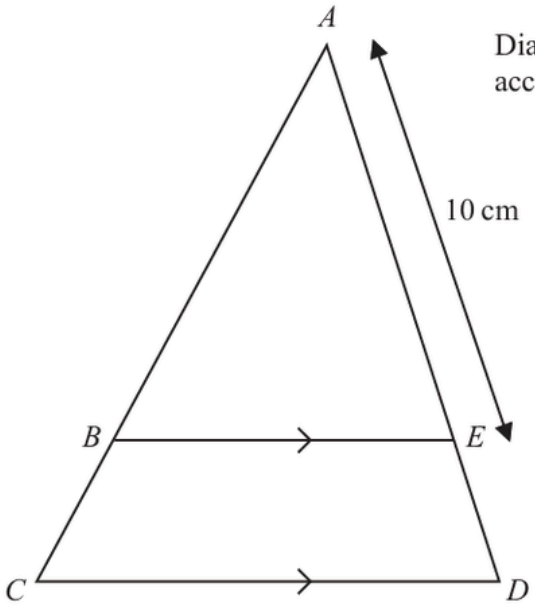
(2)

(Total for Question 3 is 4 marks)

Question 12

4 marks | Similar Shapes

12



In the diagram, ABC and AED are straight lines.
BE is parallel to CD

$$AE = 10\,\text{cm} \qquad \text{and} \qquad CD = 1.5 \times BE$$

(a) Work out the length of ED

..... cm

(2)

$AB = (2x + 5)\,\text{cm}$ and $BC = (3x - 5)\,\text{cm}$

(b) Work out the value of x

$x =$ .....

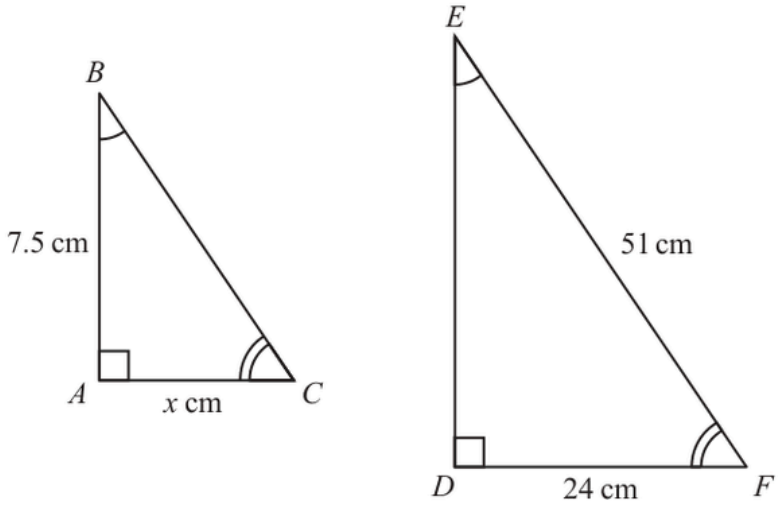
(2)

(Total for Question 12 is 4 marks)

Question 10

5 marks | Similar Shapes

10 Here are two similar triangles.



Diagrams **NOT** accurately drawn

Work out the value of x
Show your working clearly.

$x =$ .....

(Total for Question 10 is 5 marks)

Question 5

4 marks | Similar Shapes

5 The diagram shows two similar quadrilaterals, $ABCD$ and $EFGH$

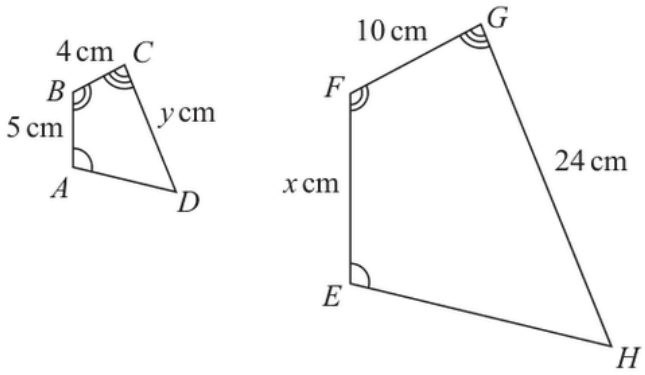


Diagram **NOT** accurately drawn

$AB = 5\,\text{cm}$ $BC = 4\,\text{cm}$ $CD = y\,\text{cm}$

$EF = x\,\text{cm}$ $FG = 10\,\text{cm}$ $GH = 24\,\text{cm}$

(a) Work out the value of x

$x =$ .....

(2)

(b) Work out the value of y

$y =$ .....

(2)

(Total for Question 5 is 4 marks)

Question 6

4 marks | Similar Shapes

6 The diagram shows two similar quadrilaterals, *ABCD* and *EFGH*

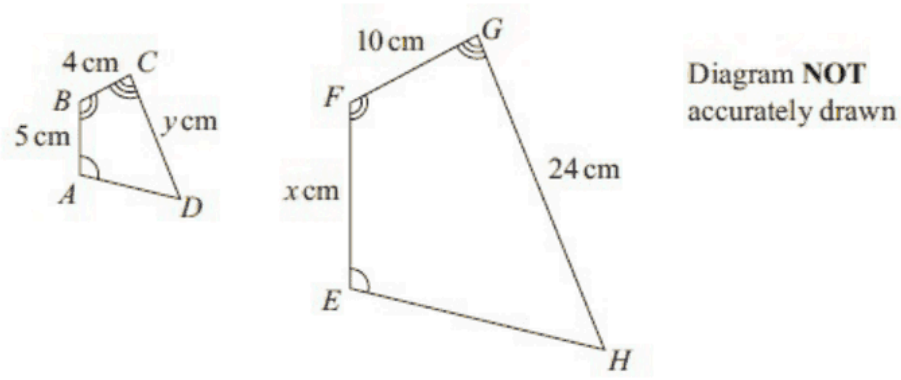


Diagram **NOT** accurately drawn

$AB = 5$ cm $BC = 4$ cm $CD = y$ cm

$EF = x$ cm $FG = 10$ cm $GH = 24$ cm

(a) Work out the value of x

$x =$ .....

(2)

(b) Work out the value of y

$y =$ .....

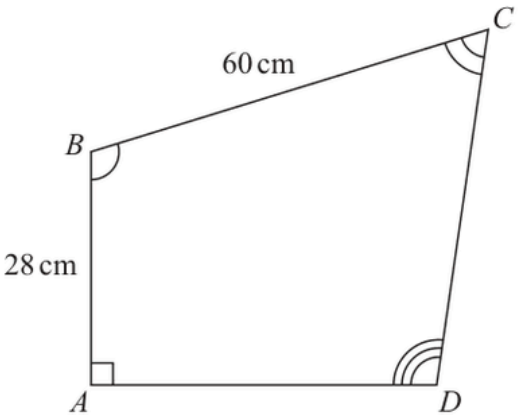
(2)

(Total for Question 6 is 4 marks)

Question 4

3 marks | Similar Shapes

4 Here are three similar quadrilaterals.



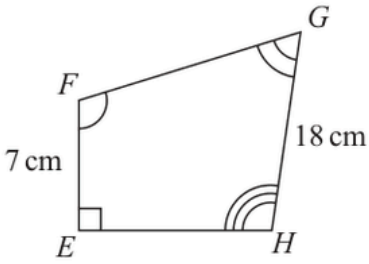
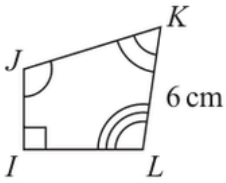


Diagram **NOT** accurately drawn



Work out the length of JK

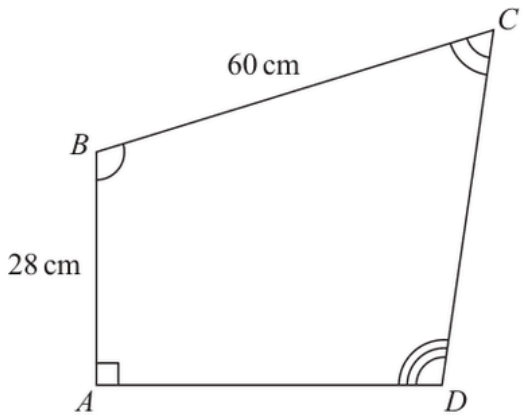
..... cm

(Total for Question 4 is 3 marks)

Question 5

3 marks | Similar Shapes

5 Here are three similar quadrilaterals.



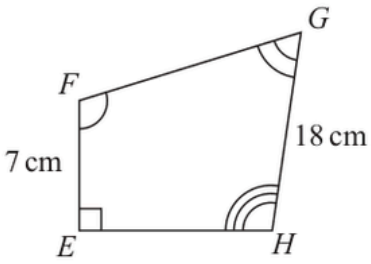
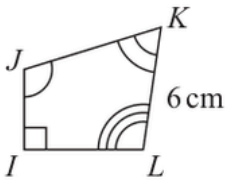


Diagram **NOT** accurately drawn



Work out the length of JK

..... cm

(Total for Question 5 is 3 marks)

TOPIC

Area & Volume of Similar Shapes

Every past-paper question on this topic, 2020 to 2026.

Question 19

4 marks | Area & Volume of Similar Shapes

19 The diagram shows two similar metal statues.

Diagram **NOT** accurately drawn



A **B**

The volume of statue **B** is 20% less than the volume of statue **A**
The surface area of statue **B** is k% less than the surface area of statue **A**

Work out the value of k
Give your answer correct to 3 significant figures.

$k =$ .....

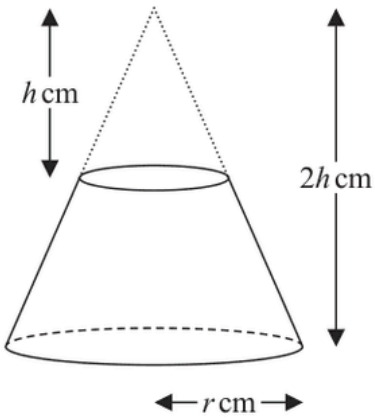
(Total for Question 19 is 4 marks)

Question 20

5 marks | Area & Volume of Similar Shapes

20 The diagram shows a frustum of a cone and a sphere.

The frustum is made by removing a small cone from a large cone.
The cones are similar.



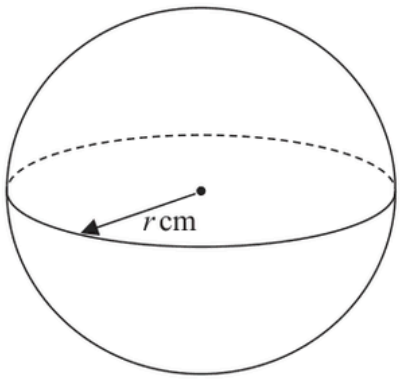


Diagram **NOT** accurately drawn

The height of the small cone is h cm.
The height of the large cone is $2h$ cm.
The radius of the base of the large cone is r cm.

The radius of the sphere is r cm.

Given that the volume of the frustum is equal to the volume of the sphere,

find an expression for r in terms of h.
Give your expression in its simplest form.

$r =$ .....

(Total for Question 20 is 5 marks)

Question 20

4 marks | Area & Volume of Similar Shapes

20 The diagram shows two similar vases, **A** and **B**.

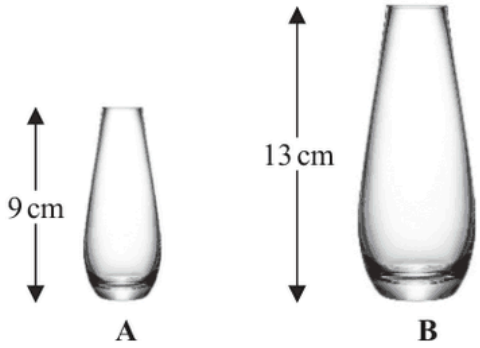


Diagram **NOT** accurately drawn

The height of vase **A** is 9 cm and the height of vase **B** is 13 cm.

Given that

surface area of vase **A** + surface area of vase **B** = 1800 cm^2

calculate the surface area of vase **A**.

..... cm^2

(Total for Question 20 is 4 marks)

Question 20

3 marks | Area & Volume of Similar Shapes

20 **R** and **S** are two similar solid shapes.

Shape **R** has surface area 108 cm^2 and volume 135 cm^3
Shape **S** has surface area 300 cm^2

Work out the volume of shape **S**.

..... cm^3

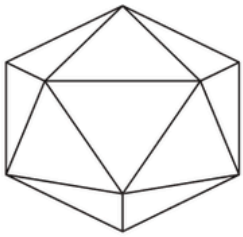
(Total for Question 20 is 3 marks)

Question 20

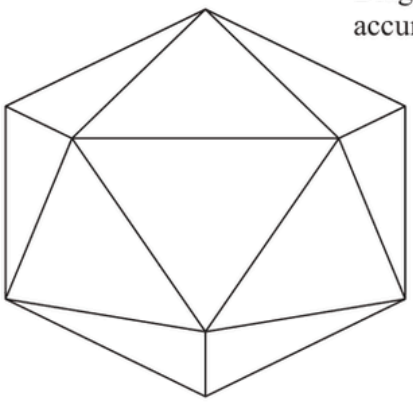
3 marks | Area & Volume of Similar Shapes

20 **A** and **B** are two similar solids.

Diagram **NOT** accurately drawn



A



B

A has a volume of $1836\,cm^3$
B has a volume of $4352\,cm^3$

B has a total surface area of $1120\,cm^2$

Work out the total surface area of **A**.

..... cm^2

(Total for Question 20 is 3 marks)

Question 20

3 marks | Area & Volume of Similar Shapes

20 Mathematically similar wooden blocks are made in a workshop.

There are small blocks and there are large blocks.

The volume of each small block is $300\,cm^3$

Given that

the surface area of each small block : the surface area of each large block = 25 : 36

work out the volume of each large block.

..... cm^3

(Total for Question 20 is 3 marks)

Question 17

4 marks | Area & Volume of Similar Shapes

17 **A** and **B** are two similar vases.

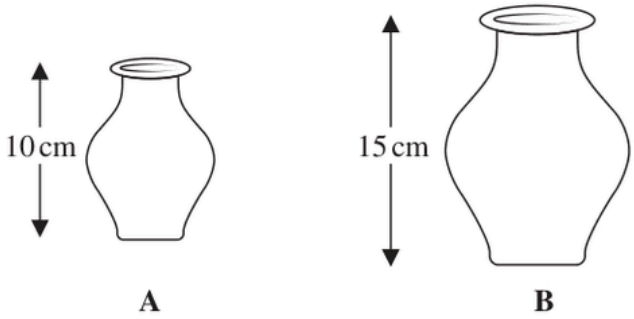


Diagram **NOT** accurately drawn

Vase **A** has height 10 cm.
Vase **B** has height 15 cm.

The difference between the volume of vase **A** and the volume of vase **B** is 1197 cm^3

Calculate the volume of vase **A**

..... cm^3

(Total for Question 17 is 4 marks)

Question 18

4 marks | Area & Volume of Similar Shapes

18 The three solids **A**, **B** and **C** are similar such that

the surface area of **A** : the surface area of **B** = 4 : 9

and

the volume of **B** : the volume of **C** = 125 : 343

Work out the ratio

the height of **A** : the height of **C**

Give your ratio in its simplest form.

(Total for Question 18 is 4 marks)

Question 20

4 marks | Area & Volume of Similar Shapes

20 The diagram shows two similar metal statues.



A



B

Diagram **NOT** accurately drawn

The volume of statue **B** is 20% less than the volume of statue **A**

The surface area of statue **B** is k% less than the surface area of statue **A**

Work out the value of k
Give your answer correct to 3 significant figures.

$k =$ .....

(Total for Question 20 is 4 marks)

Question 24

6 marks | Area & Volume of Similar Shapes

24 The diagram shows a frustum of a cone, and a sphere.

The frustum, shown shaded in the diagram, is made by removing the small cone from the large cone.
The small cone and the large cone are similar.

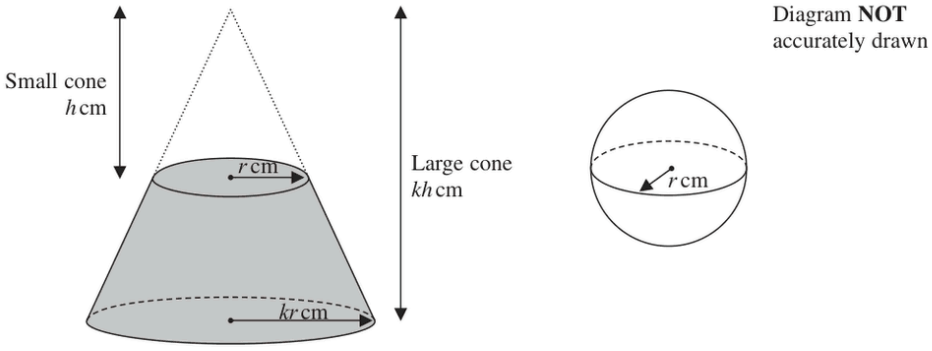


Diagram **NOT** accurately drawn

The height of the small cone is h cm and the radius of the base of the small cone is r cm.
The height of the large cone is kh cm and the radius of the base of the large cone is kr cm.
The radius of the sphere is r cm.

The sphere is divided into two hemispheres, each of radius r cm.

Solid **A** is formed by joining one of the hemispheres to the frustum.
The plane face of the hemisphere coincides with the upper plane face of the frustum, as shown in the diagram below.

Solid **B** is formed by joining the other hemisphere to the small cone that was removed from the large cone.
The plane face of the hemisphere coincides with the plane face of the base of the small cone, as shown in the diagram below.

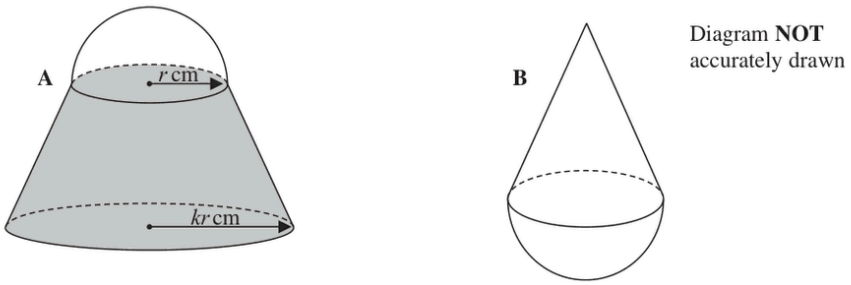


Diagram **NOT** accurately drawn

The volume of solid **A** is 6 times the volume of solid **B**.

Given that $k > \sqrt[3]{7}$

find an expression for h in terms of k and r

$h =$ .....

(Total for Question 24 is 6 marks)

Question 23

5 marks | Area & Volume of Similar Shapes

23 A frustum is made by removing a small square-based pyramid from a similar large squared-based pyramid as shown in the diagram.

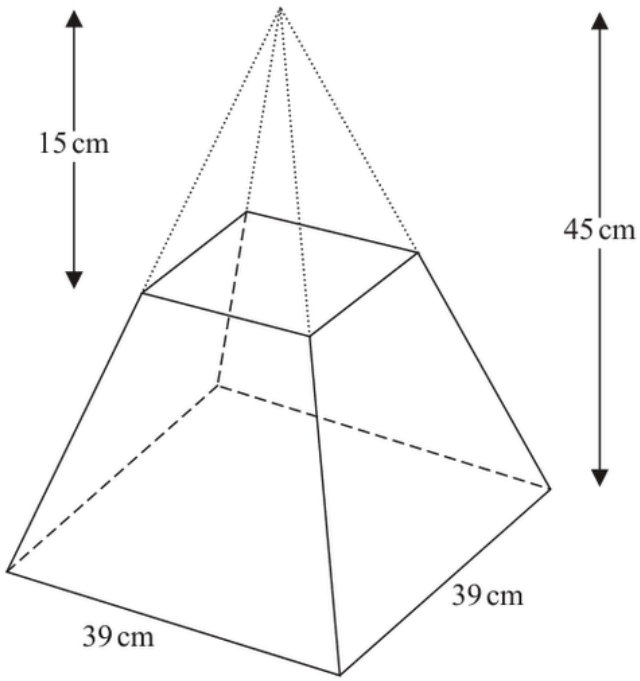


Diagram **NOT** accurately drawn

The height of the small pyramid is 15 cm.
The height of the large pyramid is 45 cm.
The square base of the large pyramid has side length 39 cm.

Work out the **total** surface area of the frustum.
Give your answer correct to the nearest whole number.

..... cm^2

(Total for Question 23 is 5 marks)

Question 23

5 marks | Area & Volume of Similar Shapes

23 Solid **A** is similar to solid **B**

Here is some information about solid **A** and solid **B**

	solid **A**	solid **B**
Height (cm)	3^x	
Area (cm^2)	7776	486
Volume (cm^3)	8^x	2^{x+4}

Work out the height of solid **B**
Give your answer as a decimal.

..... cm

(Total for Question 23 is 5 marks)

Question 23

5 marks | Area & Volume of Similar Shapes

23 Here is a frustum of a cone.
The frustum is made by removing a small cone from a similar large cone.

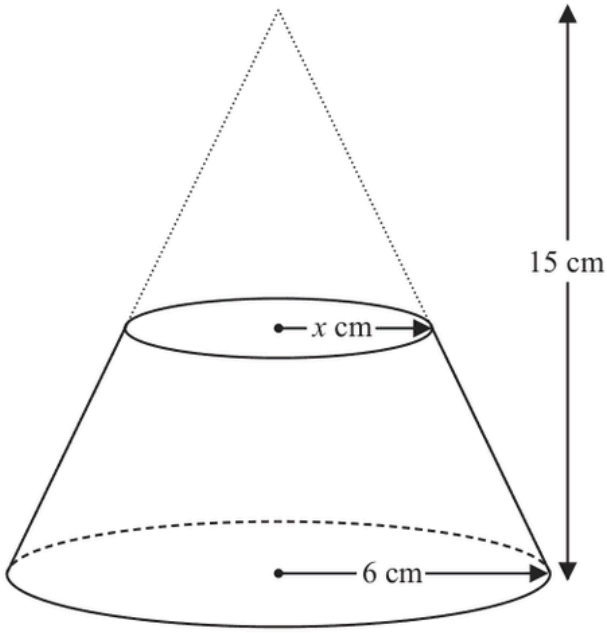


Diagram **NOT** accurately drawn

The height of the large cone is 15 cm.

The radius of the base of the large cone is 6 cm.
The radius of the base of the small cone is x cm.

Given that the volume of the frustum is $\frac{4212}{25}\pi$ cm^3

work out the value of x
Show clear algebraic working.

$x =$ .....

(Total for Question 23 is 5 marks)

Question 18

4 marks | Area & Volume of Similar Shapes

18 The diagram shows two similar vases, **A** and **B**

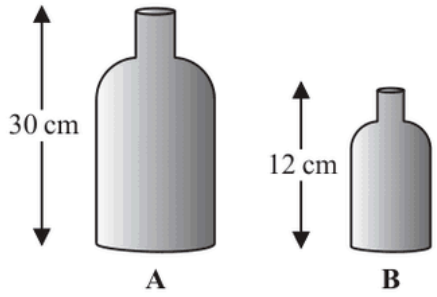


Diagram **NOT** accurately drawn

The height of vase **A** is 30 cm
The height of vase **B** is 12 cm

Given that

surface area of vase **A** – surface area of vase **B** = 178.5 cm²

find the surface area of vase **A**

..... cm²

(Total for Question 18 is 4 marks)

Question 24

5 marks | Area & Volume of Similar Shapes

24 The diagram shows a solid, **S**, made from a cone and a hemisphere.

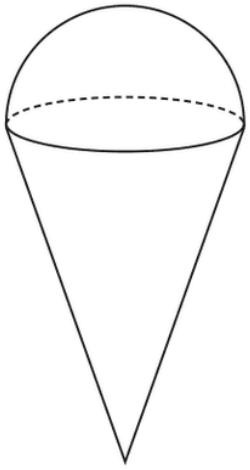


Diagram **NOT** accurately drawn

The centre of the circular face of the cone coincides with the centre of the flat surface of the hemisphere.

The radius of the circular face of the cone, x cm, is equal to the radius of the hemisphere.

The total height of **S** is 4 × the radius of the hemisphere.

A separate sphere has radius kx cm.
The volume of this sphere is 12.5 × the volume of **S**

(a) Work out the value of k

$k =$ .....

(4)

A solid, **T**, is similar to solid **S**

The volume of **T** is 512 × the volume of **S**

The total surface area of **T** is d × the total surface area of **S**

(b) Find the value of d

$d =$ .....

(1)

(Total for Question 24 is 5 marks)

Question 25

4 marks | Area & Volume of Similar Shapes

25 **A** and **B** are two similar solids.

The height of solid **A** is 31 cm
The height of solid **B** is 18.6 cm

Given that

volume of solid **A** − volume of solid **B** = 735 cm³

find the volume of solid **A**

..... cm³

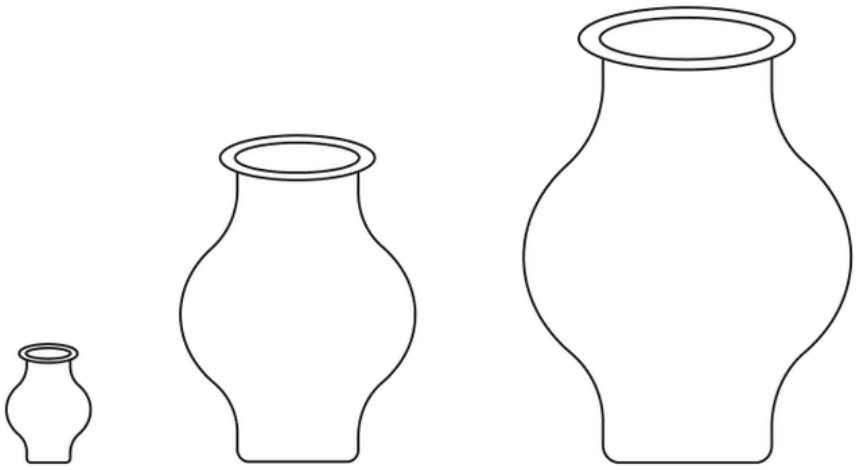
(Total for Question 25 is 4 marks)

Question 26

4 marks | Area & Volume of Similar Shapes

26 **R**, **S** and **T** are three similar vases.

Diagram **NOT** accurately drawn



The volume of vase **S** is 72.8% more than the volume of vase **R**

The height of vase **R** is h cm
The height of vase **T** is $6h$ cm

The surface area of vase **S** is A cm^2
The surface area of vase **T** is kA cm^2

Work out the value of k

$k =$ .....

(Total for Question 26 is 4 marks)

Question 26

4 marks | Area & Volume of Similar Shapes

26 **A** and **B** are two similar solids.

The height of solid **A** is 31 cm
The height of solid **B** is 18.6 cm

Given that

volume of solid **A** – volume of solid **B** = 735 cm³

find the volume of solid **A**

..... cm³

(Total for Question 26 is 4 marks)

Question 23

3 marks | Area & Volume of Similar Shapes

23 Shape **P** is similar to shape **Q**

The table shows some information about shape **P** and shape **Q**

	Surface area (cm^2)	**Volume (cm^3)**
Shape **P**	200	672
Shape **Q**	450	

Work out the volume of shape **Q**

..... cm^3

(Total for Question 23 is 3 marks)

Question 23

3 marks | Area & Volume of Similar Shapes

23 Shape **P** is similar to shape **Q**

The table shows some information about shape **P** and shape **Q**

	Surface area (cm^2)	**Volume (cm^3)**
Shape **P**	200	672
Shape **Q**	450	

Work out the volume of shape **Q**

..... cm^3

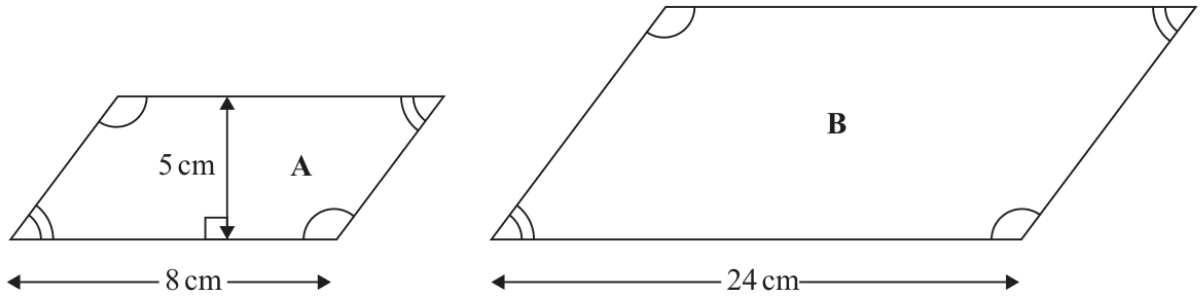
(Total for Question 23 is 3 marks)

Question 6

3 marks | Area & Volume of Similar Shapes

6

Diagram **NOT** accurately drawn



A and **B** are similar parallelograms.

Work out the area of **B**

..... cm^2

(Total for Question 6 is 3 marks)

Question 23

5 marks | Area & Volume of Similar Shapes

23 **K**, **L** and **M** are three similar solids.

volume of **K** : volume of **L** = 125 : 216

surface area of **K** : surface area of **M** = 4 : 9

The height of **M** is y% greater than the height of **L**

Work out the value of y
Show your working clearly.

$y =$ .....

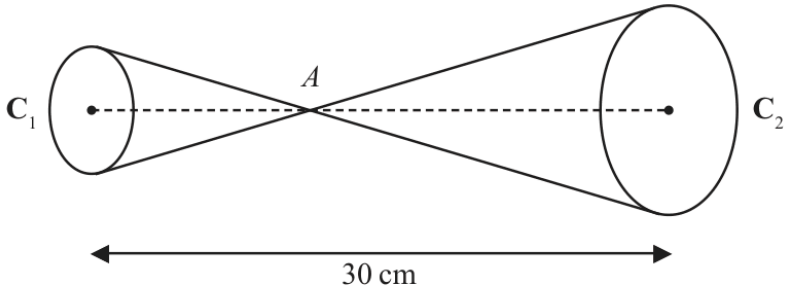
(Total for Question 23 is 5 marks)

Question 24

5 marks | Area & Volume of Similar Shapes

24 The diagram shows two cones $\mathbf{C}_1$ and $\mathbf{C}_2$

Diagram **NOT** accurately drawn



The vertex of $\mathbf{C}_1$ coincides with the vertex of $\mathbf{C}_2$ at the point A
$\mathbf{C}_1$ and $\mathbf{C}_2$ have the same axis of symmetry.

height of $\mathbf{C}_1$ + height of $\mathbf{C}_2$ = 30 cm

total surface area of $\mathbf{C}_1$: total surface area of $\mathbf{C}_2$ = 4 : 9

volume of $\mathbf{C}_1$ = 23.04π cm^3

Work out the radius of the base of $\mathbf{C}_2$
Show your working clearly.

..... cm

(Total for Question 24 is 5 marks)

TOPIC

Circle Theorems

Every past-paper question on this topic, 2020 to 2026.

Question 14

5 marks | Circle Theorems

14 A, B, C and D are points on a circle, centre O

EBF is the tangent to the circle at B

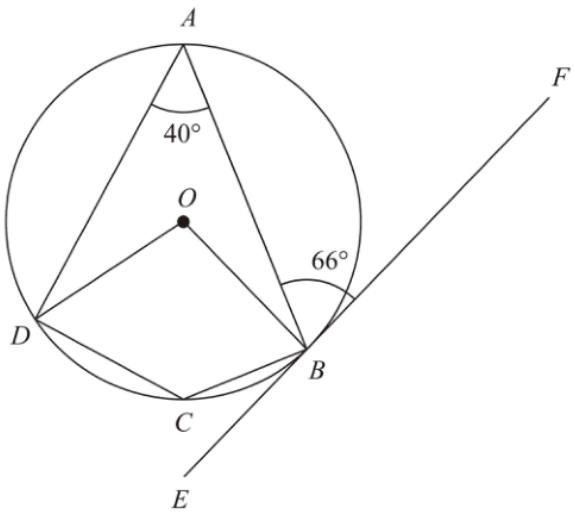


Diagram **NOT** accurately drawn

(a) (i) Work out the size of angle DCB

.....

(1)

(ii) Give a reason for your answer to (a)(i)

.....

.....

(1)

(b) Work out the size of angle ADO

..... °

(3)

(Total for Question 14 is 5 marks)

Question 13

4 marks | Circle Theorems

13

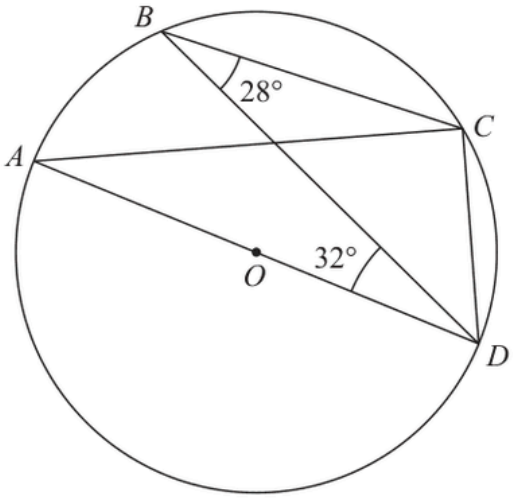


Diagram **NOT** accurately drawn

A, B, C and D are points on a circle, centre O.
AOD is a diameter of the circle.

Angle $CBD = 28°$
Angle $BDA = 32°$

Find the size of angle BDC.
Give a reason for each stage of your working.

.....°

(Total for Question 13 is 4 marks)

Question 14

4 marks | Circle Theorems

14

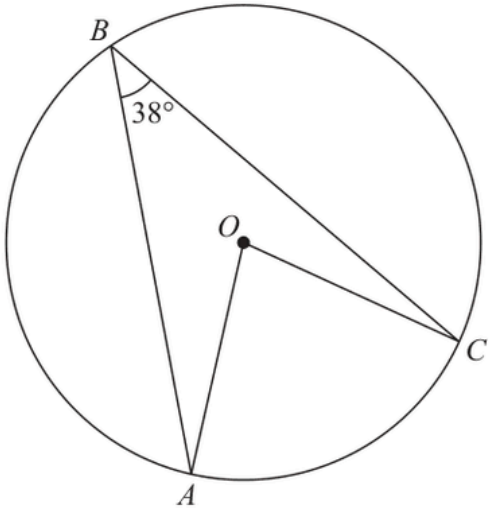


Diagram **NOT** accurately drawn

A, B and C are points on a circle, centre O.
Angle $ABC = 38°$

Work out the size of angle OAC.
Give a reason for each stage of your working.

.....°

(Total for Question 14 is 4 marks)

Question 18

2 marks | Circle Theorems

18

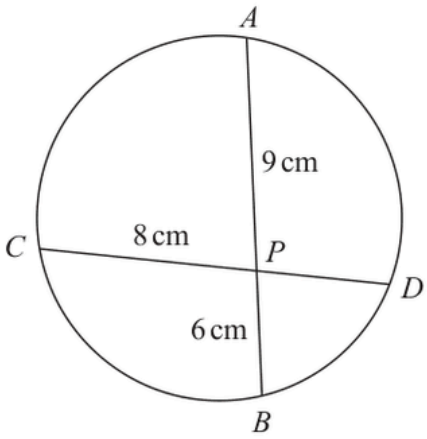


Diagram **NOT** accurately drawn

APB and *CPD* are chords of a circle.

$AP = 9\,\text{cm}$ $PB = 6\,\text{cm}$ $CP = 8\,\text{cm}$

Calculate the length of *PD*.

..... cm

(Total for Question 18 is 2 marks)

Question 15

4 marks | Circle Theorems

15

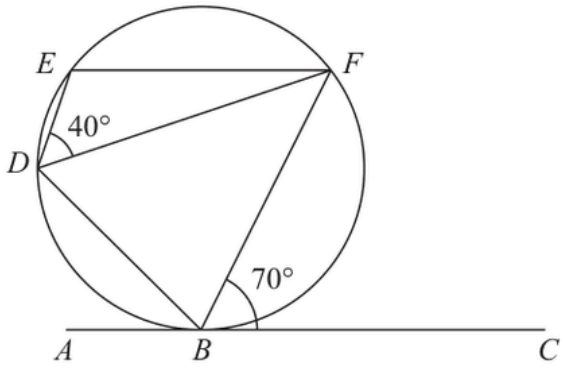


Diagram **NOT** accurately drawn

B, D, E and F are points on a circle.
ABC is the tangent to the circle at B.

Angle $EDF = 40°$
Angle $FBC = 70°$

Prove that the tangent ABC is parallel to EF.
Give a reason for each stage of your working.

(Total for Question 15 is 4 marks)

Question 16

4 marks | Circle Theorems

16

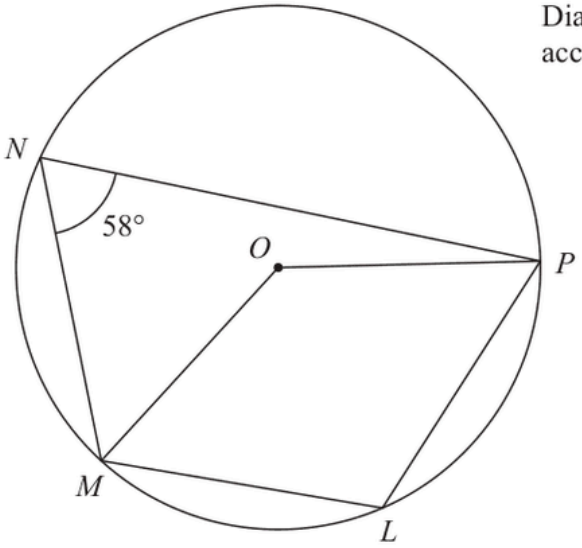


Diagram **NOT** accurately drawn

L, M, N and P are points on a circle, centre O

Angle $MNP = 58°$

(a) (i) Find the size of angle MLP

.....°

(ii) Give a reason for your answer.

.....

.....

(2)

(b) Find the size of the reflex angle MOP

.....°

(2)

(Total for Question 16 is 4 marks)

Question 13

3 marks | Circle Theorems

13 P, Q, R, S and T are points on a circle with centre O.

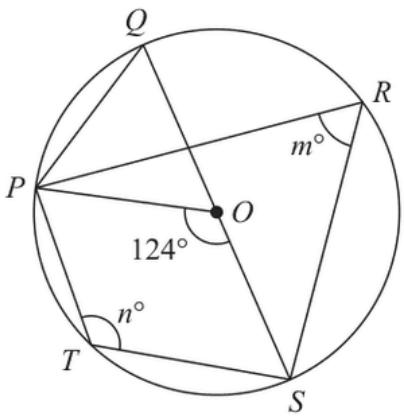


Diagram **NOT** accurately drawn

QOS is a diameter of the circle.

angle $POS = 124°$ angle $PRS = m°$ angle $PTS = n°$

(a) Find the value of

(i) m

.....

(ii) n

.....

(2)

(b) Find the size of angle QPO.

..... °

(1)

(Total for Question 13 is 3 marks)

Question 14

4 marks | Circle Theorems

14

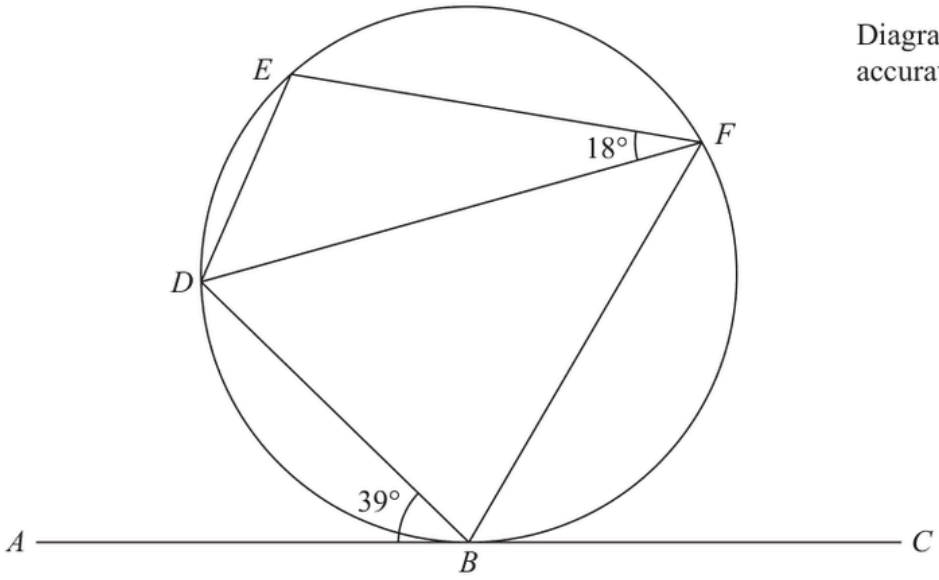


Diagram **NOT** accurately drawn

B, D, E and F are points on a circle.

ABC is the tangent at B to the circle.
Angle $ABD = 39°$
Angle $EFD = 18°$

Work out the size of angle BDE.
Give reasons for your working.

.....°

(Total for Question 14 is 4 marks)

Question 15

4 marks | Circle Theorems

15 P, Q and R are points on a circle, centre O.
TRV is the tangent to the circle at R.

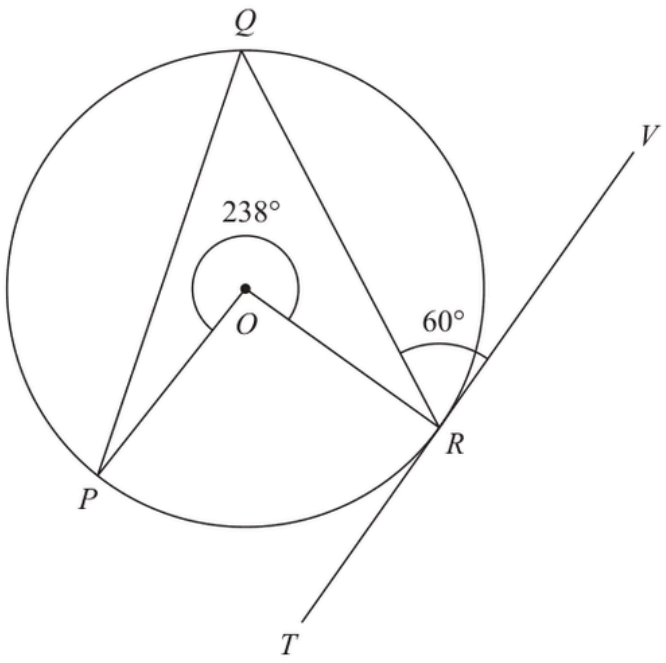


Diagram **NOT** accurately drawn

Reflex angle $POR = 238°$
Angle $QRV = 60°$

Calculate the size of angle OPQ.
Give a reason for each stage of your working.

.....°

(Total for Question 15 is 4 marks)

Question 18

6 marks | Circle Theorems

18

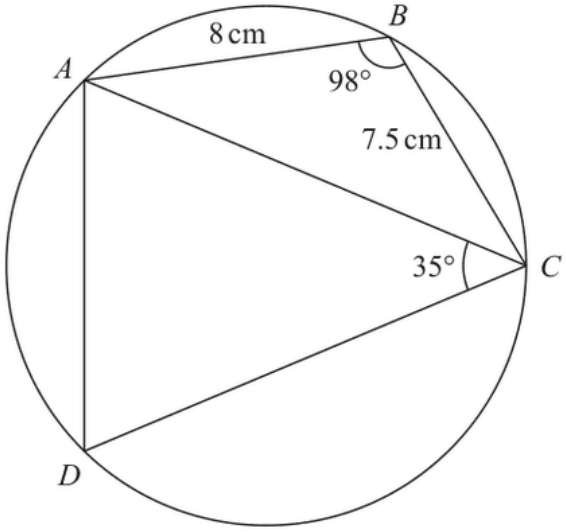


Diagram **NOT** accurately drawn

$ABCD$ is a quadrilateral where A, B, C and D are points on a circle.

$AB = 8$ cm
$BC = 7.5$ cm
Angle $ABC = 98°$
Angle $ACD = 35°$

Work out the perimeter of quadrilateral $ABCD$.
Give your answer correct to one decimal place.

..... cm

(Total for Question 18 is 6 marks)

Question 11

3 marks | Circle Theorems

11

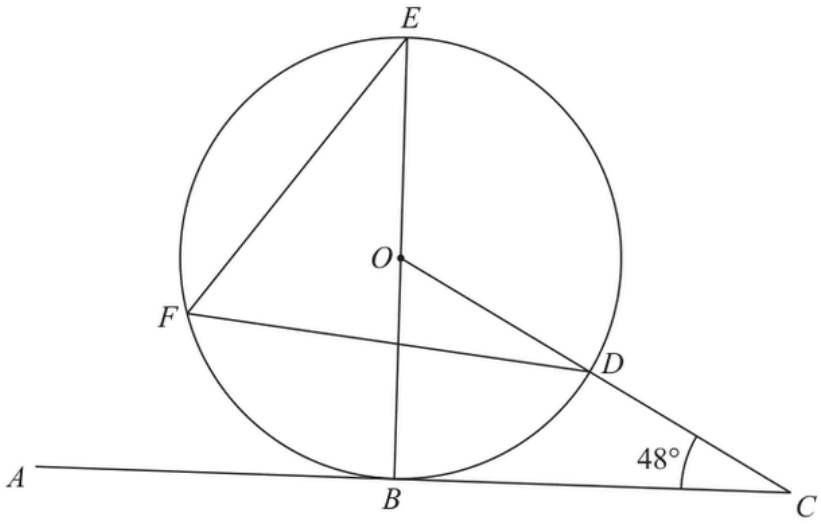


Diagram **NOT** accurately drawn

B, *D*, *E* and *F* are points on a circle, centre *O*.
ABC is a tangent to the circle.
ODC is a straight line.

BOE is a diameter of the circle.

Angle *BCD* = 48°

Find the size of angle *DFE*.

..... °

(Total for Question 11 is 3 marks)

Question 14

4 marks | Circle Theorems

14

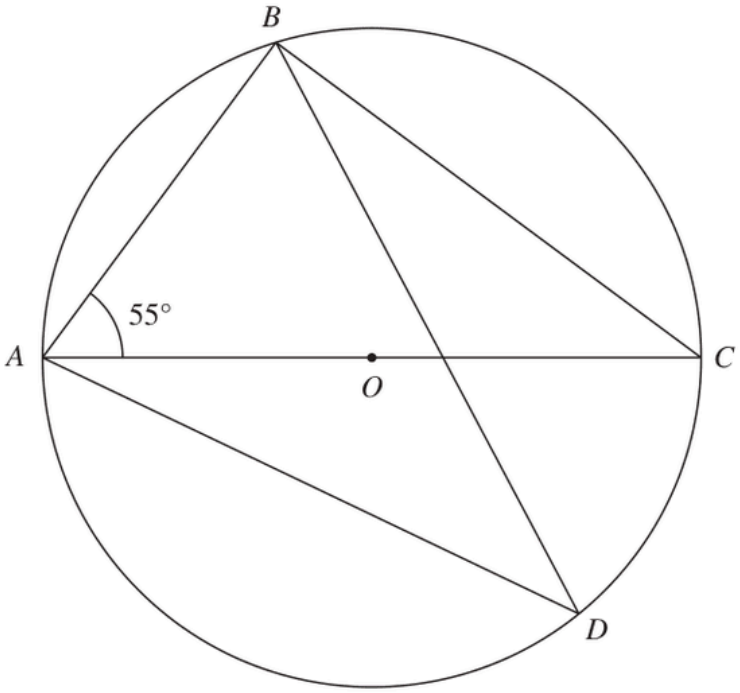


Diagram **NOT** accurately drawn

A, B, C and D are points on a circle, centre O
AOC is a diameter of the circle.

Angle $BAC = 55°$

Work out the size of angle ADB
Give a reason for each stage of your working.

.....°

(Total for Question 14 is 4 marks)

Question 16

4 marks | Circle Theorems

16 D, E, F and G are points on a circle, centre O

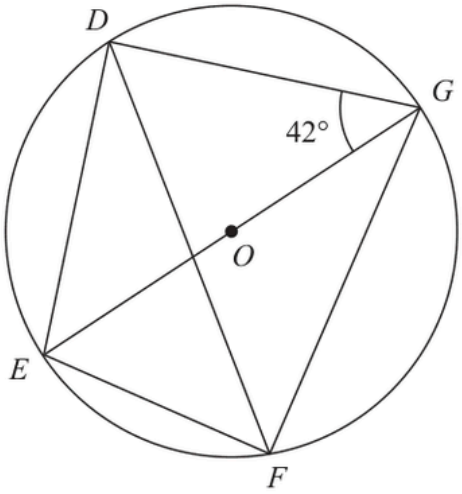


Diagram **NOT** accurately drawn

EOG is a diameter of the circle.

Angle $EGD = 42°$

Calculate the size of angle DFG
Give a reason for each stage of your working.

Angle DFG = ... °

(Total for Question 16 is 4 marks)

Question 19

3 marks | Circle Theorems

19

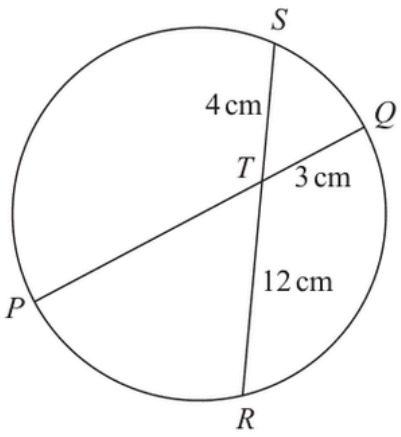


Diagram **NOT** accurately drawn

PTQ is a diameter of a circle.
RTS is a chord of the circle.

$TQ = 3\,\text{cm}$ $ST = 4\,\text{cm}$ $TR = 12\,\text{cm}$

Calculate the radius of the circle.

..... cm

(Total for Question 19 is 3 marks)

Question 15

3 marks | Circle Theorems

15

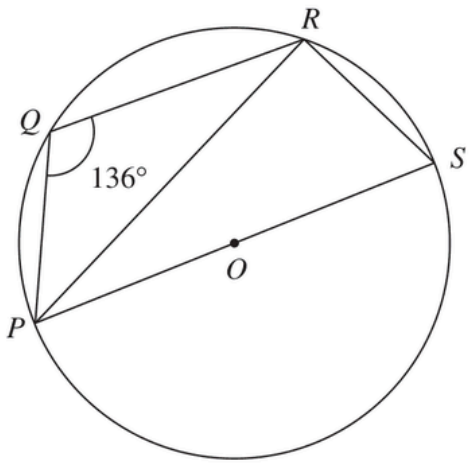


Diagram **NOT** accurately drawn

P, Q, R and S are points on a circle with centre O

PS is a diameter of the circle.

Angle $PQR = 136°$

Work out the size of angle RPS

.....°

(Total for Question 15 is 3 marks)

Question 7

3 marks | Circle Theorems

7

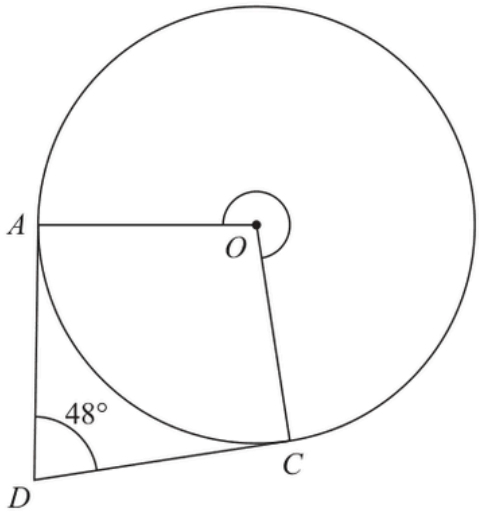


Diagram **NOT** accurately drawn

A and C are points on a circle, centre O
DA is the tangent to the circle at A and DC is the tangent to the circle at C

Angle $ADC = 48°$

Work out the size of reflex angle AOC

.....°

(Total for Question 7 is 3 marks)

Question 14

4 marks | Circle Theorems

14

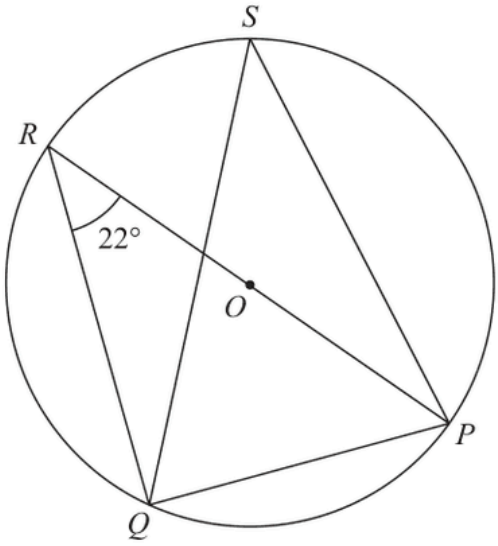


Diagram **NOT** accurately drawn

P, Q, R and S are points on a circle, centre O
ROP is a diameter of the circle.
Angle $PRQ = 22°$

(a) (i) Find the size of angle RQP

.....°

(1)

(ii) Give a reason for your answer.

.....

(1)

(b) (i) Find the size of angle PSQ

.....°

(1)

(ii) Give a reason for your answer.

.....

(1)

(Total for Question 14 is 4 marks)

Question 18

3 marks | Circle Theorems

18

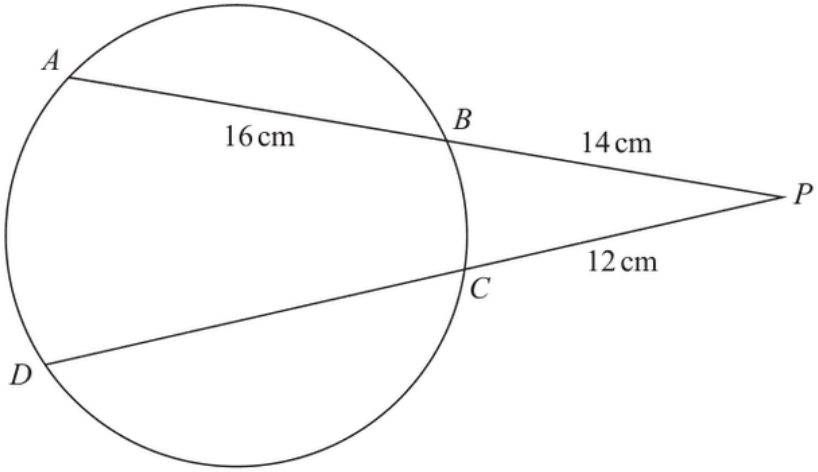


Diagram **NOT** accurately drawn

A, B, C and D are points on a circle.

ABP and DCP are straight lines.

$AB = 16\,\text{cm}$ $BP = 14\,\text{cm}$ $CP = 12\,\text{cm}$

Work out the length of DC

..... cm

(Total for Question 18 is 3 marks)

Question 20

2 marks | Circle Theorems

20 A, B and C are points on a circle.

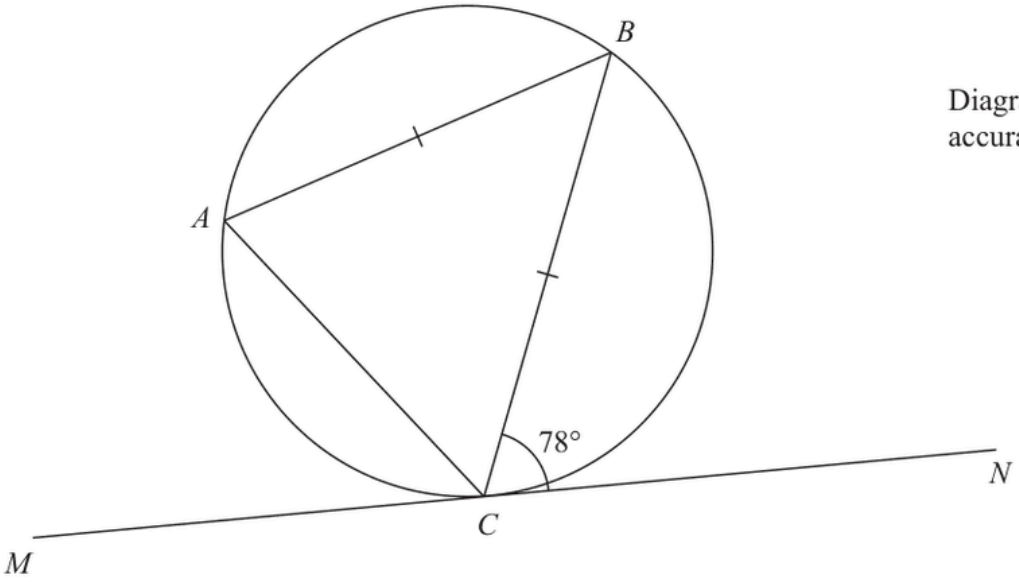


Diagram **NOT** accurately drawn

MN is the tangent to the circle at C

$AB = CB$

Angle $BCN = 78°$

Find the size of angle ABC

.....°

(Total for Question 20 is 2 marks)

Question 14

3 marks | Circle Theorems

14

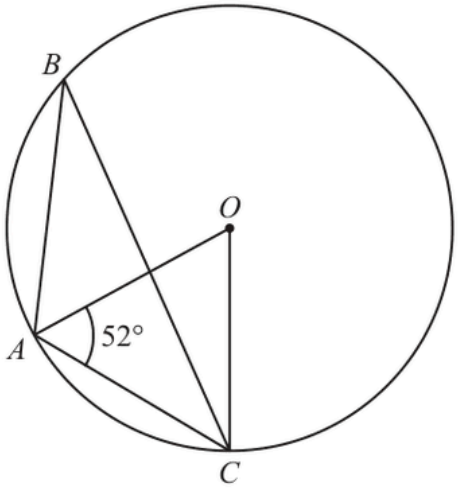


Diagram **NOT** accurately drawn

A, B and C are points on a circle, centre O

Angle $OAC = 52°$

Find the size of angle ABC
Give reasons for your working.

.....°

(Total for Question 14 is 3 marks)

Question 13

5 marks | Circle Theorems

13

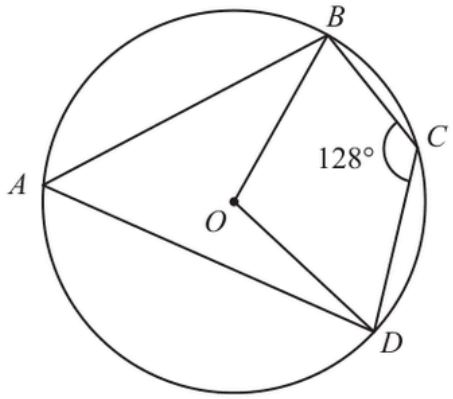


Diagram **NOT** accurately drawn

A, B, C and D are points on a circle, centre O

Angle $BCD = 128°$

Work out the size of angle OBD
Give a reason for each stage of your working.

angle OBD = ... °

(Total for Question 13 is 5 marks)

Question 16

5 marks | Circle Theorems

16 A, B, C and D are points on a circle, centre O

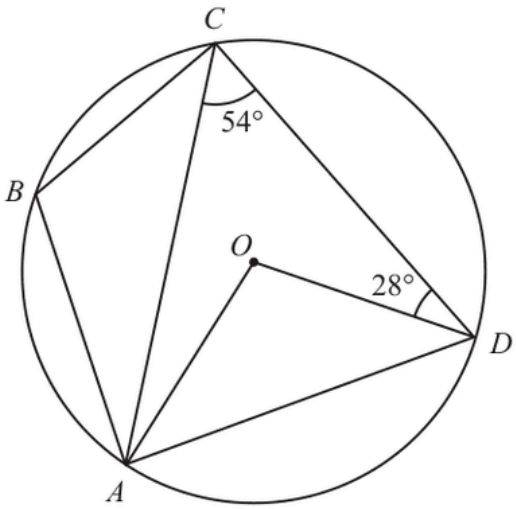


Diagram **NOT** accurately drawn

(a) (i) Work out the size of angle AOD

.....°

(1)

(ii) Give a reason for your answer to part (a)(i)

.....

(1)

(b) Work out the size of angle CAO

.....°

(1)

(c) Work out the size of angle ABC

.....°

(2)

(Total for Question 16 is 5 marks)

Question 13

4 marks | Circle Theorems

13 The diagram shows a circle, centre O

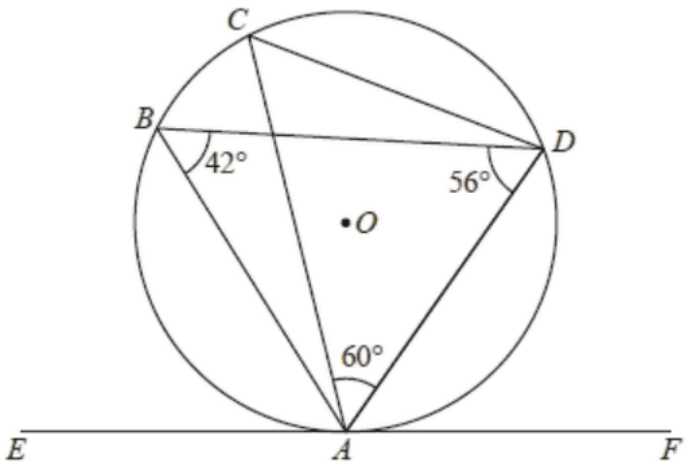


Diagram **NOT** accurately drawn

A, B, C and D are points on the circle.
EAF is the tangent to the circle at A

angle ABD = 42° **angle BDA = 56°** **angle CAD = 60°**

(a) (i) Find the size of angle EAB

..... °

(1)

(ii) Give a reason for your answer to (a) (i)

.....

.....

(1)

(b) Work out the size of angle CDB

..... °

(2)

(Total for Question 13 is 4 marks)

Question 15

3 marks | Circle Theorems

15 A, B and C are points on a circle, centre O

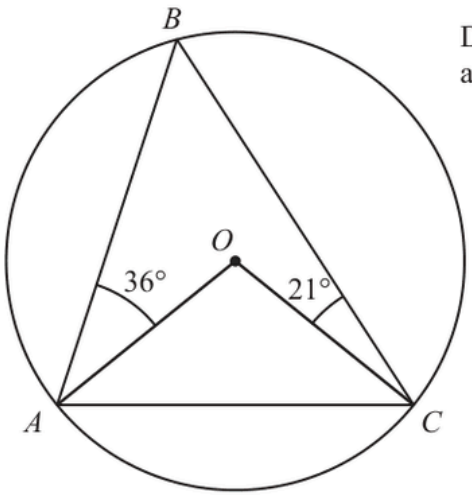


Diagram **NOT** accurately drawn

Angle $BAO = 36°$
Angle $BCO = 21°$

Work out the size of angle ACO

.....°

(Total for Question 15 is 3 marks)

Question 15

3 marks | Circle Theorems

15 A, B and C are points on a circle, centre O

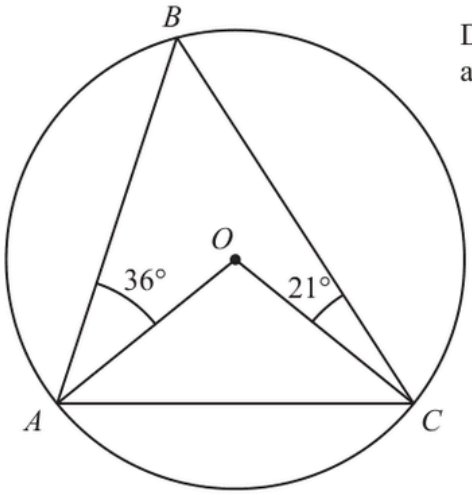


Diagram **NOT** accurately drawn

Angle $BAO = 36°$
Angle $BCO = 21°$

Work out the size of angle ACO

.....°

(Total for Question 15 is 3 marks)

Question 18

3 marks | Circle Theorems

18

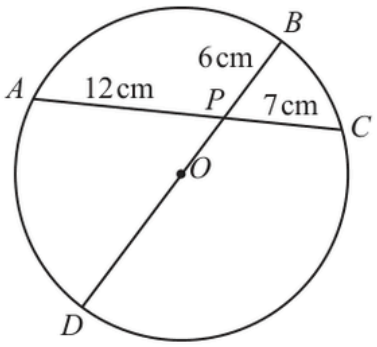


Diagram **NOT** accurately drawn

A, B, C and D are points on a circle, centre O

DB is a diameter of the circle.
AC and DB intersect at the point P

$AP = 12\,\text{cm}$ $PC = 7\,\text{cm}$ $PB = 6\,\text{cm}$

Work out the area of the circle.
Give your answer correct to 3 significant figures.

..... cm^2

(Total for Question 18 is 3 marks)

Question 23

5 marks | Circle Theorems

23

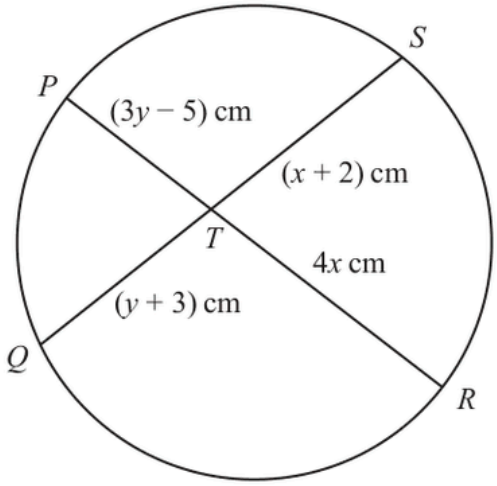


Diagram **NOT** accurately drawn

PTR and QTS are chords of a circle.

$PT = (3y - 5)\,\text{cm}$ $QT = (y + 3)\,\text{cm}$ $RT = 4x\,\text{cm}$ $ST = (x + 2)\,\text{cm}$

Find an expression for y in terms of x

$y =$ .....

Total for Question 23 is 5 marks)

Question 15

4 marks | Circle Theorems

15 A, B, C and D are points on a circle with centre O

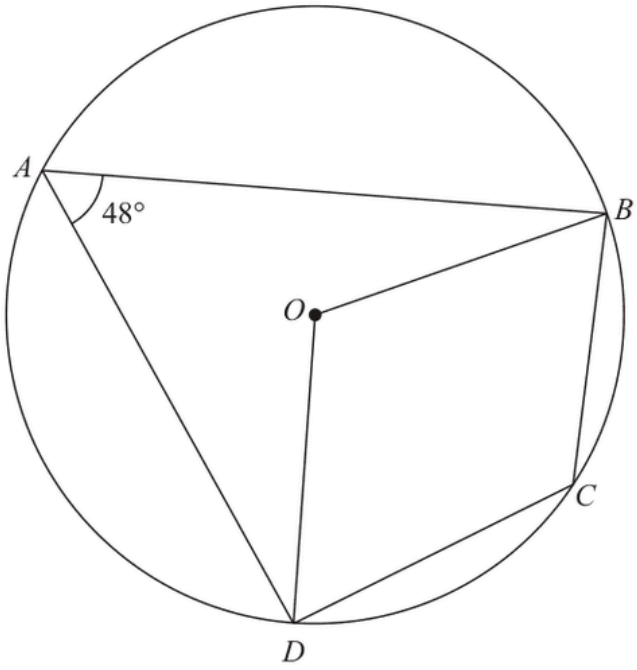


Diagram **NOT** accurately drawn

Angle $DAB = 48°$

(a) (i) Work out the size of the obtuse angle DOB

.....°

(1)

(ii) Give a reason for your answer.

.....

(1)

(b) (i) Work out the size of angle BCD

.....°

(1)

(ii) Give a reason for your answer.

.....

(1)

(Total for Question 15 is 4 marks)

Question 15

4 marks | Circle Theorems

15 A, B, C and D are points on a circle with centre O

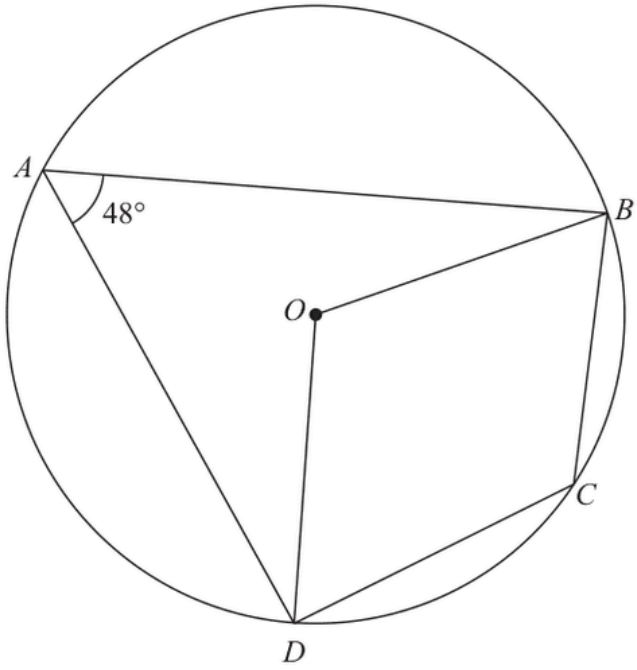


Diagram **NOT** accurately drawn

Angle $DAB = 48°$

(a) (i) Work out the size of the obtuse angle DOB

.....°

(1)

(ii) Give a reason for your answer.

.....

(1)

(b) (i) Work out the size of angle BCD

.....°

(1)

(ii) Give a reason for your answer.

.....

(1)

(Total for Question 15 is 4 marks)

Question 14

4 marks | Circle Theorems

14

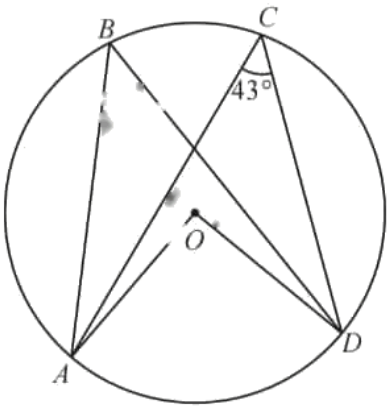


Diagram **NOT** accurately drawn

A, B, C and D are points on a circle, centre O

angle $ACD = 43°$

(a) (i) Find the size of angle ABD

..... °

(1)

(ii) Give a reason for your answer.

.....

.....

(1)

(b) Find the size of the reflex angle AOD

..... °

(2)

(Total for Question 14 is 4 marks)

Question 19

5 marks | Circle Theorems

19 P, Q, R and S are points on a circle, centre O

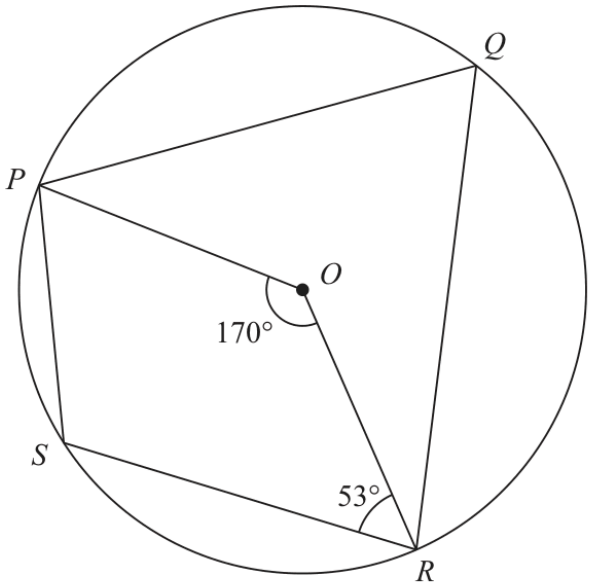


Diagram **NOT** accurately drawn

Angle $POR = 170°$ Angle $ORS = 53°$

Find the size of angle SPO
Give a reason for each stage of your working.

.....°

.....

(Total for Question 19 is 5 marks)

Question 19

2 marks | Circle Theorems

19 B, D and E are points on a circle.

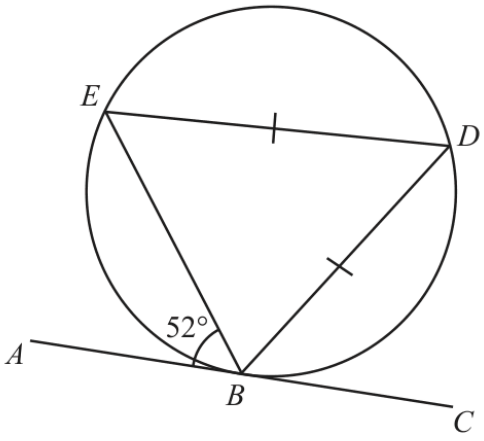


Diagram **NOT** accurately drawn

ABC is the tangent to the circle at B

angle $ABE = 52°$ $ED = BD$

Work out the size of angle BED

.....°

(Total for Question 19 is 2 marks)

4MA1/1HR JUNE 2026

Question 24

4 marks | Circle Theorems

24 The centre of a circle is the point with coordinates (3, 1)

The point P with coordinates (7, 6) lies on the circle.

The line **L** is the tangent to the circle at P

Find an equation for **L**
Give your answer in the form $ax + by + c = 0$ where a, b and c are integers.

.....

(Total for Question 24 is 4 marks)

TOPIC

Bearings

Every past-paper question on this topic, 2020 to 2026.

Question 16

5 marks | Bearings

16 The diagram shows the positions of three ships, A, B and C.

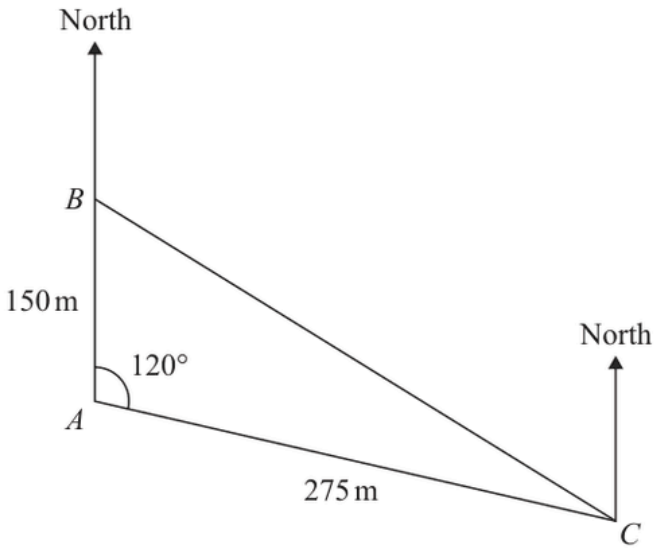


Diagram **NOT** accurately drawn

Ship B is due north of ship A.

The bearing of ship C from ship A is 120°

Calculate the bearing of ship C from ship B.
Give your answer correct to the nearest degree.

.....°

(Total for Question 16 is 5 marks)

Question 3

2 marks | Bearings

3 The bearing of Paris from London is 149°

Work out the bearing of London from Paris.

.....°

(Total for Question 3 is 2 marks)

Question 18

5 marks | Bearings

18 The diagram shows the positions of three villages, A, B and C

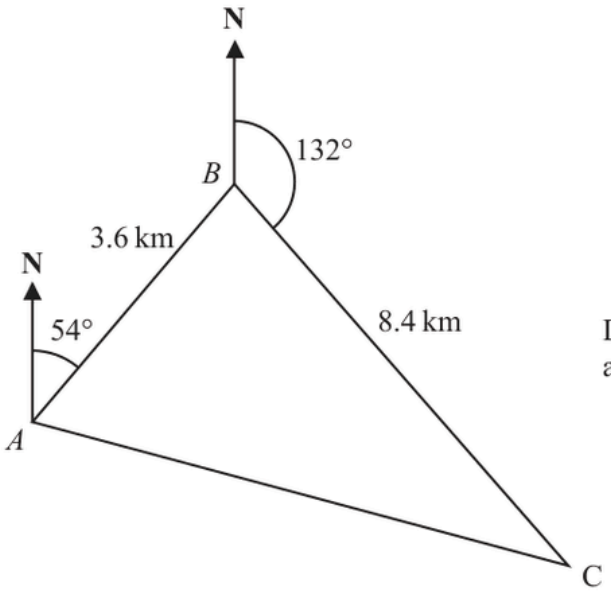


Diagram **NOT** accurately drawn

The bearing of B from A is 054°
The bearing of C from B is 132°

Melur walks from A to B
She then walks from B to C and from C to A

Melur walks at an average speed of 6 km/h

Work out the total time Melur takes.
Give your answer in hours and minutes.

..... hours ..... minutes

(Total for Question 18 is 5 marks)

Question 24

6 marks | Bearings

24 A, B and C are three points on horizontal ground.

$AB = 8.4$ metres $BC = 9.2$ metres

B is on a bearing of 067° from A
C is on a bearing of 129° from B

Calculate the bearing of A from C
Give your answer correct to the nearest degree.

.....°

(Total for Question 24 is 6 marks)

TOPIC

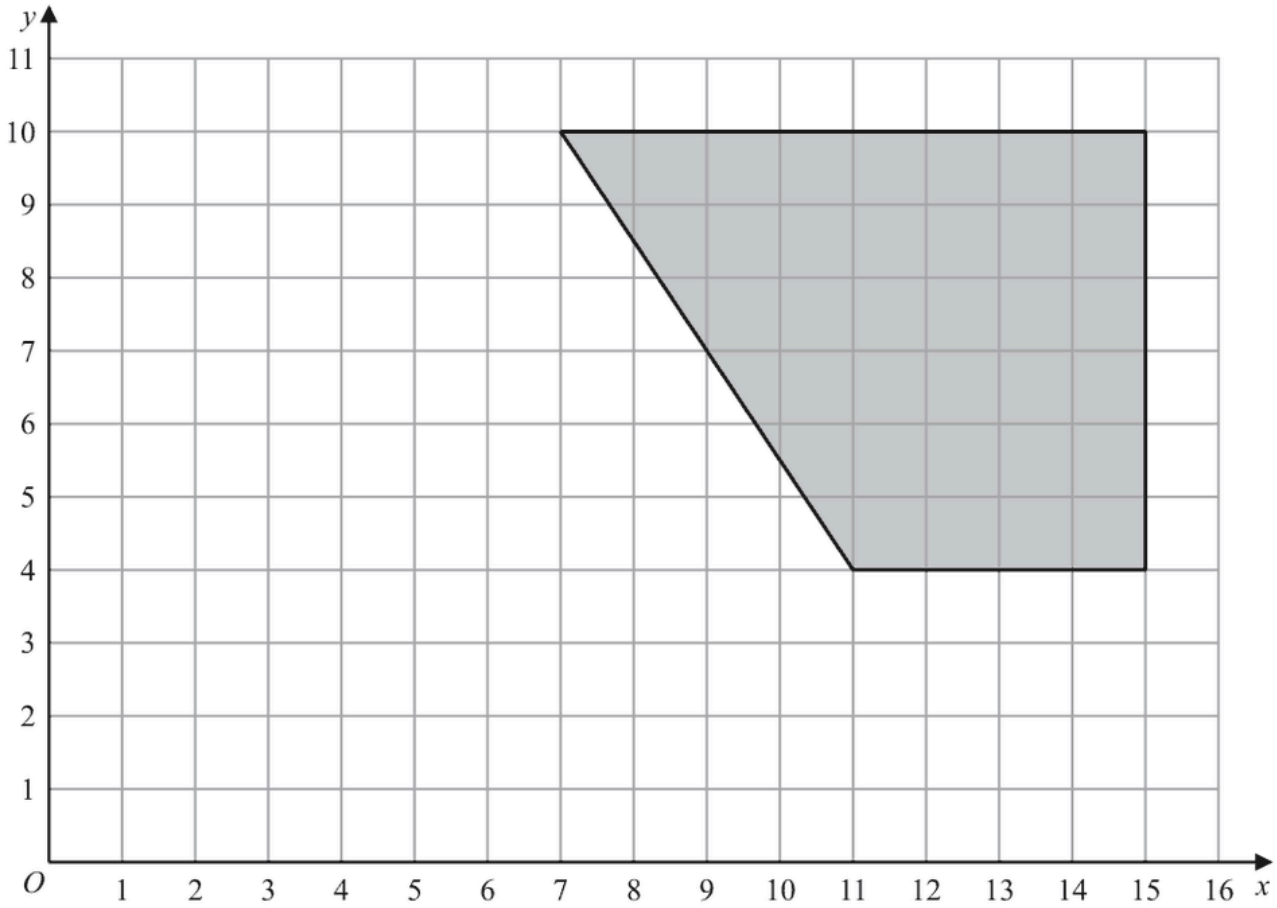
Transformations

Every past-paper question on this topic, 2020 to 2026.

Question 8

2 marks | Transformations

8



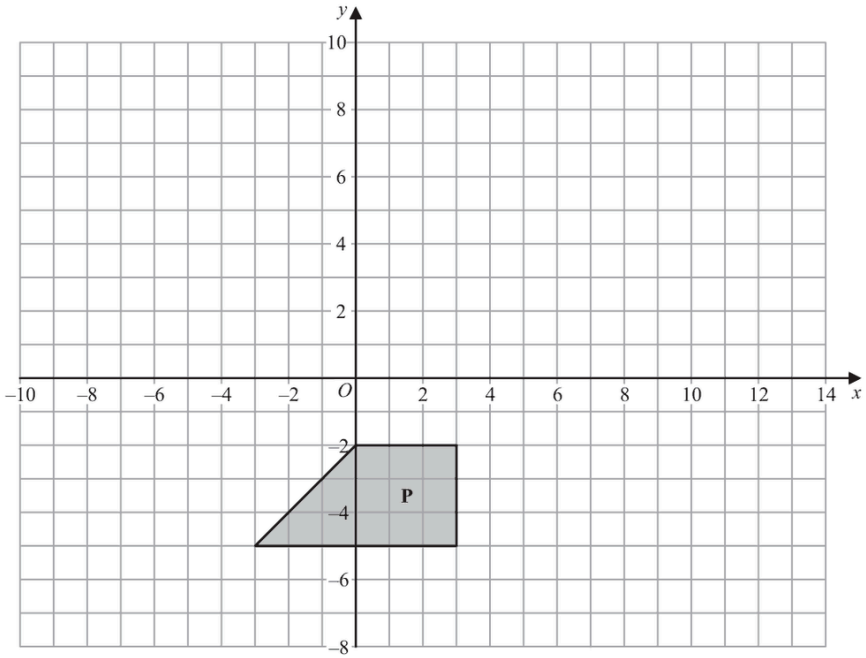
On the grid, enlarge the shaded shape with scale factor $\frac{1}{2}$ and centre (1, 2)

(Total for Question 8 is 2 marks)

Question 5

6 marks | Transformations

5 Here is a shape **P** drawn on a grid of squares.



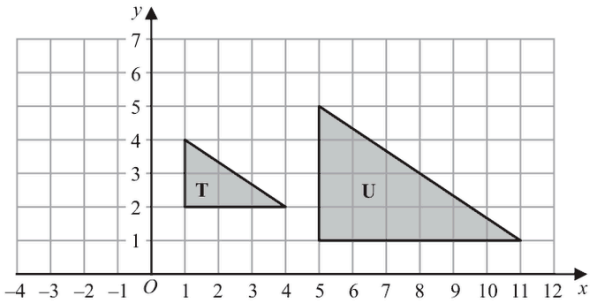
(a) On the grid, rotate shape **P** 180° about the point (–3, 2)
Label the new shape **Q**.

(2)

(b) On the grid, translate shape **P** by the vector $\begin{pmatrix} 10 \\ 8 \end{pmatrix}$
Label the new shape **R**.

(1)

Here are triangle **T** and triangle **U** drawn on a grid of squares.



(c) Describe fully the single transformation that maps triangle **T** onto triangle **U**.

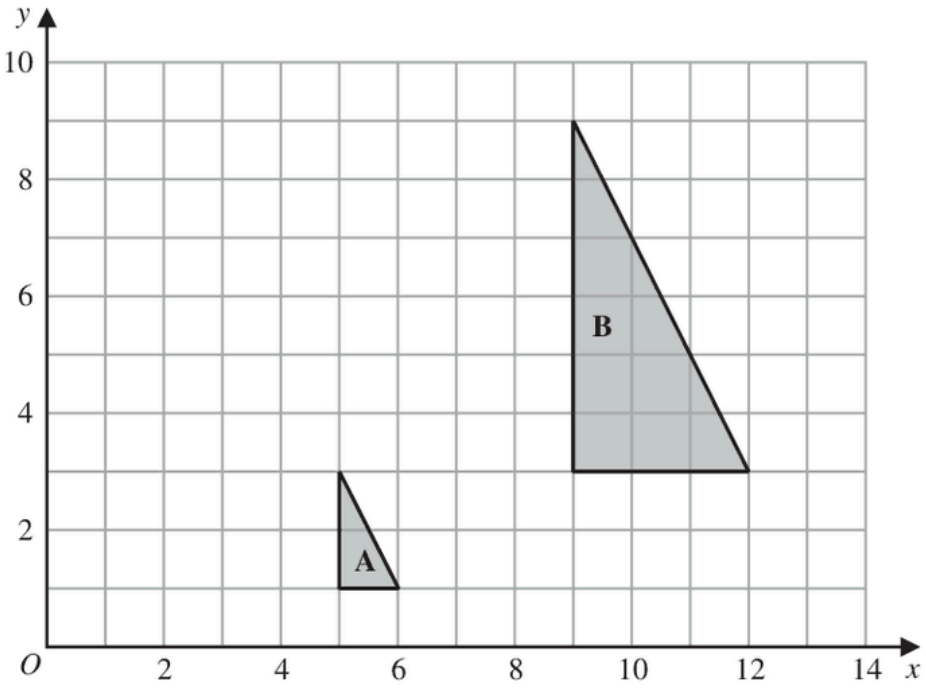
(3)

(Total for Question 5 is 6 marks)

Question 1

4 marks | Transformations

1



(a) Describe fully the single transformation that maps triangle **A** onto triangle **B**

.....

.....

(3)

(b) On the grid above, translate triangle **A** by the vector $\begin{pmatrix} -4 \\ 3 \end{pmatrix}$

Label your triangle **C**

(1)

(Total for Question 1 is 4 marks)

Question 4

8 marks | Transformations

4 The diagram shows a sketch of triangle **A** and triangle **B** on a coordinate grid.

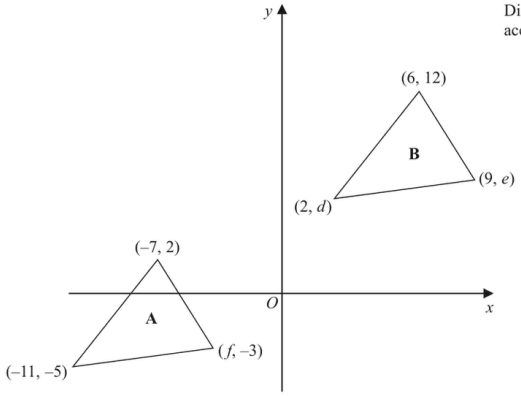


Diagram **NOT** accurately drawn

(a) Given that triangle **A** has been translated to give triangle **B**, work out the value of d, the value of e and the value of f

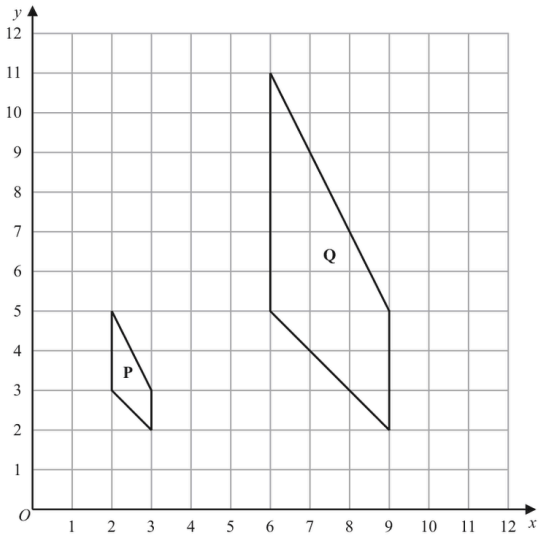
$d =$ .....

$e =$ .....

$f =$ .....

(3)

The diagram shows shape **P** and shape **Q** drawn on a grid.



(b) Describe fully the single transformation that maps shape **P** onto shape **Q**

.....

(3)

(c) On the grid above, rotate shape **P** 90° clockwise about (3, 5)
Label your shape **R**

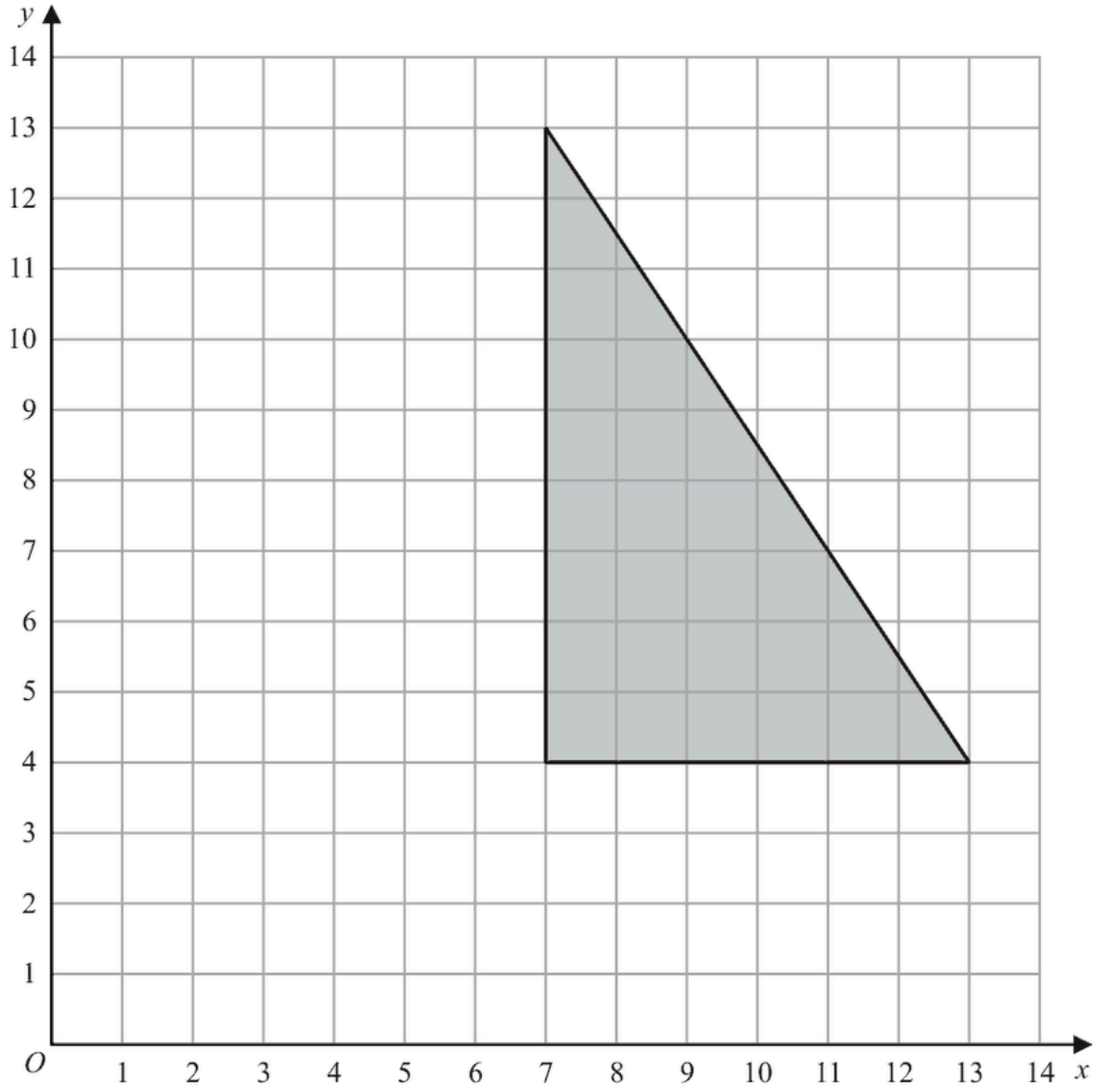
(2)

(Total for Question 4 is 8 marks)

Question 10

2 marks | Transformations

10



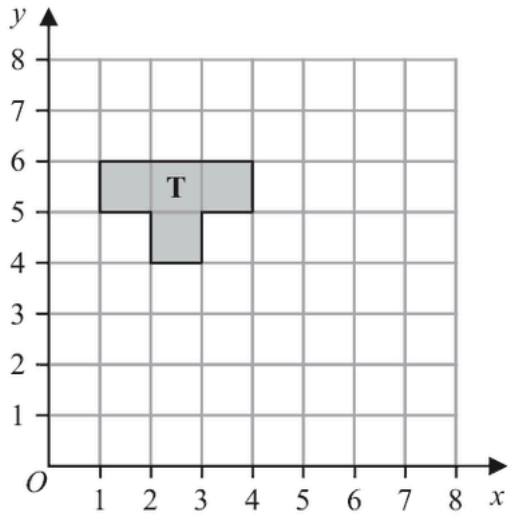
On the grid, enlarge the shaded shape with scale factor $\frac{1}{3}$ and centre (1, 7)

(Total for Question 10 is 2 marks)

Question 3

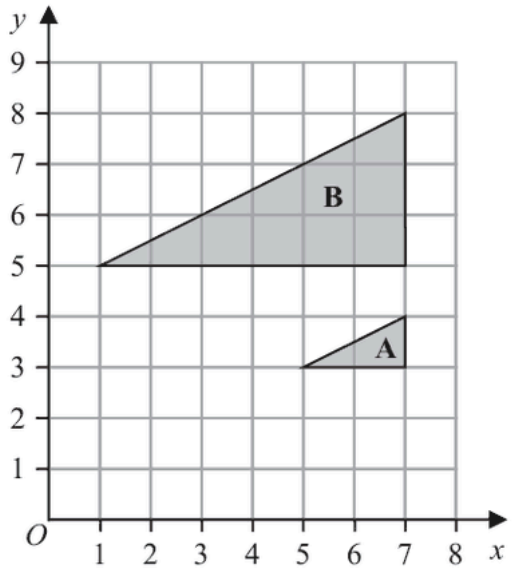
5 marks | Transformations

3



(a) Reflect shape **T** in the line $y = x$

(2)



(b) Describe fully the single transformation that maps triangle **A** onto triangle **B**

.....

.....

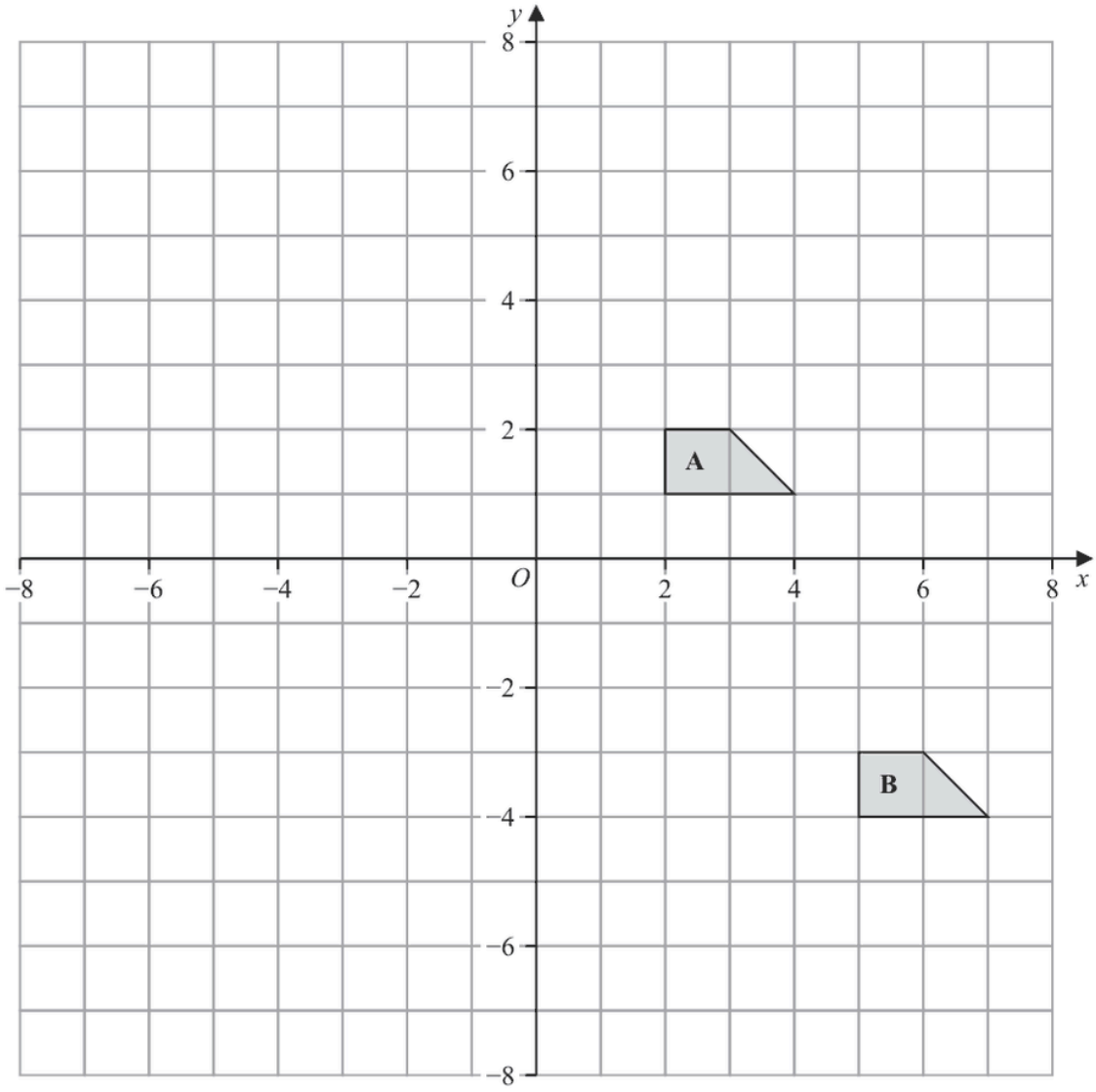
(3)

(Total for Question 3 is 5 marks)

Question 2

4 marks | Transformations

2



(a) Describe fully the single transformation that maps shape **A** onto shape **B**

.....

.....

(2)

(b) On the grid above, rotate shape **A** 180° about (−1, 0)
Label your shape **C**

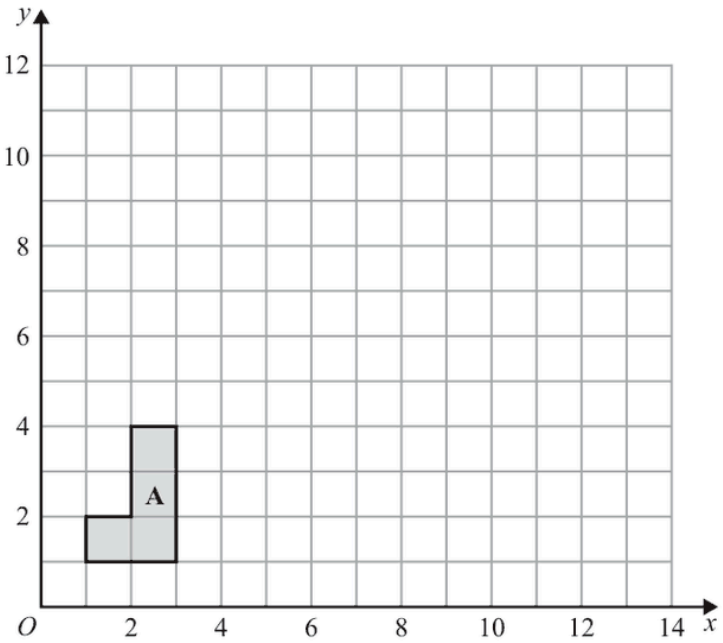
(2)

(Total for Question 2 is 4 marks)

Question 2

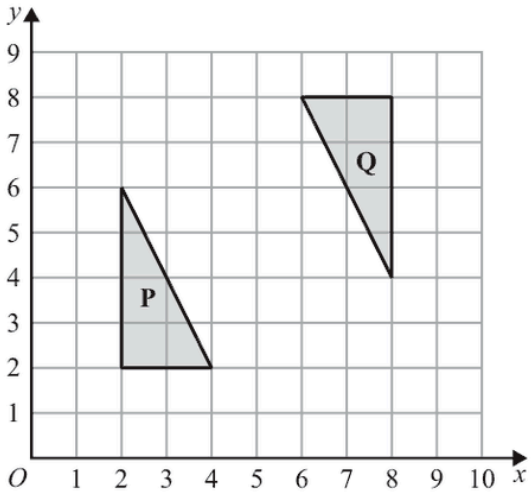
5 marks | Transformations

2



(a) On the grid, enlarge shape **A** with scale factor 3 and centre (0, 1)

(2)



(b) Describe fully the single transformation that maps triangle **P** onto triangle **Q**

.....

.....

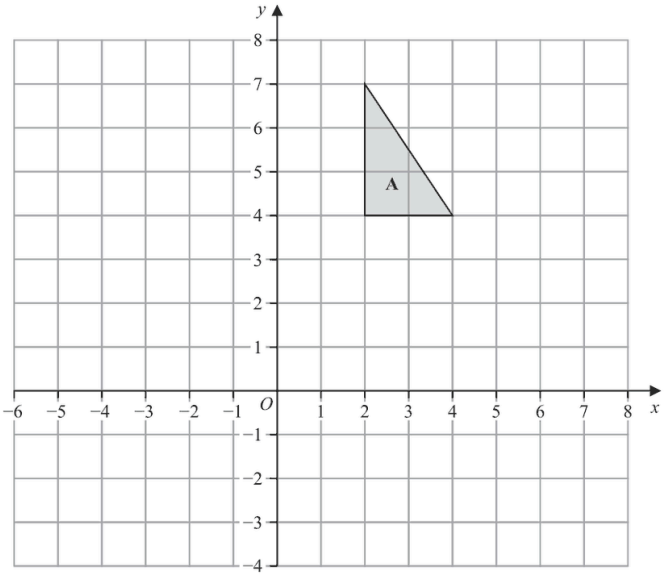
(3)

(Total for Question 2 is 5 marks)

Question 4

4 marks | Transformations

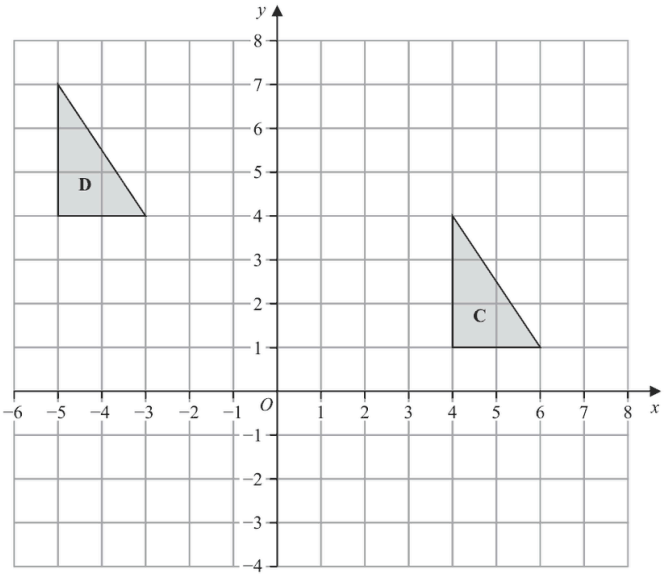
4



(a) On the grid above, rotate triangle **A** 90° anticlockwise about $(1, 2)$

Label your triangle **B**

(2)



(b) Describe fully the single transformation that maps triangle **C** onto triangle **D**

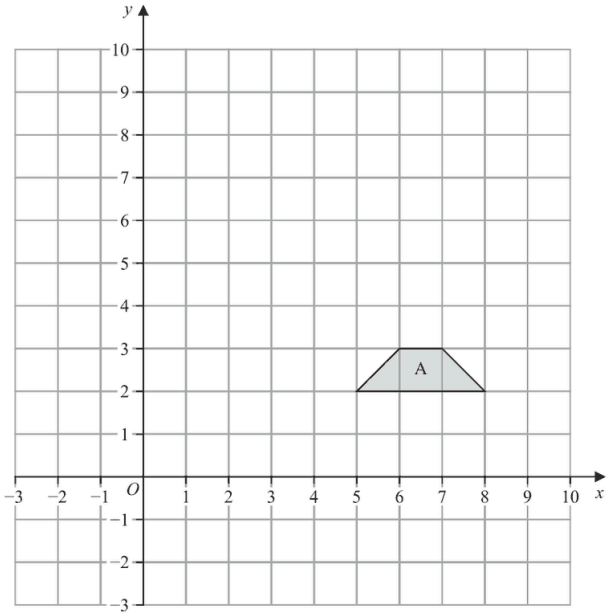
(2)

(Total for Question 4 is 4 marks)

Question 5

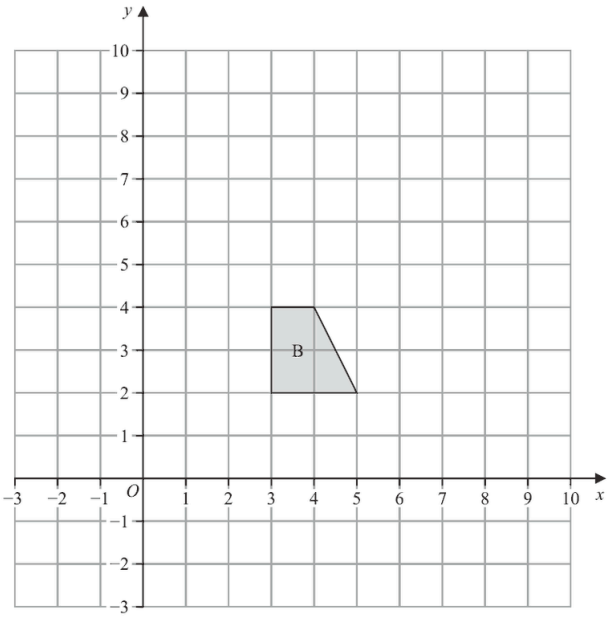
4 marks | Transformations

5



(a) On the grid above, reflect shape **A** in the line $y = x$

(2)



(b) On the grid above, enlarge shape **B** by scale factor 2 with centre (1, 1)

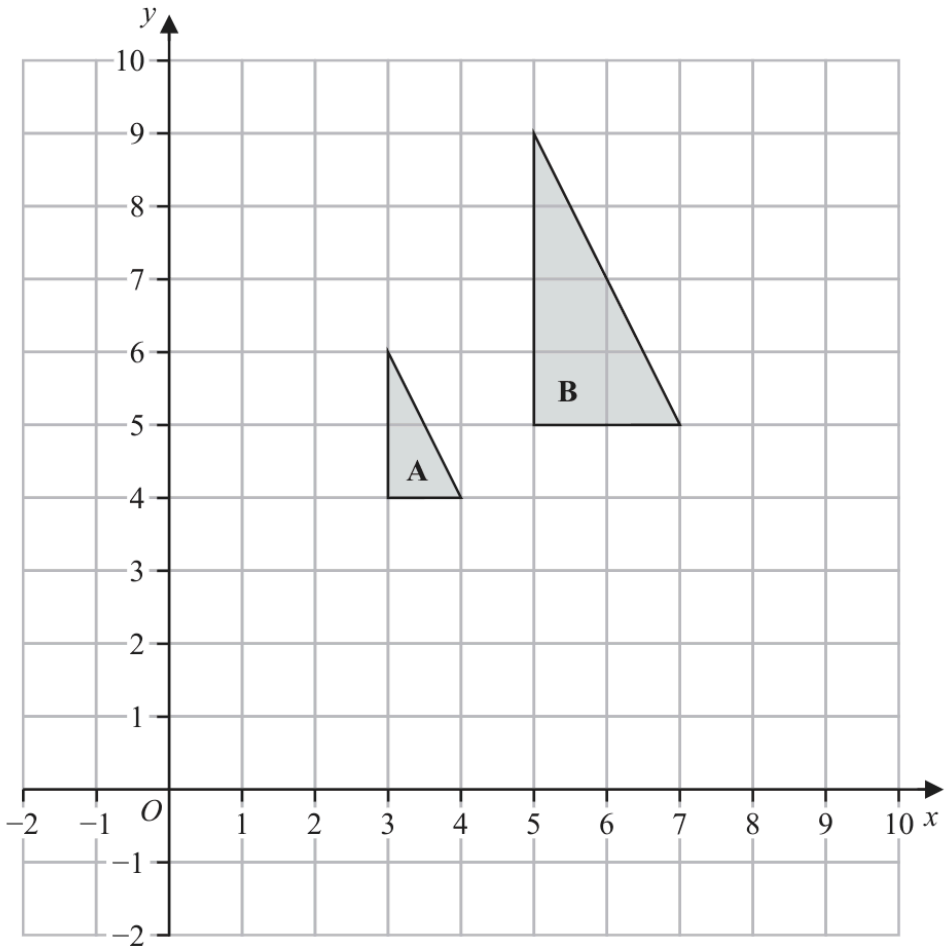
(2)

(Total for Question 5 is 4 marks)

Question 5

4 marks | Transformations

5



(a) Describe fully the single transformation that maps triangle **A** onto triangle **B**

.....

.....

(3)

(b) On the grid, translate triangle **A** by the vector $\begin{pmatrix} 4 \\ -3 \end{pmatrix}$

Label your triangle **C**

(1)

(Total for Question 5 is 4 marks)

TOPIC

Vectors

Every past-paper question on this topic, 2020 to 2026.

Question 23

5 marks | Vectors

23

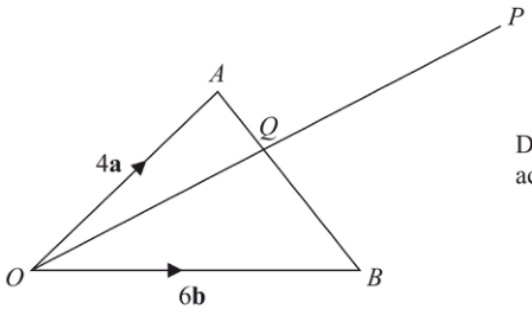


Diagram **NOT** accurately drawn

OAB is a triangle.
Q is the point on AB such that OQP is a straight line.

$\overrightarrow{OA} = \mathbf{4a}$ $\overrightarrow{OB} = \mathbf{6b}$ $\overrightarrow{AP} = \mathbf{2a} + \mathbf{8b}$

Using a vector method, find the ratio $AQ : QB$

$AQ : QB =$ .....

(Total for Question 23 is 5 marks)

Question 23

3 marks | Vectors

23

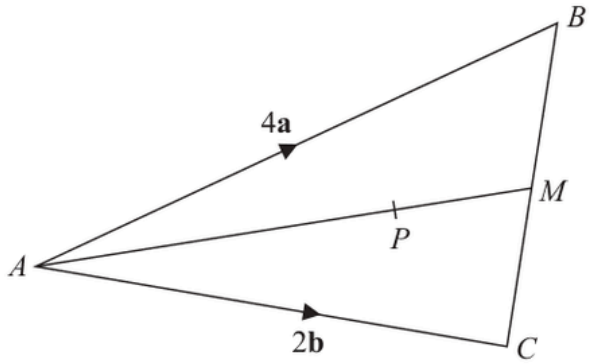


Diagram **NOT** accurately drawn

ABC is a triangle.
The midpoint of BC is M.
P is a point on AM.

$\overrightarrow{AB} = 4\mathbf{a}$

$\overrightarrow{AC} = 2\mathbf{b}$

$\overrightarrow{AP} = \frac{3}{2}\mathbf{a} + \frac{3}{4}\mathbf{b}$

Find the ratio $AP : PM$

(Total for Question 23 is 3 marks)

Question 26

5 marks | Vectors

26 The diagram shows trapezium $OACB$.

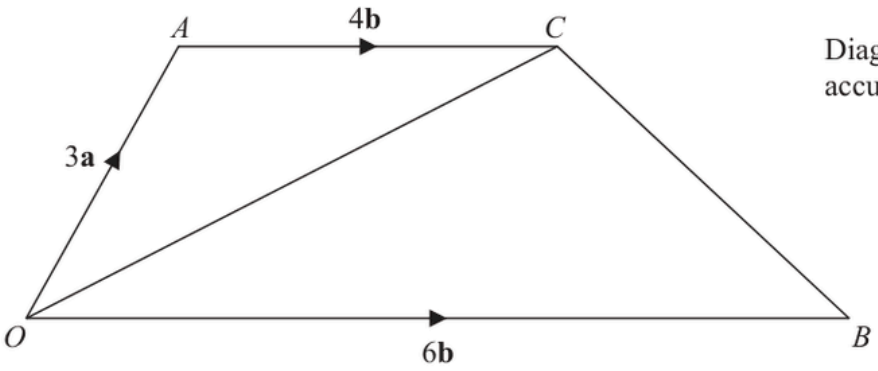


Diagram **NOT** accurately drawn

$\overrightarrow{OA} = 3\mathbf{a}$ $\overrightarrow{OB} = 6\mathbf{b}$ $\overrightarrow{AC} = 4\mathbf{b}$

N is the point on OC such that ANB is a straight line.

Find $\overrightarrow{ON}$ as a simplified expression in terms of **a** and **b**.

(Total for Question 26 is 5 marks)

Question 13

2 marks | Vectors

13 Here are two vectors.

$$\overrightarrow{AB} = \begin{pmatrix} 5 \\ 3 \end{pmatrix} \qquad \overrightarrow{CB} = \begin{pmatrix} -2 \\ 4 \end{pmatrix}$$

Find, as a column vector, $\overrightarrow{AC}$

(Total for Question 13 is 2 marks)

Question 23

6 marks | Vectors

23 OAB is a triangle.

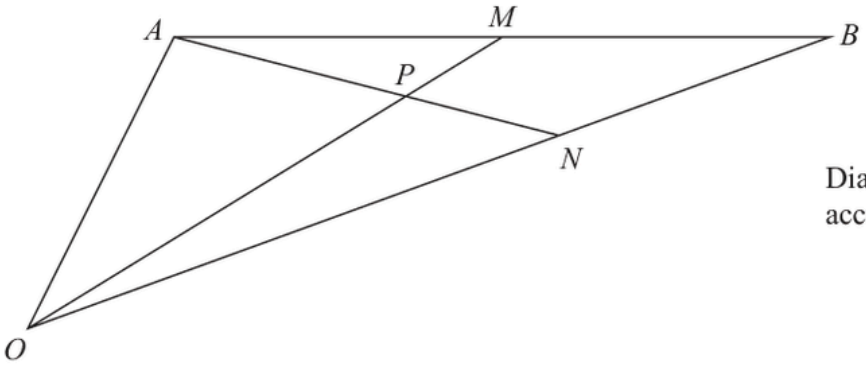


Diagram **NOT** accurately drawn

$\overrightarrow{OA} = 2\mathbf{a}$ and $\overrightarrow{OB} = 2\mathbf{b}$

M is the midpoint of AB.
N is the point on OB such that $ON : NB = 2 : 1$

P is the point on AN such that OPM is a straight line.

Use a vector method to find $OP : PM$
Show your working clearly.

(Total for Question 23 is 6 marks)

Question 26

5 marks | Vectors

26 $OACB$ is a trapezium.

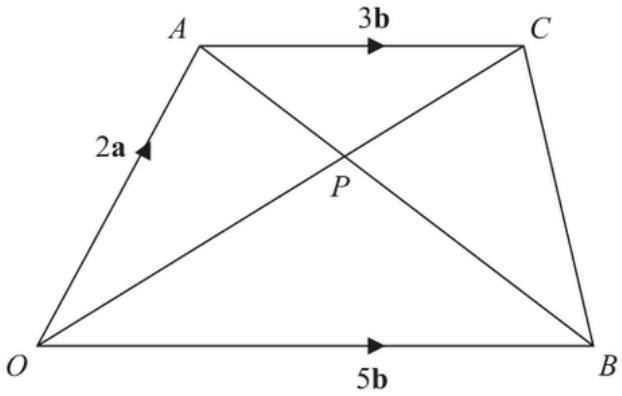


Diagram **NOT** accurately drawn

$\overrightarrow{OA} = \mathbf{2a}$ $\overrightarrow{OB} = \mathbf{5b}$ $\overrightarrow{AC} = \mathbf{3b}$

The diagonals, OC and AB, of the trapezium intersect at the point P.

Find and simplify an expression, in terms of **a** and **b**, for $\overrightarrow{OP}$
Show your working clearly.

$\overrightarrow{OP} =$ .....

(Total for Question 26 is 5 marks)

Question 14

8 marks | Vectors

14 *ABCDEF* and *GHIJKL* are regular hexagons each with centre *O*.

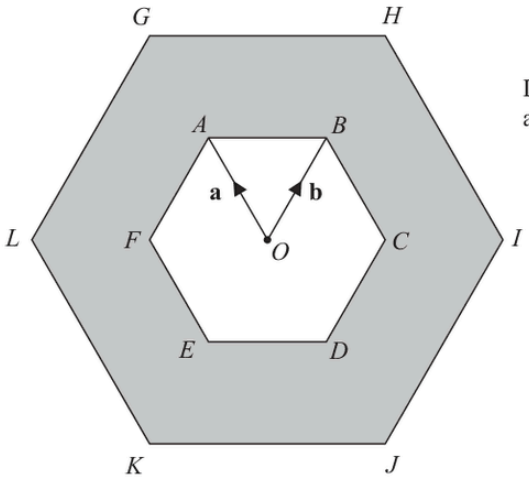


Diagram **NOT** accurately drawn

GHIJKL is an enlargement of *ABCDEF*, with centre *O* and scale factor 2

$\overrightarrow{OA} = \mathbf{a}$ $\overrightarrow{OB} = \mathbf{b}$

(a) Write the following vectors, in terms of **a** and **b**.
Simplify your answers.

(i) $\overrightarrow{AB}$

.....

(1)

(ii) $\overrightarrow{KI}$

.....

(2)

(iii) $\overrightarrow{LD}$

.....

(2)

The triangle *OAB* has an area of 5 cm^2

(b) Calculate the area of the shaded region.

..... cm^2

(3)

(Total for Question 14 is 8 marks)

Question 22

5 marks | Vectors

22 The diagram shows triangle OAB

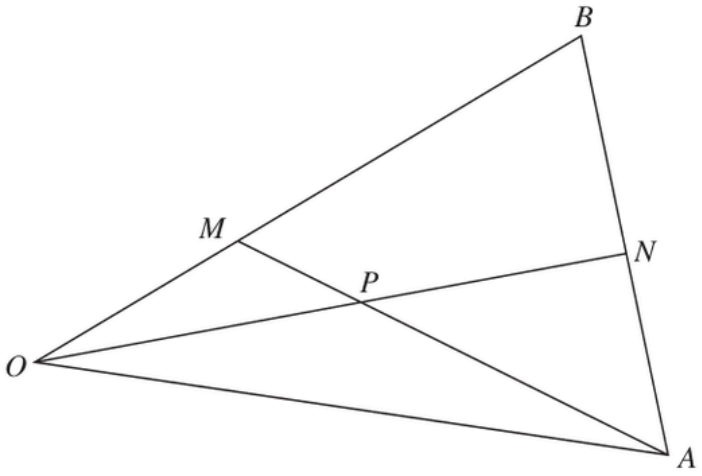


Diagram **NOT** accurately drawn

$\overrightarrow{OA} = 8\mathbf{a}$ $\overrightarrow{OB} = 6\mathbf{b}$

M is the point on OB such that $OM : MB = 1 : 2$
N is the midpoint of AB
P is the point of intersection of ON and AM

Using a vector method, find $\overrightarrow{OP}$ as a simplified expression in terms of **a** and **b**
Show your working clearly.

$\overrightarrow{OP} =$ .....

(Total for Question 22 is 5 marks)

Question 24

5 marks | Vectors

24 $OXYZ$ is a trapezium.

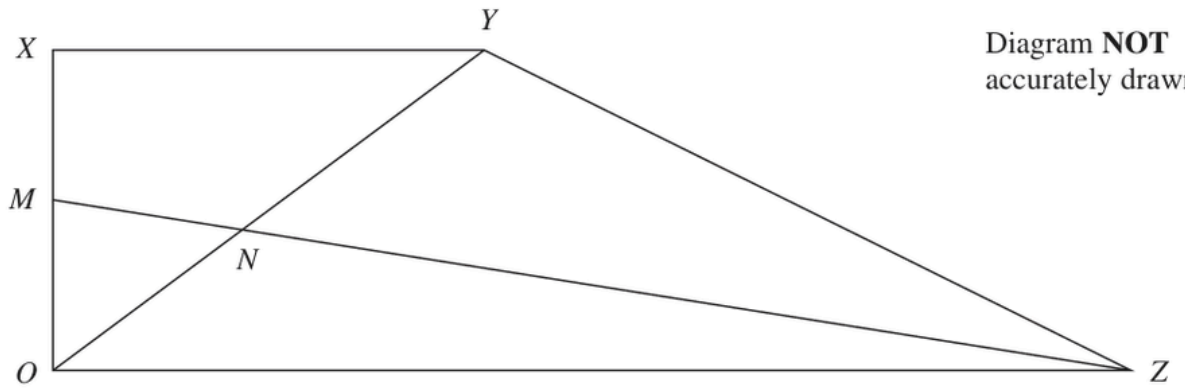


Diagram **NOT** accurately drawn

$\overrightarrow{OX} = \mathbf{a}$

$\overrightarrow{XY} = \mathbf{b}$

$\overrightarrow{OZ} = 3\mathbf{b}$

M is the midpoint of OX
N is the point such that MNZ and ONY are straight lines.

Given that $ON : OY = \lambda : 1$

use a vector method to find the value of λ

$\lambda =$ .....

(Total for Question 24 is 5 marks)

Question 21

5 marks | Vectors

21

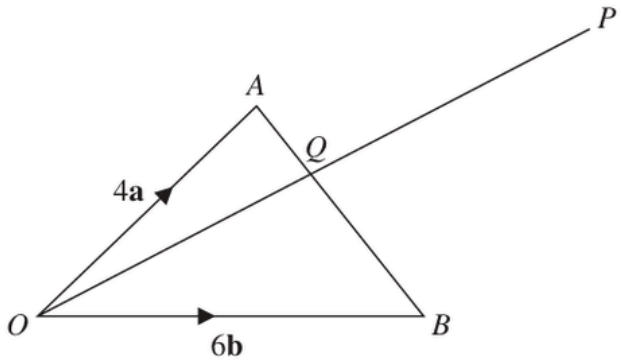


Diagram **NOT** accurately drawn

OAB is a triangle.
Q is the point on AB such that OQP is a straight line.

$\overrightarrow{OA} = 4\mathbf{a}$ $\overrightarrow{OB} = 6\mathbf{b}$ $\overrightarrow{AP} = 2\mathbf{a} + 8\mathbf{b}$

Using a vector method, find the ratio $AQ : QB$

$AQ : QB =$ .....

(Total for Question 21 is 5 marks)

Question 25

5 marks | Vectors

25 $ABCD$ is a parallelogram and ADM is a straight line.

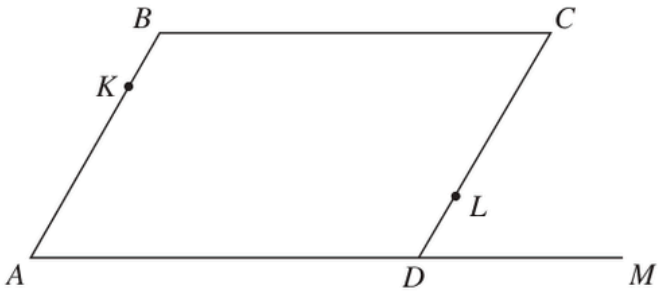


Diagram **NOT** accurately drawn

$\overrightarrow{AB} = \mathbf{a}$ $\overrightarrow{BC} = \mathbf{b}$ $\overrightarrow{DM} = \frac{1}{2}\mathbf{b}$

K is the point on AB such that $AK : AB = \lambda : 1$
L is the point on CD such that $CL : CD = \mu : 1$
KLM is a straight line.

Given that $\lambda : \mu = 1 : 2$

use a vector method to find the value of λ and the value of μ

$\lambda =$ .....

$\mu =$ .....

(Total for Question 25 is 5 marks)

Question 19

5 marks | Vectors

19

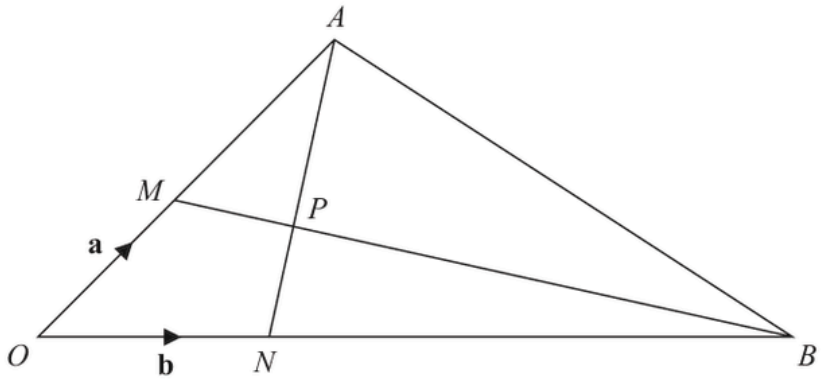


Diagram **NOT** accurately drawn

OMA, *ONB*, *MPB* and *NPA* are straight lines.

M is the midpoint of *OA*

$ON : NB = 1 : 5$

$\overrightarrow{OM} = \mathbf{a}$ $\overrightarrow{ON} = \mathbf{b}$

(a) Find in terms of **a** and **b** the vector $\overrightarrow{AN}$

.....

(1)

(b) Use a vector method to find the ratio $AP : PN$

$AP : PN =$ .....

(4)

(Total for Question 19 is 5 marks)

Question 19

5 marks | Vectors

19 The diagram shows a triangle ABC where A, B and C represent the positions of three towns.

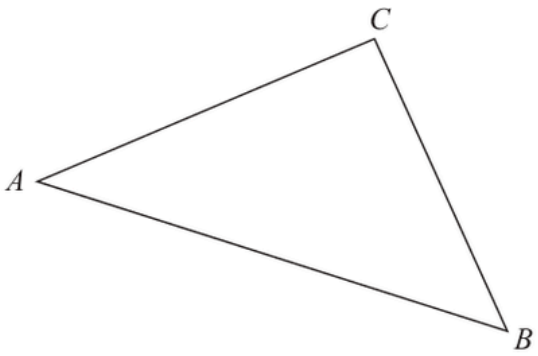


Diagram **NOT** accurately drawn

$$\overrightarrow{AB} = \begin{pmatrix} 7 \\ -2 \end{pmatrix} \qquad \overrightarrow{BC} = \begin{pmatrix} -3 \\ 5 \end{pmatrix}$$

Pru travels directly from A to B and then directly from B to C

Yang travels directly from A to C

Given that the values for $\overrightarrow{AB}$ and $\overrightarrow{BC}$ are in kilometres,

work out how much further Pru travels than Yang travels.
Give your answer in km, correct to one decimal place.

..... km

(Total for Question 19 is 5 marks)

Question 22

5 marks | Vectors

22

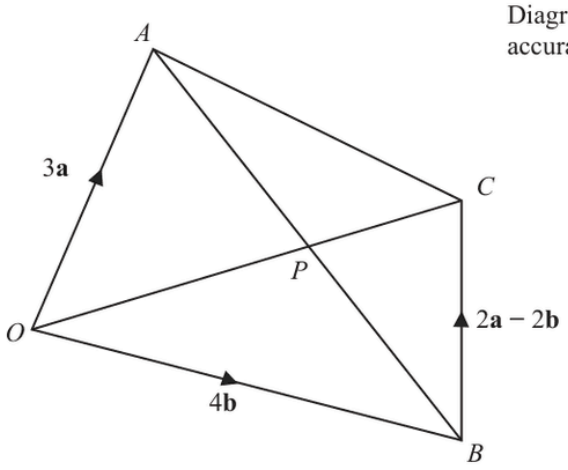


Diagram **NOT** accurately drawn

$OACB$ is a quadrilateral.

$\overrightarrow{OA} = \mathbf{3a}$ $\overrightarrow{OB} = \mathbf{4b}$ $\overrightarrow{BC} = \mathbf{2a} - \mathbf{2b}$

(a) (i) Find the vector $\overrightarrow{OC}$ in terms of **a** and **b**
Simplify your answer.

$\overrightarrow{OC} =$ .....

(1)

(ii) Find the vector $\overrightarrow{AB}$ in terms of **a** and **b**

$\overrightarrow{AB} =$ .....

(1)

The point P lies on AB and on OC

(b) Using a vector method, find the ratio $AP : PB$
Show your working clearly.

.....

(3)

(Total for Question 22 is 5 marks)

Question 24

6 marks | Vectors

24

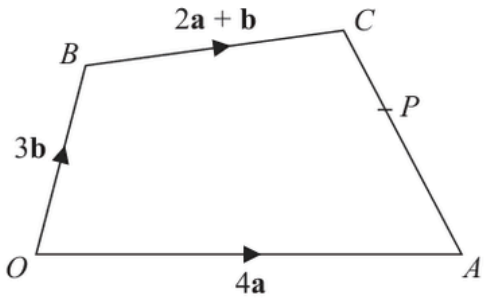


Diagram **NOT** accurately drawn

The diagram shows a quadrilateral $OACB$ in which

$\overrightarrow{OA} = 4\mathbf{a}$ $\overrightarrow{OB} = 3\mathbf{b}$ $\overrightarrow{BC} = 2\mathbf{a} + \mathbf{b}$

(a) Find $\overrightarrow{AC}$ in terms of **a** and **b**
Give your answer in its simplest form.

$\overrightarrow{AC} =$ .....

(2)

The point P lies on AC such that $AP : PC = 3 : 2$

The point Q is such that OPQ and BCQ are straight lines.

(b) Using a vector method, find $\overrightarrow{OQ}$ in terms of **a** and **b**
Give your answer in its simplest form.
Show your working clearly.

$\overrightarrow{OQ} =$ .....

(4)

(Total for Question 24 is 6 marks)

Question 25

6 marks | Vectors

25 $OPQR$ is a parallelogram.

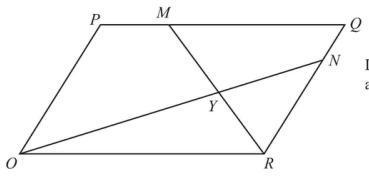


Diagram **NOT** accurately drawn

$\overrightarrow{OP} = 2\mathbf{a}$ and $\overrightarrow{OR} = 3\mathbf{b}$

The point M lies on PQ such that $PM = \frac{1}{4}PQ$

The point N lies on RQ such that $RN = \frac{4}{5}RQ$

(a) Find, in terms of **a** and **b**, giving your answers in simplest form

(i) $\overrightarrow{ON}$

.....

(1)

(ii) $\overrightarrow{MR}$

.....

(1)

MR and ON intersect at the point Y

Given that

$$OY = k \times ON$$

(b) use a vector method to find the value of k

$k =$ .....

(4)

(Total for Question 25 is 6 marks)

Question 17

3 marks | Vectors

17 Here are two vectors.

$$\overrightarrow{FG} = \begin{pmatrix} -5 \\ 2 \end{pmatrix} \qquad \overrightarrow{HG} = \begin{pmatrix} 4 \\ 14 \end{pmatrix}$$

Calculate the magnitude of the vector $\overrightarrow{HF}$

(Total for Question 17 is 3 marks)

Question 24

6 marks | Vectors

24 OAB is a triangle.

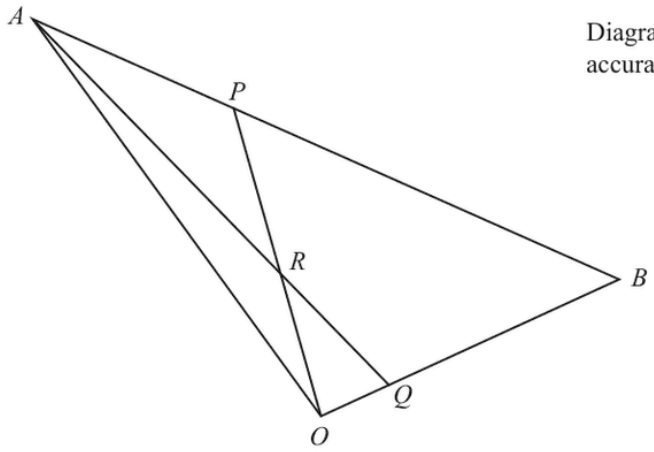


Diagram **NOT** accurately drawn

$\overrightarrow{OA} = 10\mathbf{a}$ $\overrightarrow{OB} = 10\mathbf{b}$

ARQ and ORP are straight lines.

$\overrightarrow{AP} = \frac{1}{4}\overrightarrow{AB}$ and $\overrightarrow{OQ} = \frac{1}{5}\overrightarrow{OB}$

Write the following vectors in terms of **a** and **b**
Simplify your answers.

(i) $\overrightarrow{AQ}$

.....

(1)

(ii) $\overrightarrow{OP}$

.....

(1)

(iii) $\overrightarrow{OR}$

.....

(4)

(Total for Question 24 is 6 marks)

Question 16

3 marks | Vectors

16 OAB is a triangle.

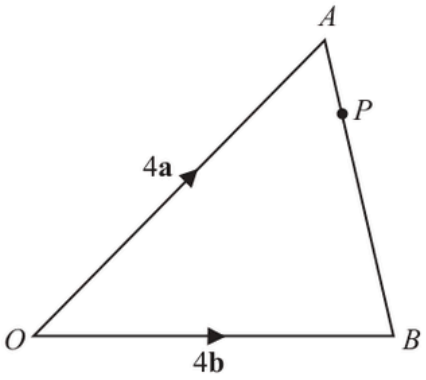


Diagram **NOT** accurately drawn

$\overrightarrow{OA} = \mathbf{4a}$

$\overrightarrow{OB} = \mathbf{4b}$

P is the point on AB such that $AP : PB = 1 : 3$

(a) Write down $\overrightarrow{AB}$ in terms of **a** and **b**

.....

(1)

(b) Express $\overrightarrow{OP}$ in terms of **a** and **b**
Give your answer in its simplest form.

.....

(2)

(Total for Question 16 is 3 marks)

Question 18

3 marks | Vectors

18 OAB is a triangle.

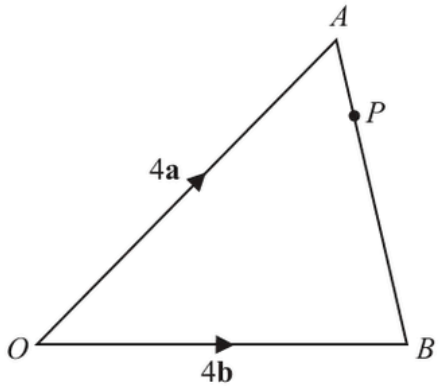


Diagram **NOT** accurately drawn

$\overrightarrow{OA} = 4\mathbf{a}$

$\overrightarrow{OB} = 4\mathbf{b}$

P is the point on AB such that $AP : PB = 1 : 3$

(a) Write down $\overrightarrow{AB}$ in terms of **a** and **b**

.....

(1)

(b) Express $\overrightarrow{OP}$ in terms of **a** and **b**
Give your answer in its simplest form.

.....

(2)

(Total for Question 18 is 3 marks)

Question 23

5 marks | Vectors

23

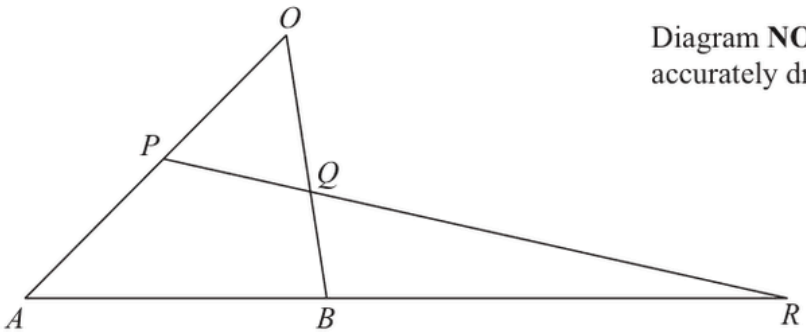


Diagram **NOT** accurately drawn

OAB is a triangle.
P is the midpoint of OA
Q is a point on OB

ABR and PQR are straight lines.

$\overrightarrow{OA} = 12\mathbf{a}$ $\overrightarrow{OB} = 8\mathbf{b}$

(a) Express $\overrightarrow{AB}$ in terms of **a** and **b**

.....

(1)

$AB : BR = 1 : 2$ $\overrightarrow{OQ} = n\mathbf{b}$

(b) Use a vector method to find the value of n

$n =$ .....

(4)

(Total for Question 23 is 5 marks)

Question 26

5 marks | Vectors

26

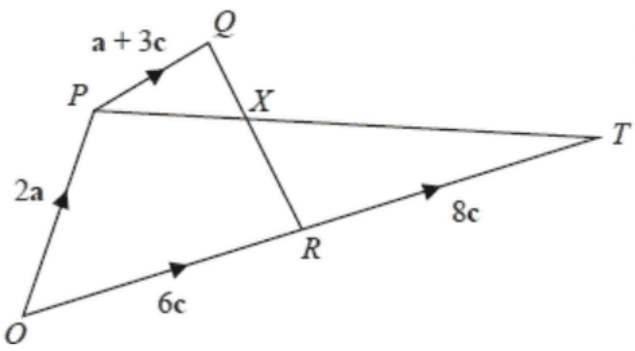


Diagram **NOT** accurately drawn

The diagram shows a quadrilateral $OPQR$ in which

$\overrightarrow{OP} = 2\mathbf{a}$ $\overrightarrow{OR} = 6\mathbf{c}$ $\overrightarrow{PQ} = \mathbf{a} + 3\mathbf{c}$

(a) Find in terms of **a** and **c**

$\overrightarrow{QR}$ = ...

(1)

The point T is such that $\overrightarrow{RT} = 8\mathbf{c}$
The point X lies on QR such that PXT is a straight line.

(b) Using a vector method, find the ratio $QX : XR$
Give your answer in the form $m : n$ where m and n are integers.
Show your working clearly.

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$QX : XR$ = ...

(4)

(Total for Question 26 is 5 marks)

Question 24

6 marks | Vectors

24 The diagram shows a quadrilateral $OABC$

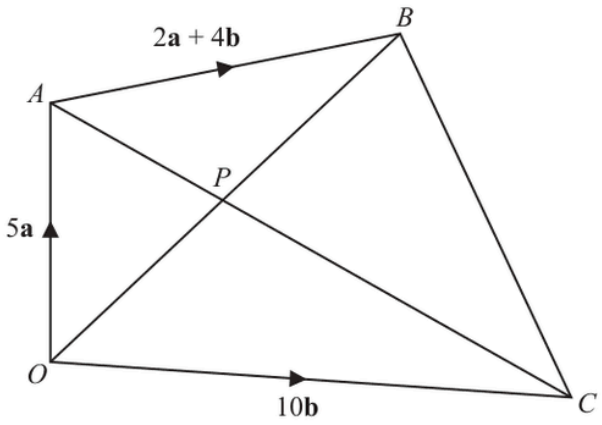


Diagram **NOT** accurately drawn

$\overrightarrow{OA} = 5\mathbf{a}$ $\overrightarrow{OC} = 10\mathbf{b}$ $\overrightarrow{AB} = 2\mathbf{a} + 4\mathbf{b}$

(a) Find $\overrightarrow{AC}$ in terms of **a** and **b**

$\overrightarrow{AC} =$ .....

(1)

(b) Find $\overrightarrow{OB}$ in terms of **a** and **b**
Give your answer in its simplest form.

$\overrightarrow{OB} =$ .....

(1)

The point P is such that APC and OPB are straight lines.

(c) Using a vector method, find $\overrightarrow{OP}$ in terms of **a** and **b**
Give your answer in its simplest form.
Show your working clearly.

$\overrightarrow{OP} =$ .....

(4)

(Total for Question 24 is 6 marks)

Question 27

6 marks | Vectors

27

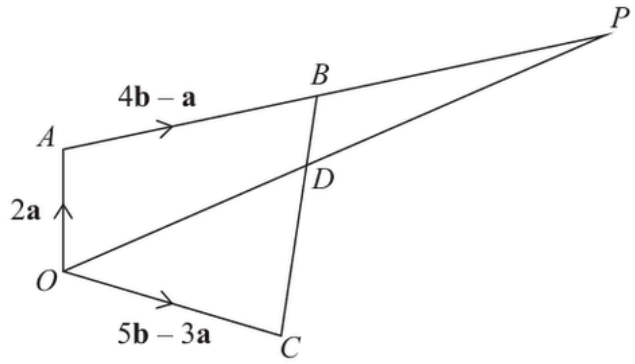


Diagram **NOT** accurately drawn

$OABC$ is a quadrilateral.
ABP and ODP are straight lines.

$\overrightarrow{OA} = \mathbf{2a}$ $\overrightarrow{AB} = \mathbf{4b - a}$ $\overrightarrow{OC} = \mathbf{5b - 3a}$

(a) Find an expression in terms of **a** and **b** for the vector $\overrightarrow{BC}$
Simplify your answer.

.....

(2)

The point D lies on BC such that $BD : DC = 1 : 3$

Given that $\overrightarrow{OP} = n\overrightarrow{OD}$

(b) use a vector method to find the value of n

$n =$ .....

(4)

(Total for Question 27 is 6 marks)

Question 18

5 marks | Vectors

18 Here are two vectors.

$$\overrightarrow{OA} = \begin{pmatrix} 4 \\ -3 \end{pmatrix} \qquad \overrightarrow{BA} = \begin{pmatrix} -15 \\ 8 \end{pmatrix}$$

(a) Find $2\overrightarrow{AO}$ as a column vector.

$$2\overrightarrow{AO} = \begin{pmatrix} \ldots\ldots \\ \ldots\ldots \end{pmatrix}$$

(1)

(b) Find $\overrightarrow{OB}$ as a column vector.

$$\overrightarrow{OB} = \begin{pmatrix} \ldots\ldots \\ \ldots\ldots \end{pmatrix}$$

(2)

(c) Calculate the magnitude of the vector $\overrightarrow{BA}$

.....

(2)

(Total for Question 18 is 5 marks)

Question 18

2 marks | Vectors

18 Here are two vectors.

$$\overrightarrow{AB} = \begin{pmatrix} 4 \\ 5 \end{pmatrix} \qquad \overrightarrow{CB} = \begin{pmatrix} -2 \\ 8 \end{pmatrix}$$

Find $\overrightarrow{AC}$ as a column vector.

$$\overrightarrow{AC} = \begin{pmatrix} \ldots\ldots\ldots \\ \ldots\ldots\ldots \end{pmatrix}$$

(Total for Question 18 is 2 marks)

Question 22

4 marks | Vectors

22 The diagram shows a quadrilateral $OABC$ where O, A, B and C represent the positions of four houses.

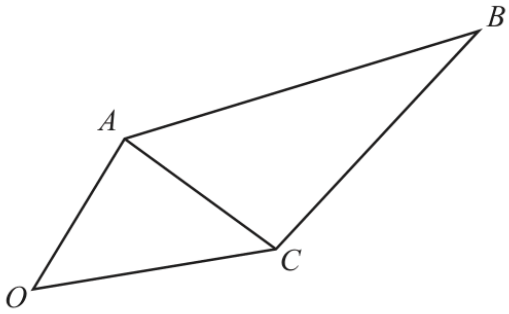


Diagram **NOT** accurately drawn

$\overrightarrow{OA} = \begin{pmatrix} 2 \\ 8 \end{pmatrix}$ $\overrightarrow{OB} = \begin{pmatrix} 21 \\ 14 \end{pmatrix}$ $\overrightarrow{OC} = \begin{pmatrix} 12 \\ 3 \end{pmatrix}$

Ria walks directly from A to B
Anna walks directly from A to C and then walks directly from C to B

$\overrightarrow{OA}$, $\overrightarrow{OB}$ and $\overrightarrow{OC}$ are given in metres.

Work out how much further Anna walks than Ria walks.
Give your answer correct to one decimal place.

..... metres

(Total for Question 22 is 4 marks)

Question 25

6 marks | Vectors

25

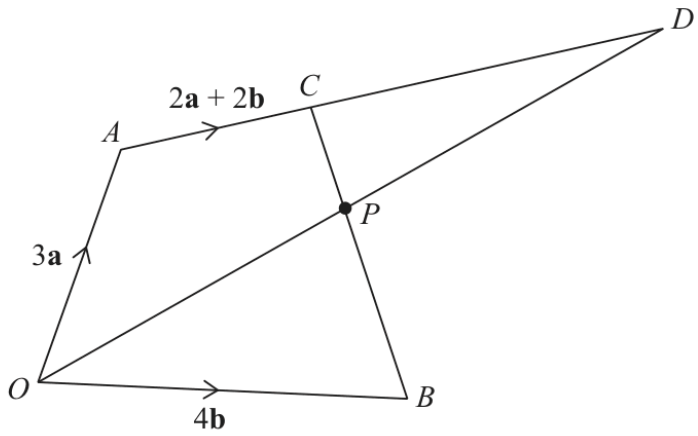


Diagram **NOT** accurately drawn

$\overrightarrow{OA} = 3\mathbf{a}$ $\overrightarrow{OB} = 4\mathbf{b}$ $\overrightarrow{AC} = 2\mathbf{a} + 2\mathbf{b}$ $\overrightarrow{CD} = \frac{3}{2} \times \overrightarrow{AC}$

P is the point on BC such that OPD is a straight line.

(a) Find $\overrightarrow{OD}$ in terms of **a** and **b**
Give your answer in its simplest form.

.....

(2)

(b) Find the ratio $OP : PD$
Show your working clearly.

.....

(4)

(Total for Question 25 is 6 marks)

TOPIC

Statistics Toolkit

Every past-paper question on this topic, 2020 to 2026.

Question 1

3 marks | Statistics Toolkit

1 Here are five cards, where x represents a number.

15	7	–2	23	x

The mean of the five numbers is 12

Work out the value of x

$x =$ .....

(Total for Question 1 is 3 marks)

Question 6

3 marks | Statistics Toolkit

6 Here are some integers where $a < b < c < d$

$$a \quad b \quad c \quad d \quad d \quad d$$

The mode of the integers is 9
The range of the integers is 4
The median of the integers is 8

Work out the value of a, the value of b, the value of c and the value of d

$a =$ .....

$b =$ .....

$c =$ .....

$d =$ .....

(Total for Question 6 is 3 marks)

Question 2

3 marks | Statistics Toolkit

2 The table gives information about the amount of money, in £, that Fiona spent in a grocery store each week during 2019

Amount spent (£x)	Frequency
$0 \leqslant x < 20$	5
$20 \leqslant x < 40$	11
$40 \leqslant x < 60$	8
$60 \leqslant x < 80$	19
$80 \leqslant x < 100$	9

Work out an estimate for the total amount of money that Fiona spent in the grocery store during 2019

£.....

(Total for Question 2 is 3 marks)

Question 8

3 marks | Statistics Toolkit

8 5 children are playing on a trampoline.
The mean weight of the 5 children is 28 kg.

2 of the children get off the trampoline.
The mean weight of these 2 children is 26.5 kg.

Work out the mean weight of the 3 children who remain on the trampoline.

..... kg

(Total for Question 8 is 3 marks)

Question 14

3 marks | Statistics Toolkit

14 Max kept a record of the marks he scored in each of the 11 spelling tests he took one term.

Here are his marks.

18 5 7 12 11 18 15 16 17 13 14

Find the interquartile range of the marks.

(Total for Question 14 is 3 marks)

Question 4

4 marks | Statistics Toolkit

4 Here is a list of six numbers written in order of size.

4 7 x 10 y y

The numbers have

a median of 9
a mean of 11

Find the value of x and the value of y.

$x =$ .....

$y =$ .....

(Total for Question 4 is 4 marks)

Question 2

4 marks | Statistics Toolkit

2 Given that $a < b < c$

the four whole numbers a, a, b and c have

a mode of 7
a median of 8.5
a mean of 9

Work out the value of a, the value of b and the value of c.

$a =$ .....

$b =$ .....

$c =$ .....

(Total for Question 2 is 4 marks)

Question 2

3 marks | Statistics Toolkit

2 Ava writes down five whole numbers.

For these five numbers

the median is 7

the mode is 8

the range is 5

Find a possible value for each of the five numbers that Ava writes down.

(Total for Question 2 is 3 marks)

Question 7

3 marks | Statistics Toolkit

7 There are 5 cocoa pods in a bag.
The mean weight of the 5 cocoa pods is 398 grams.

A sixth cocoa pod is put into the bag.
The mean weight of the 6 cocoa pods is 401 grams.

Work out the weight of the sixth cocoa pod that is put into the bag.

..... grams

(Total for Question 7 is 3 marks)

Question 12

2 marks | Statistics Toolkit

12 15 people were asked how long, in minutes, they had been waiting for a bus.

Here are the results.

2 3 3 4 5 6 6 8 9 10 11 13 14 15 18

Find the interquartile range of these times.

..... minutes

(Total for Question 12 is 2 marks)

Question 10

3 marks | Statistics Toolkit

10 Jethro has sat 5 tests.
Each test was marked out of 100 and Jethro's mean mark for the 5 tests is 74

Jethro has to sit one more test that is also to be marked out of 100

Jethro wants his mean mark for all 6 tests to be at least 77

Work out the least mark that Jethro needs to get for the last test.

(Total for Question 10 is 3 marks)

Question 14

2 marks | Statistics Toolkit

14 Here is the number of goals that Henri's team scored one summer in each water polo match.

5 8 9 11 13 13 14 15 16 17 20

Find the interquartile range of the numbers of goals.
Show your working clearly.

(Total for Question 14 is 2 marks)

Question 5

6 marks | Statistics Toolkit

5 Jenny has six cards.

Each card has a whole number written on it so that

the smallest number is 5
the largest number is 24
the median of the six numbers is 14
the mode of the six numbers is 8

Jenny arranges her cards so that the numbers are in order of size.



(a) For the remaining four cards, write on each dotted line a number that could be on the card.

(3)

A basketball team plays 6 games.
After playing 5 games, the team has a mean score of 21 points per game.
After playing 6 games, the team has a mean score of 23 points per game.

(b) Work out the number of points the team scored in its 6th game.

.....

(3)

(Total for Question 5 is 6 marks)

Question 5

4 marks | Statistics Toolkit

5 Yusuf sat 8 examinations.

Here are his marks for 5 of the examinations.

68 72 75 77 80

For his results in all 8 examinations

the mode of his marks is 80
the median of his marks is 74
the range of his marks is 16

Find Yusuf's marks for each of the other 3 examinations.

(Total for Question 5 is 4 marks)

Question 8

3 marks | Statistics Toolkit

8 A scientist is investigating the weight of 50 tigers.

Here is some information about these tigers.

	Type of tiger	
	Siberian	**Bengal**
Number of tigers	22	28
Mean weight of tigers (kg)	260	

The mean weight of all 50 tigers is 218 kg

Work out the mean weight of the Bengal tigers.

..... kg

(Total for Question 8 is 3 marks)

Question 15

3 marks | Statistics Toolkit

15 Diyar recorded the distance, in kilometres, that he cycled each day for 11 days.
Here are his results.

8 10 12 13 5 23 21 7 5 16 14

Find the interquartile range of his results.

..... km

(Total for Question 15 is 3 marks)

Question 1

3 marks | Statistics Toolkit

1 Here are some integers where $a < b < c < d$

$$a \quad b \quad c \quad d \quad d \quad d$$

The mode of the integers is 9
The median of the integers is 8
The range of the integers is 4

Work out the value of a, the value of b, the value of c and the value of d

$a =$ .....

$b =$ .....

$c =$ .....

$d =$ .....

(Total for Question 1 is 3 marks)

Question 3

3 marks | Statistics Toolkit

3 Here are five cards.

Each card has a number written on it.



The mean of the five numbers is 12

Work out the value of x

$x =$ .....

(Total for Question 3 is 3 marks)

Question 3

3 marks | Statistics Toolkit

3 Alberto, Bill, Candela and Diana are four friends.

Here is some information about the height of each of these friends.

Alberto's height is 158 cm.
Bill's height is 175 cm.
Candela's height is greater than Diana's height.

The median height of these four friends is 160 cm.
The range of the heights of these four friends is 21 cm.

Work out Candela's height and Diana's height.

Candela ..... cm

Diana ..... cm

(Total for Question 3 is 3 marks)

Question 12

3 marks | Statistics Toolkit

12 Larry is a delivery man.

He has 7 parcels to deliver.
The mean weight of the 7 parcels is 2.7 kg

Larry delivers 3 of the parcels.
Each of these 3 parcels has a weight of W kg

The mean weight of the other 4 parcels is 3.3 kg

Work out the value of W

$W =$ .....

(Total for Question 12 is 3 marks)

Question 13

2 marks | Statistics Toolkit

13 Here is the number of runs scored by a baseball team in each of its 15 games this season.

The number of runs have been arranged in order of size.

0 1 1 3 5 6 7 7 8 9 9 12 12 15 16

Work out the interquartile range of the number of runs.

(Total for Question 13 is 2 marks)

Question 2

3 marks | Statistics Toolkit

2 The table gives information about the number of minutes that Abby spent walking each day in September.

Number of minutes (M)	Frequency
$0 < M \leqslant 30$	5
$30 < M \leqslant 60$	6
$60 < M \leqslant 90$	8
$90 < M \leqslant 120$	9
$120 < M \leqslant 150$	2

Work out an estimate for the total number of minutes that Abby spent walking in September.

..... minutes

(Total for Question 2 is 3 marks)

Question 10

4 marks | Statistics Toolkit

10 Team **A** and Team **B** take part in a quiz league.

After 11 rounds, Team **A** has a mean score per round of 17
After 9 rounds, Team **B** has a mean score per round of 18

Both teams take part in a further round.
After this round, both teams have a mean score per round of 18.5

In the further round, Team **A** scored more points than Team **B**.

How many more?

(Total for Question 10 is 4 marks)

Question 10

3 marks | Statistics Toolkit

10 Gemara works as a taxi driver.
Last week, he recorded the following information about the distances he drove.

For the 5 days from Monday to Friday, the mean number of kilometres he drove was 104
For the 7 days from Monday to Sunday, the mean number of kilometres he drove was 127

On Saturday, Gemara drove 132 kilometres.

Work out the number of kilometres he drove on Sunday.

..... kilometres

(Total for Question 10 is 3 marks)

Question 10

2 marks | Statistics Toolkit

10 Here are the test marks of 15 students.

7 10 14 15 16 17 18 19 20 20 23 25 30 39 40

Find the interquartile range of these marks.

(Total for Question 10 is 2 marks)

Question 14

4 marks | Statistics Toolkit

14 Akari played a computer game eleven times.
Here are her scores.

25 20 28 27 26 22 23 29 20 29 26

(a) Find the interquartile range of her scores.

.....

(3)

Machi played the same computer game eleven times.

The interquartile range for Machi's scores was 9

(b) Who had the more consistent scores, Akari or Machi?
Give a reason for your answer.

.....

(1)

(Total for Question 14 is 4 marks)

Question 8

3 marks | Statistics Toolkit

8 The mean number of goals scored by a hockey team in 8 matches is 6
The team plays 2 more matches and scores k goals in each match.
The mean number of goals scored by the hockey team in the 10 matches is 7

Work out the value of k

$k =$ .....

(Total for Question 8 is 3 marks)

Question 13

2 marks | Statistics Toolkit

13 Robert asked 11 people how many meetings they attended last week.

Here are the results in numerical order.

1 2 4 6 6 8 11 12 13 14 17

Find the interquartile range of the number of meetings.

(Total for Question 13 is 2 marks)

Question 1

3 marks | Statistics Toolkit

1 Here are eight numbers written in order of size

$$h \quad 6 \quad 7 \quad 8 \quad j \quad 16 \quad k \quad k$$

where h, j and k are integers.

The median of the eight numbers is 10

The mode of the eight numbers is 18

The range of the eight numbers is 13

Work out the value of h, the value of j and the value of k

$h =$ .....

$j =$ .....

$k =$ .....

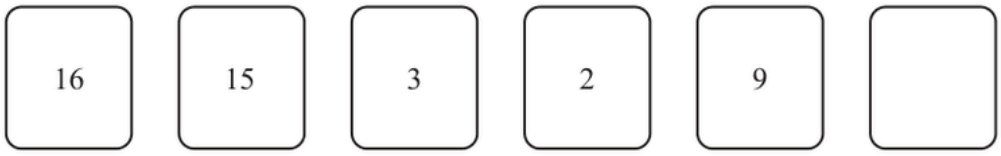
(Total for Question 1 is 3 marks)

Question 1

3 marks | Statistics Toolkit

1 Here are six cards.

Five of the cards have a number written on them.



Work out the number that should be written on the last card so that the mean of the six numbers will be 11

(Total for Question 1 is 3 marks)

Question 3

2 marks | Statistics Toolkit

3 Here is a list of four numbers written in ascending order of size

$$x \quad x \quad y \quad 15$$

where x and y are integers.

The numbers have

a median of 12.5
a range of 4

Find the value of x and the value of y

$x =$ .....

$y =$ .....

(Total for Question 3 is 2 marks)

Question 10

2 marks | Statistics Toolkit

10 Here are the numbers of goals scored by a hockey team in its 11 games this season.

0 1 2 2 3 4 4 6 7 9 11

Work out the interquartile range of the numbers of goals.

(Total for Question 10 is 2 marks)

4MA1/2H JUNE 2024

Question 12

3 marks | Statistics Toolkit

12 Ali uses a fitness tracker to count the number of steps he walks each day for 7 days.

For the first 4 days, his mean number of steps is 11 800
For the next 3 days, his mean number of steps is 13 207

Work out his mean number of steps for the 7 days.

(Total for Question 12 is 3 marks)

Question 8

3 marks | Statistics Toolkit

8 Kim puts 4 bananas in a bag.
The mean weight of the 4 bananas in the bag is 145 grams.

Andy puts one more banana into the bag.
The mean weight of the 5 bananas in the bag is 142 grams.

Work out the weight of the banana that Andy puts into the bag.

..... grams

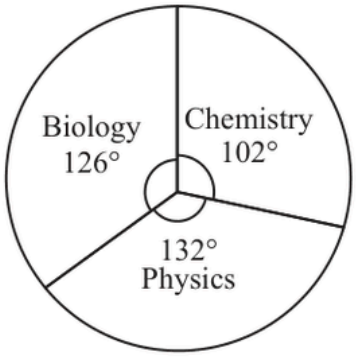
(Total for Question 8 is 3 marks)

Question 10

5 marks | Statistics Toolkit

10 All the students in year 10 and all the students in year 11 named their favourite science subject from Biology, Chemistry and Physics.

The pie chart shows information about the results for the year 10 students.
The table shows information about the results for the year 11 students.



Pie chart for year 10

science subject	number of students
Biology	$3x + 6$
Chemistry	$5x + 8$
Physics	$7x - 9$

Table for year 11

There are 300 students in year 10
There are 320 students in year 11

More students in year 10 than in year 11 said Biology was their favourite science subject.

How many more?

(Total for Question 10 is 5 marks)

Question 1

3 marks | Statistics Toolkit

1 Rio has six cards.
He writes a number on each card so that

the range of the numbers is 10
the median of the numbers is 7.5
the mode of the numbers is 6

Rio arranges the cards so that the numbers are in order of size.

		6		10	14

Three of the numbers are hidden.

Complete the cards above to show the three numbers that are hidden.

(Total for Question 1 is 3 marks)

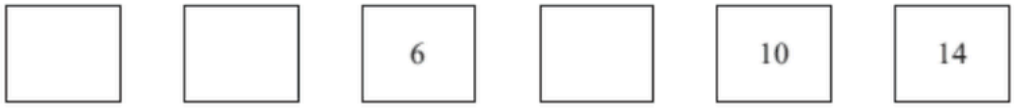
Question 1

3 marks | Statistics Toolkit

1 Rio has six cards.
He writes a number on each card so that

the range of the numbers is 10
the median of the numbers is 7.5
the mode of the numbers is 6

Rio arranges the cards so that the numbers are in order of size.



Three of the numbers are hidden.
Complete the cards above to show the three numbers that are hidden.

(Total for Question 1 is 3 marks)

Question 7

3 marks | Statistics Toolkit

7 The mean of 7 numbers is 60

The mean of 3 of the numbers is 46

Work out the mean of the other 4 numbers.

(Total for Question 7 is 3 marks)

Question 8

3 marks | Statistics Toolkit

8 The mean of 7 numbers is 60

The mean of 3 of the numbers is 46

Work out the mean of the other 4 numbers.

(Total for Question 8 is 3 marks)

Question 13

2 marks | Statistics Toolkit

13 Here are the numbers of eggs laid by some hens on each of 11 days in June.

9 10 12 15 17 18 19 19 20 25 26

Work out the interquartile range of the numbers of eggs.

(Total for Question 13 is 2 marks)

Question 16

2 marks | Statistics Toolkit

16 Here are the numbers of goals scored by a netball team in its 11 games this season.

7 8 10 11 13 14 16 17 19 21 24

Work out the interquartile range for the number of goals.

.....

(Total for Question 16 is 2 marks)

Question 4

3 marks | Statistics Toolkit

4 e, f and g represent integers such that

$$e \quad f \quad 7 \quad g \quad 12 \quad 17$$

is a list of integers written in order of size.

The integers have

a range of 15
a median of 8.5
a mean of 9

Work out the value of e, the value of f and the value of g

$e =$ .....

$f =$ .....

$g =$ .....

(Total for Question 4 is 3 marks)

Question 10

3 marks | Statistics Toolkit

10 There are 5 potatoes in a bag.
The mean weight of the 5 potatoes is 217 grams.

One more potato, of weight 175 grams, is put into the bag.

Work out the mean weight of the 6 potatoes in the bag.

..... grams

(Total for Question 10 is 3 marks)

Question 16

2 marks | Statistics Toolkit

16 11 people were asked how long, in minutes, they stayed in a coffee shop last Friday.

Here are the results.

14 15 16 18 19 20 22 25 28 40 50

Work out the interquartile range of these times.

..... minutes

(Total for Question 16 is 2 marks)

Question 16

2 marks | Statistics Toolkit

16 Ivan asked 15 people how many books they read last year.

Here are his results.

1 1 3 4 6 7 8 9 10 12 15 25 30 37 50

Work out the interquartile range of the number of books read.

(Total for Question 16 is 2 marks)

Question 6

4 marks | Statistics Toolkit

6 Mika has six cards.
There is a number on each card.
The cards are arranged with the numbers in order of size.
Three of the numbers are hidden.



The mode of the six numbers is 8
The range of the six numbers is 7
The sum of the six numbers is 31

Work out the median of the six numbers.

.....

(Total for Question 6 is 4 marks)

Question 9

3 marks | Statistics Toolkit

9 Caleb owns 11 sheep.

The mean weight of all 11 sheep is 77 kg
The mean weight of 8 of the sheep is 75.2 kg

Work out the mean weight of the other 3 sheep.

..... kg

(Total for Question 9 is 3 marks)

Question 13

4 marks | Statistics Toolkit

13 Leo collects apples from three trees.
The incomplete table gives some information about the apples he collects from these trees.

Tree	Number of apples	Mean weight of apples (grams)	Total weight of apples (grams)
A	12	150	
B	20		2700
C		145	2610

Work out the mean weight of all the apples Leo collects from these three trees.

..... grams

(Total for Question 13 is 4 marks)

Question 15

2 marks | Statistics Toolkit

15 Mina recorded the times taken, in minutes, by 11 people to complete a puzzle.
Here are her results.

2 2 3 6 7 8 9 12 13 17 20

Find the interquartile range of these times.

..... minutes

(Total for Question 15 is 2 marks)

4MA1/2HR JUNE 2026

Question 15

2 marks | Statistics Toolkit

15 Mina recorded the times taken, in minutes, by 11 people to complete a puzzle.
Here are her results.

2 2 3 6 7 9 9 12 13 17 20

Find the interquartile range of these times.

..... minutes

(Total for Question 15 is 2 marks)

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TOPIC

Averages from Frequency Tables

Every past-paper question on this topic, 2020 to 2026.

Question 4

7 marks | Averages from Frequency Tables

4 The table shows information about the weights, in kilograms, of 40 babies.

Weight (w kg)	Frequency
$2 < w \leqslant 3$	12
$3 < w \leqslant 4$	16
$4 < w \leqslant 5$	9
$5 < w \leqslant 6$	2
$6 < w \leqslant 7$	1

(a) Write down the modal class.

.....

(1)

(b) Work out an estimate for the mean weight of the 40 babies.

..... kg

(4)

One of the 40 babies is going to be chosen at random.

(c) Find the probability that this baby has a weight of more than 5 kg.

.....

(2)

(Total for Question 4 is 7 marks)

Question 4

5 marks | Averages from Frequency Tables

4 The table gives information about the length of time, in minutes, that each of 60 students took to travel to school on Monday.

Length of time (t minutes)	Frequency
$0 < t \leqslant 10$	4
$10 < t \leqslant 20$	10
$20 < t \leqslant 30$	15
$30 < t \leqslant 40$	25
$40 < t \leqslant 50$	6

(a) Write down the modal class interval.

.....

(1)

(b) Work out an estimate for the mean length of time taken by these 60 students to travel to school on Monday.
Give your answer correct to one decimal place.

..... minutes

(4)

(Total for Question 4 is 5 marks)

Question 2

5 marks | Averages from Frequency Tables

2 The table gives information about the speeds, in kilometres per hour, of 80 motorbikes as each pass under a bridge.

Speed (s kilometres per hour)	Frequency
$40 < s \leqslant 50$	10
$50 < s \leqslant 60$	16
$60 < s \leqslant 70$	19
$70 < s \leqslant 80$	23
$80 < s \leqslant 90$	12

(a) Write down the modal class.

.....

(1)

(b) Work out an estimate for the mean speed of the motorbikes as they pass under the bridge. Give your answer correct to 3 significant figures.

..... kilometres per hour

(4)

(Total for Question 2 is 5 marks)

Question 10

4 marks | Averages from Frequency Tables

10 A mathematics teacher at a school asked a group of students how far, in kilometres, each student had travelled to get to school that day.

The table gives information about their answers.

Distance travelled (d km)	Number of students
$0 < d \leqslant 2$	x
$2 < d \leqslant 4$	11
$4 < d \leqslant 6$	8
$6 < d \leqslant 8$	6
$8 < d \leqslant 10$	5

The teacher calculated that an estimate for the mean distance travelled by the whole group of students was 4.25 km.

Work out the value of x.
Show your working clearly.

$x =$.....

(Total for Question 10 is 4 marks)

Question 3

5 marks | Averages from Frequency Tables

3 The table gives information about the amounts of money, in euros, that 70 of Anjali's friends spent last Saturday.

Money spent (S euros)	Frequency
$0 < S \leqslant 8$	6
$8 < S \leqslant 16$	14
$16 < S \leqslant 24$	19
$24 < S \leqslant 32$	25
$32 < S \leqslant 40$	6

One of Anjali's 70 friends is going to be chosen at random.

(a) Find the probability that this friend spent more than 24 euros last Saturday.

.....

(1)

(b) Work out an estimate for the mean amount of money spent by Anjali's friends last Saturday. Give your answer correct to 2 decimal places.

..... euros

(4)

(Total for Question 3 is 5 marks)

Question 9

4 marks | Averages from Frequency Tables

9 The frequency table gives information about the number of points scored by a player.

Number of points	Frequency
0	13
1	17
2	8
3	x
4	11

The mean number of points scored is 2

Work out the value of x

$x =$ .....

(Total for Question 9 is 4 marks)

Question 1

4 marks | Averages from Frequency Tables

1 The table shows information about the lengths, in minutes, of 50 telephone calls.

Length of telephone call (m minutes)	Frequency
$0 < m \leqslant 5$	8
$5 < m \leqslant 10$	2
$10 < m \leqslant 15$	6
$15 < m \leqslant 20$	4
$20 < m \leqslant 25$	12
$25 < m \leqslant 30$	18

(a) Write down the modal class.

.....

(1)

(b) Work out an estimate for the total length, in minutes, of these telephone calls.

..... minutes

(3)

(Total for Question 1 is 4 marks)

Question 1

5 marks | Averages from Frequency Tables

1 The table shows some information about the hourly rates of pay of 60 workers.

Hourly rate of pay (p dollars)	Frequency
$10 < p \leqslant 15$	18
$15 < p \leqslant 20$	16
$20 < p \leqslant 25$	14
$25 < p \leqslant 30$	8
$30 < p \leqslant 35$	4

(a) Write down the modal class.

.....

(1)

(b) Work out an estimate for the mean hourly rate of pay of the 60 workers.

..... dollars

(4)

(Total for Question 1 is 5 marks)

Question 1

5 marks | Averages from Frequency Tables

1 The table gives information about the distances 100 adults travel to work.

Distance (d km)	Frequency
$0 < d \leqslant 5$	26
$5 < d \leqslant 10$	40
$10 < d \leqslant 15$	16
$15 < d \leqslant 20$	10
$20 < d \leqslant 25$	8

(a) Write down the modal class.

.....

(1)

(b) Work out an estimate for the mean distance.

..... km

(4)

(Total for Question 1 is 5 marks)

Question 1

5 marks | Averages from Frequency Tables

1 The table shows information about the weights, in kilograms, of 50 dogs.

Weight (w kg)	Frequency
$4 < w \leqslant 8$	5
$8 < w \leqslant 12$	17
$12 < w \leqslant 16$	15
$16 < w \leqslant 20$	9
$20 < w \leqslant 24$	4

(a) Write down the modal class.

..... kg

(1)

(b) Work out an estimate for the mean weight of the 50 dogs.

..... kg

(4)

(Total for Question 1 is 5 marks)

Question 8

4 marks | Averages from Frequency Tables

8 The table gives information about the lengths of time, in minutes, that some people were in a coffee shop.

Length of time (m minutes)	Frequency
$0 < m \leqslant 10$	x
$10 < m \leqslant 20$	3
$20 < m \leqslant 30$	2
$30 < m \leqslant 40$	4
$40 < m \leqslant 50$	2

The information in the table is used to calculate an estimate for the mean length of time these people were in the coffee shop.

The estimate for the mean length of time is 20

Work out the value of x

x = ...

(Total for Question 8 is 4 marks)

Question 1

4 marks | Averages from Frequency Tables

1 The table gives information about the number of kilometres that Ted cycled on each of the 30 days in April.

Number of kilometres (K)	Frequency
$0 \leqslant K < 5$	8
$5 \leqslant K < 10$	7
$10 \leqslant K < 15$	3
$15 \leqslant K < 20$	10
$20 \leqslant K < 25$	2

Calculate an estimate for the mean number of kilometres that Ted cycled on each day in April.

..... kilometres

(Total for Question 1 is 4 marks)

Question 2

4 marks | Averages from Frequency Tables

2 The table gives information about the heights, in cm, of 60 flowers in Abby's garden.

Height (h cm)	Frequency
$0 < h \leqslant 10$	17
$10 < h \leqslant 20$	9
$20 < h \leqslant 30$	16
$30 < h \leqslant 40$	14
$40 < h \leqslant 50$	4

Work out an estimate for the mean height of these flowers.

..... cm

(Total for Question 2 is 4 marks)

Question 3

5 marks | Averages from Frequency Tables

3 The table shows information about the number of hours each of 40 candles burned.

Number of hours (h)	Frequency
$15 < h \leqslant 19$	2
$19 < h \leqslant 23$	5
$23 < h \leqslant 27$	12
$27 < h \leqslant 31$	15
$31 < h \leqslant 35$	6

(a) Write down the modal class.

.....

(1)

(b) Work out an estimate for the mean number of hours.

..... hours

(4)

(Total for Question 3 is 5 marks)

TOPIC

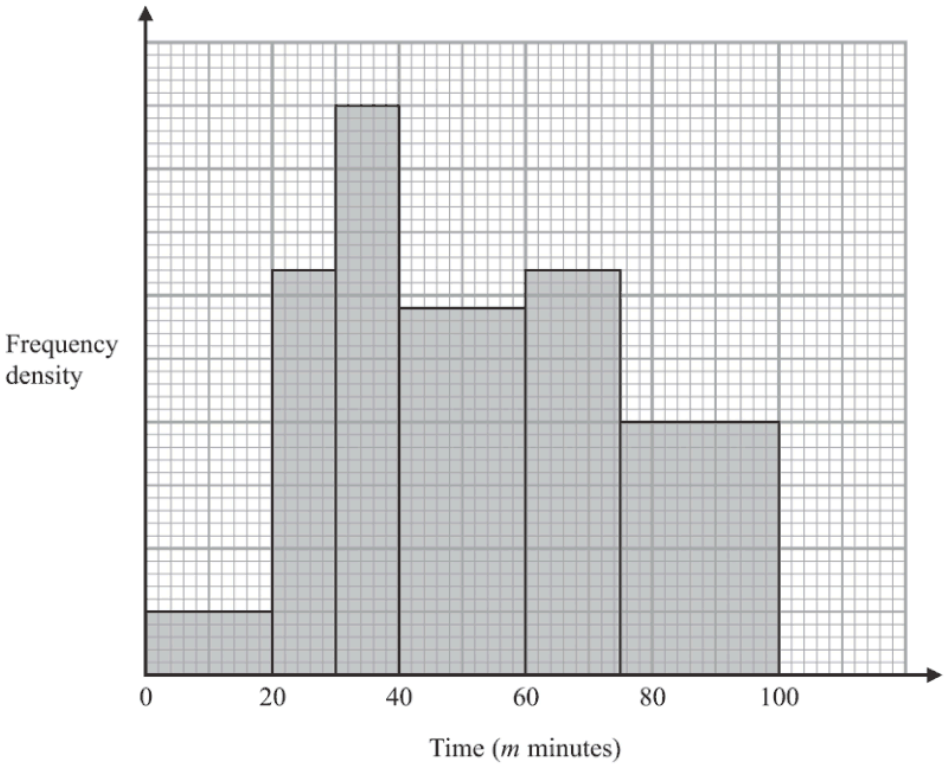
Histograms

Every past-paper question on this topic, 2020 to 2026.

Question 16

3 marks | Histograms

16 The histogram shows information about the total time, m minutes, taken by each child in a school to walk to school every day for one week.



There are no children for whom $m > 100$
There are 10 children for whom $m \leqslant 20$
Work out an estimate for the number of children for whom $50 < m \leqslant 80$

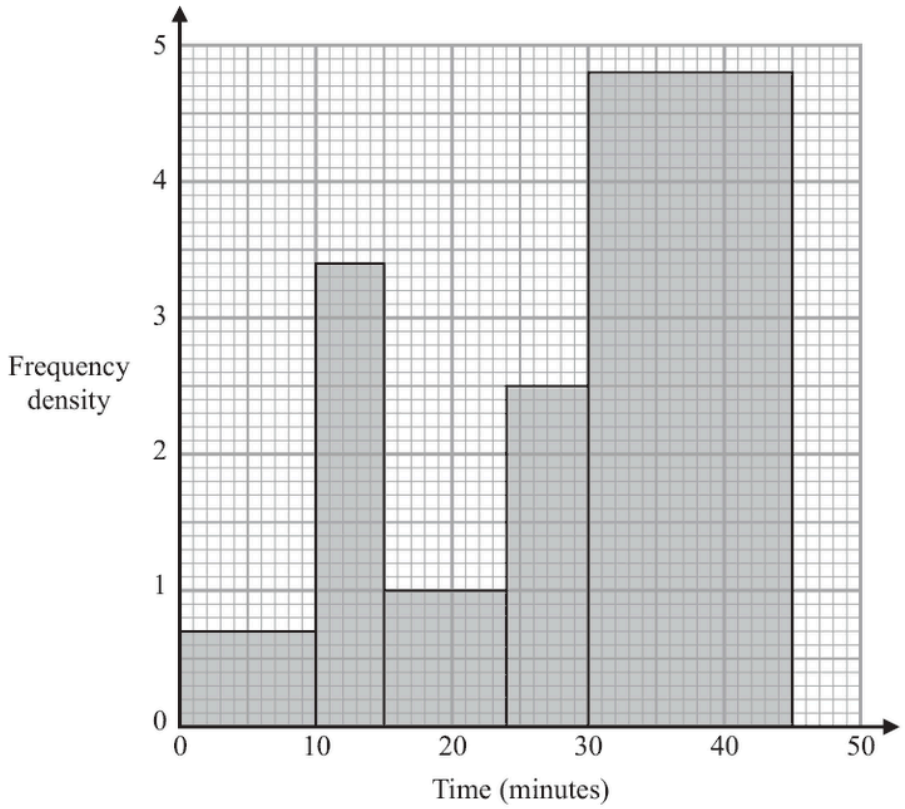
.....

(Total for Question 16 is 3 marks)

Question 18

5 marks | Histograms

18 The histogram gives information about the times, in minutes, that some customers spent in a supermarket.



(a) Work out an estimate for the proportion of these customers who spent between 17 minutes and 35 minutes in the supermarket.

.....

(3)

One of the customers is selected at random.

Given that this customer had spent more than 30 minutes in the supermarket,

(b) find the probability that this customer spent more than 36 minutes in the supermarket.

.....

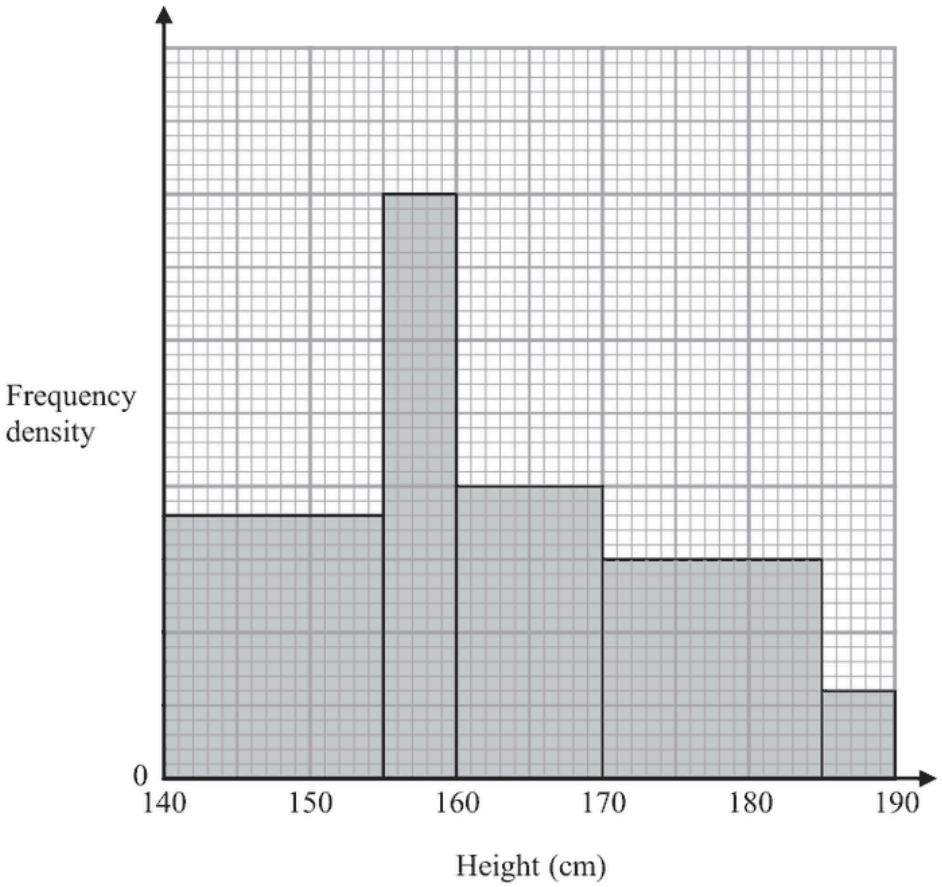
(2)

(Total for Question 18 is 5 marks)

Question 19

4 marks | Histograms

19



The histogram gives information about the heights of all the Year 11 students at a school.

There are 160 students in Year 11 with a height between 155 cm and 170 cm.

Work out the total number of students in Year 11 at the school.

(Total for Question 19 is 4 marks)

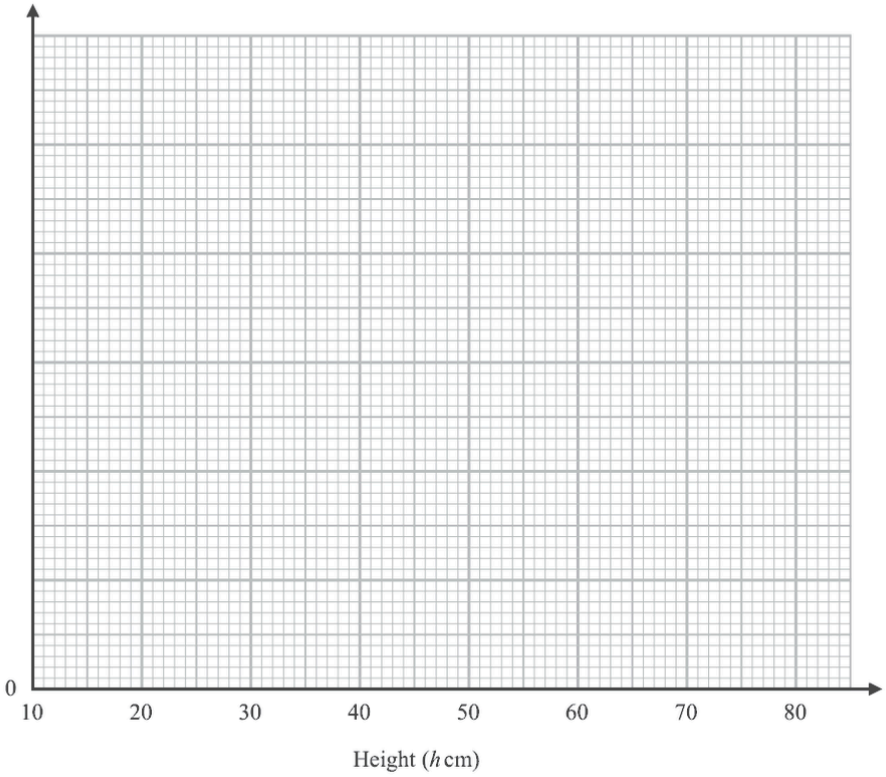
Question 18

5 marks | Histograms

18 The table gives information about the heights, in centimetres, of some plants.

Height (h cm)	Frequency
$10 < h \leqslant 20$	35
$20 < h \leqslant 35$	45
$35 < h \leqslant 50$	75
$50 < h \leqslant 70$	40
$70 < h \leqslant 80$	8

(a) On the grid, draw a histogram for this information.



(3)

(b) Work out an estimate for the number of these plants with a height greater than 40 cm.

.....

(2)

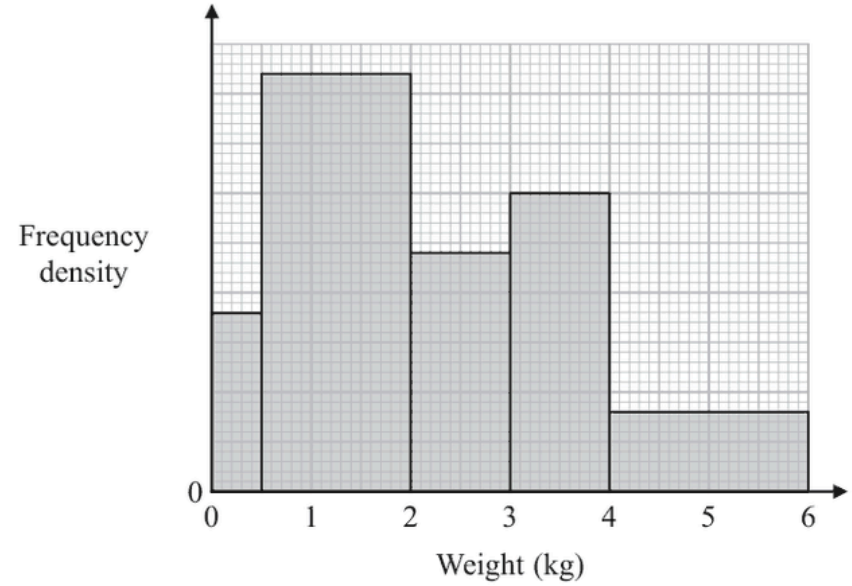
(Total for Question 18 is 5 marks)

Question 15

6 marks | Histograms

15 A postman records the weight of each parcel that he delivers.

The histogram shows information about the weights of all the parcels that the postman delivered last Monday. No parcels weighed more than 6 kg.



63 of the parcels that the postman delivered last Monday each had a weight between 0.5 kg and 2 kg.

(a) Work out the total number of parcels the postman delivered last Monday.

.....

(3)

The postman picks at random two of the records of the parcels he delivered last Monday.

(b) Work out an estimate for the probability that each parcel weighed more than 2.25 kg.

.....

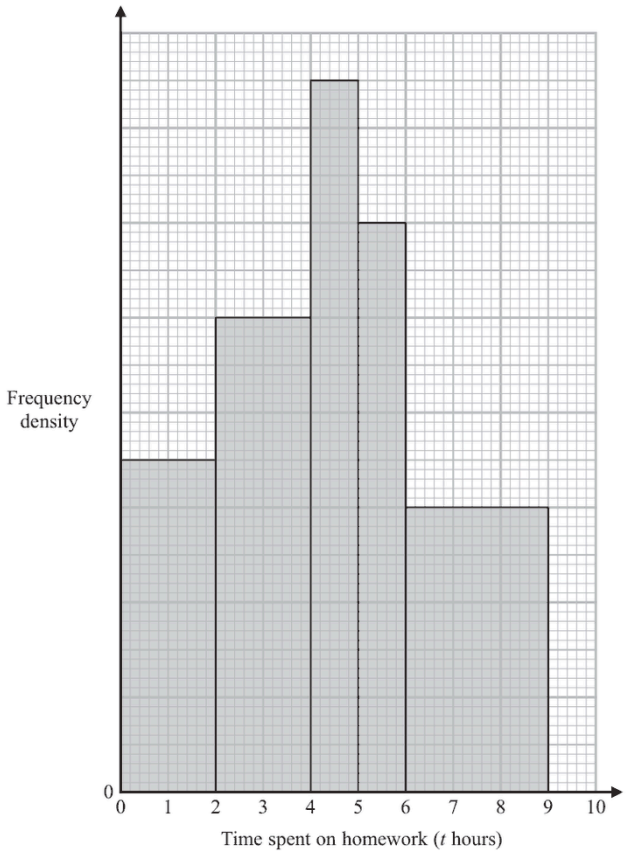
(3)

(Total for Question 15 is 6 marks)

Question 18

5 marks | Histograms

18 The histogram and the table give some information about the amounts of time, in hours, that Year 11 students at Bergdesh Academy spent, in total, on their homework last week.
No student in Year 11 spent longer than 9 hours on their homework.



Time spent on homework (t hours)	Frequency
$0 < t \leqslant 2$	28
$2 < t \leqslant 4$	
$4 < t \leqslant 5$	
$5 < t \leqslant 6$	
$6 < t \leqslant 9$	

Using the information in the histogram and in the table, work out an estimate for the mean amount of time the Year 11 students spent on their homework last week.
Give your answer in hours correct to 3 significant figures.

..... hours

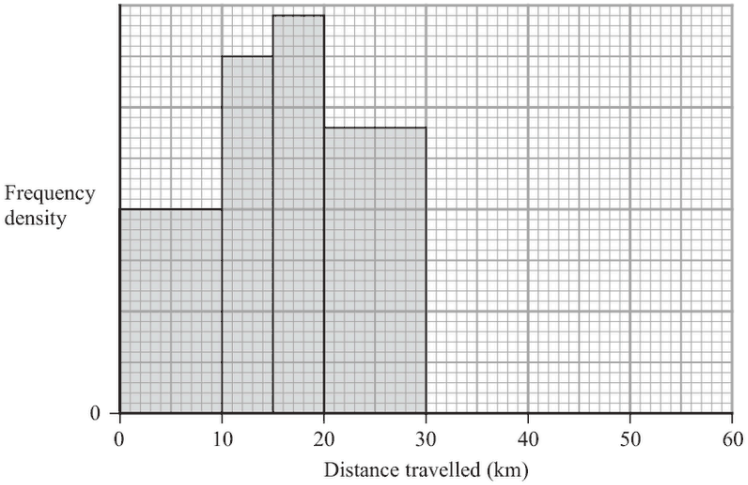
(Total for Question 18 is 5 marks)

Question 18

5 marks | Histograms

18 The table and histogram give information about the distance travelled, in order to get to work, by each person working in a large store.

Distance (d km)	Frequency
$0 \leqslant d < 10$	40
$10 \leqslant d < 15$	
$15 \leqslant d < 20$	
$20 \leqslant d < 30$	
$30 \leqslant d < 60$	30



Using the information in the table and in the histogram,

(a) complete the table,

(2)

(b) complete the histogram.

(1)

One of the people working in the store is chosen at random.

(c) Work out an estimate for the probability that the distance travelled by this person, in order to get to work, was greater than 25 km.

.....

(2)

(Total for Question 18 is 5 marks)

Question 14

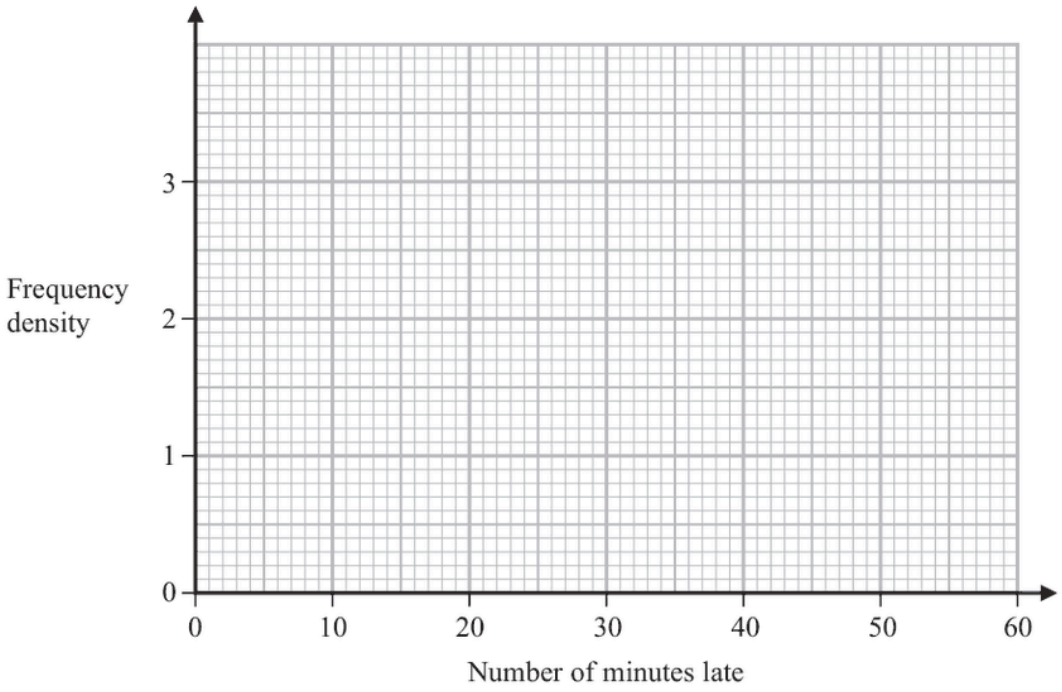
5 marks | Histograms

14 Manuel collected information about the flights that arrived late at an airport last month.

The table gives information about the number of minutes that these flights were late.

Minutes late (L minutes)	Frequency
$0 < L \leqslant 10$	8
$10 < L \leqslant 15$	13
$15 < L \leqslant 25$	19
$25 < L \leqslant 40$	24
$40 < L \leqslant 60$	6

(a) On the grid, draw a histogram for this information.



(3)

Manuel selected at random a flight that was late by 25 minutes or less from his results.

(b) Work out an estimate for the probability that this flight was late by 5 minutes or less.

.....

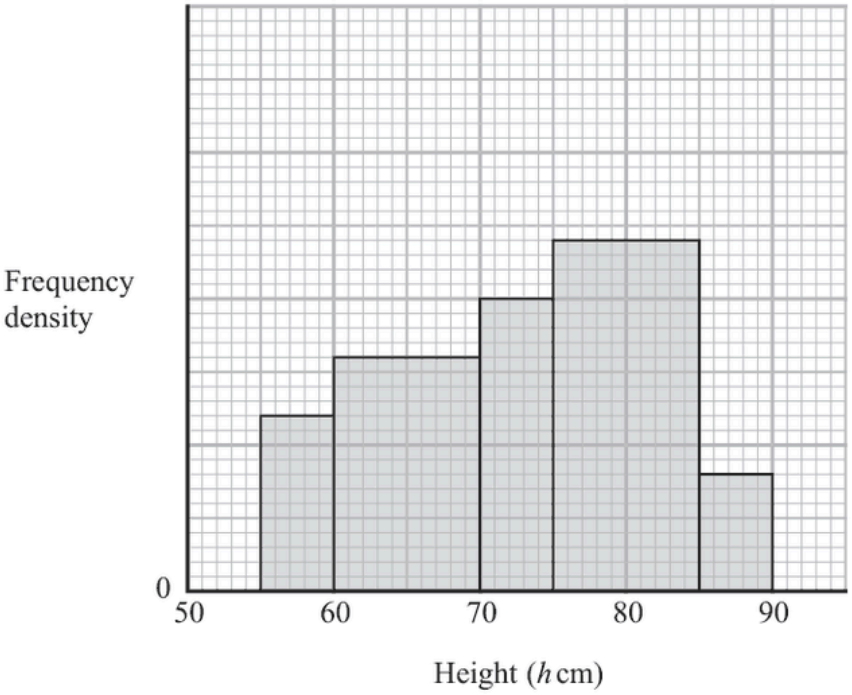
(2)

(Total for Question 14 is 5 marks)

Question 20

4 marks | Histograms

20 The histogram gives information about the heights, h cm, of some tomato plants.



There are 12 tomato plants for which $75 < h \leqslant 85$
One of the tomato plants is selected at random.

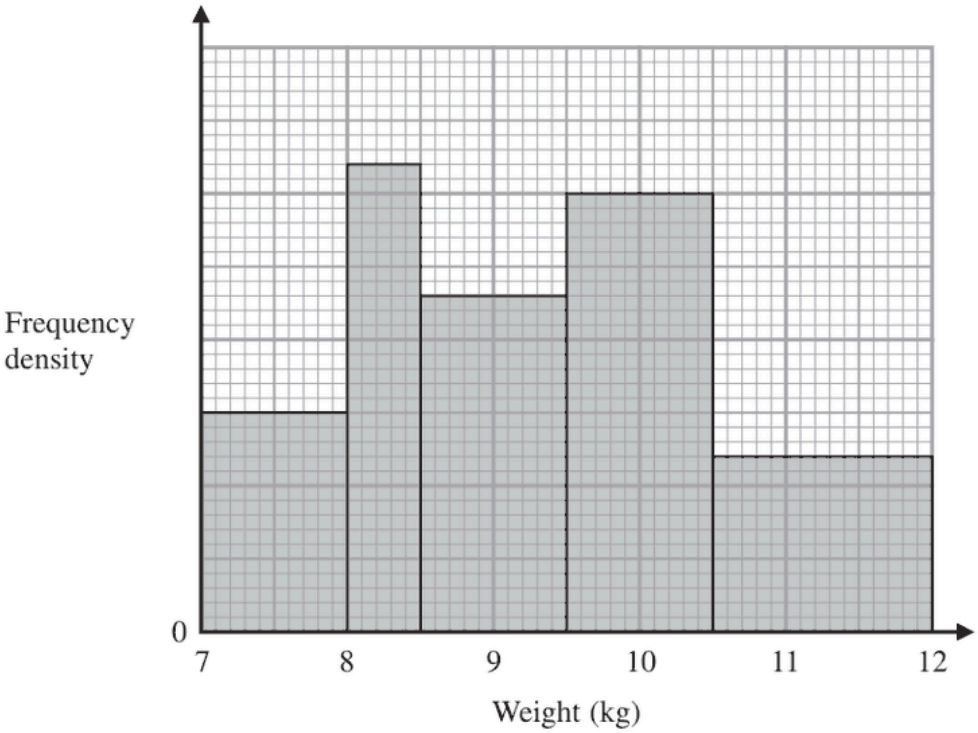
Find an estimate for the probability that this tomato plant has a height greater than 82.5 cm

(Total for Question 20 is 4 marks)

Question 21

3 marks | Histograms

21



The histogram gives information about the weights, in kg, of all the watermelons in a field.

There are 16 watermelons with a weight between 8 kg and 8.5 kg

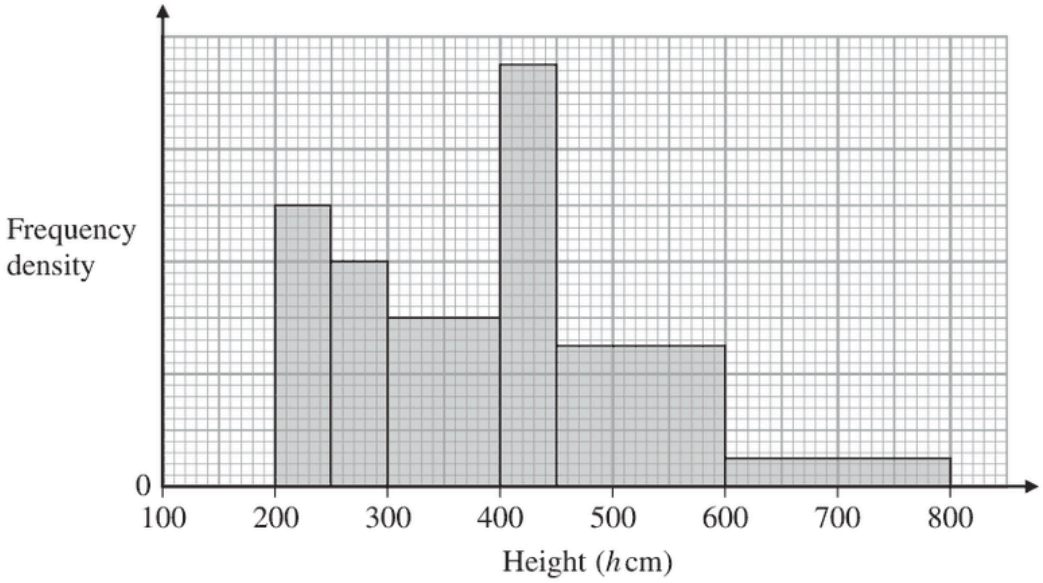
Work out the total number of watermelons in the field.

(Total for Question 21 is 3 marks)

Question 19

3 marks | Histograms

19 The histogram gives information about the height, h cm, of each tree in part of a forest.



There are no trees for which $h \leqslant 200$ and for which $h > 800$

The number of trees for which $300 < h \leqslant 400$ is 8 fewer than the number of trees for which $400 < h \leqslant 500$

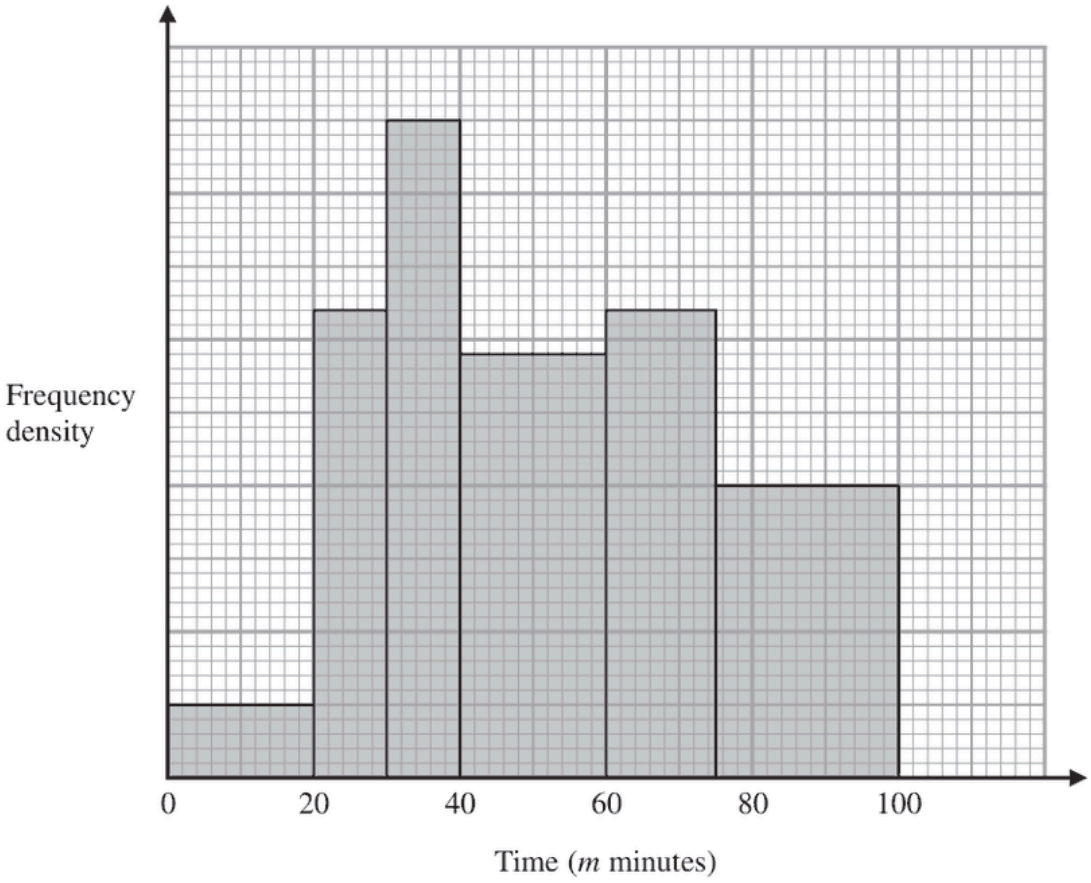
Work out an estimate for the number of trees in this part of the forest that have a height greater than 500 cm.

(Total for Question 19 is 3 marks)

Question 21

3 marks | Histograms

21 The histogram shows information about the total time, m minutes, taken by each child in a school to walk to school every day for one week.



There are no children for whom $m > 100$
There are 10 children for whom $m \leqslant 20$

Work out an estimate for the number of children for whom $50 < m \leqslant 80$

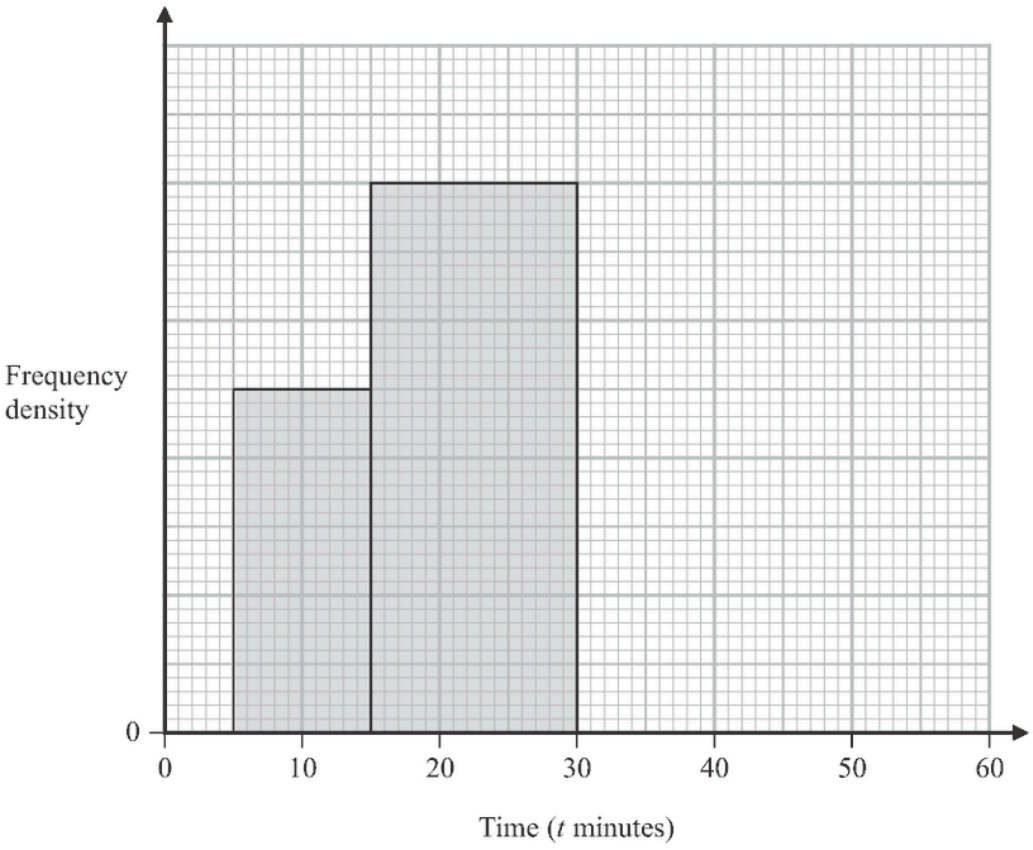
(Total for Question 21 is 3 marks)

Question 18

4 marks | Histograms

18 The incomplete table and incomplete histogram give information about the times, in minutes, that 140 people waited at a station for a train.

Time (t minutes)	Frequency
$0 < t \leqslant 5$	23
$5 < t \leqslant 15$	
$15 < t \leqslant 30$	
$30 < t \leqslant 40$	18
$40 < t \leqslant 60$	14



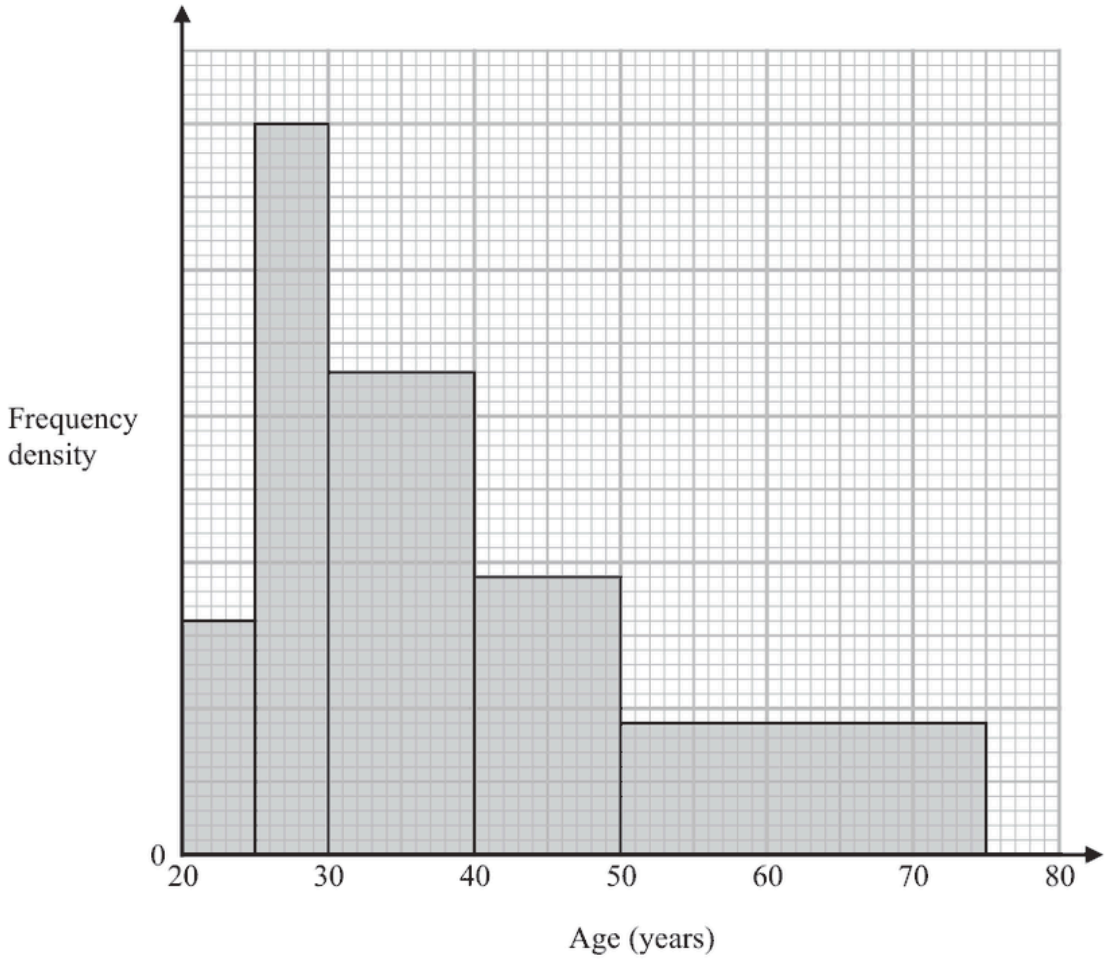
Complete the table and the histogram.

(Total for Question 18 is 4 marks)

Question 22

4 marks | Histograms

22 Some people attend a concert.
The histogram shows information about the ages of these people.



Work out an estimate for the percentage of these people who are aged more than 55 years.
Give your answer correct to one decimal place.

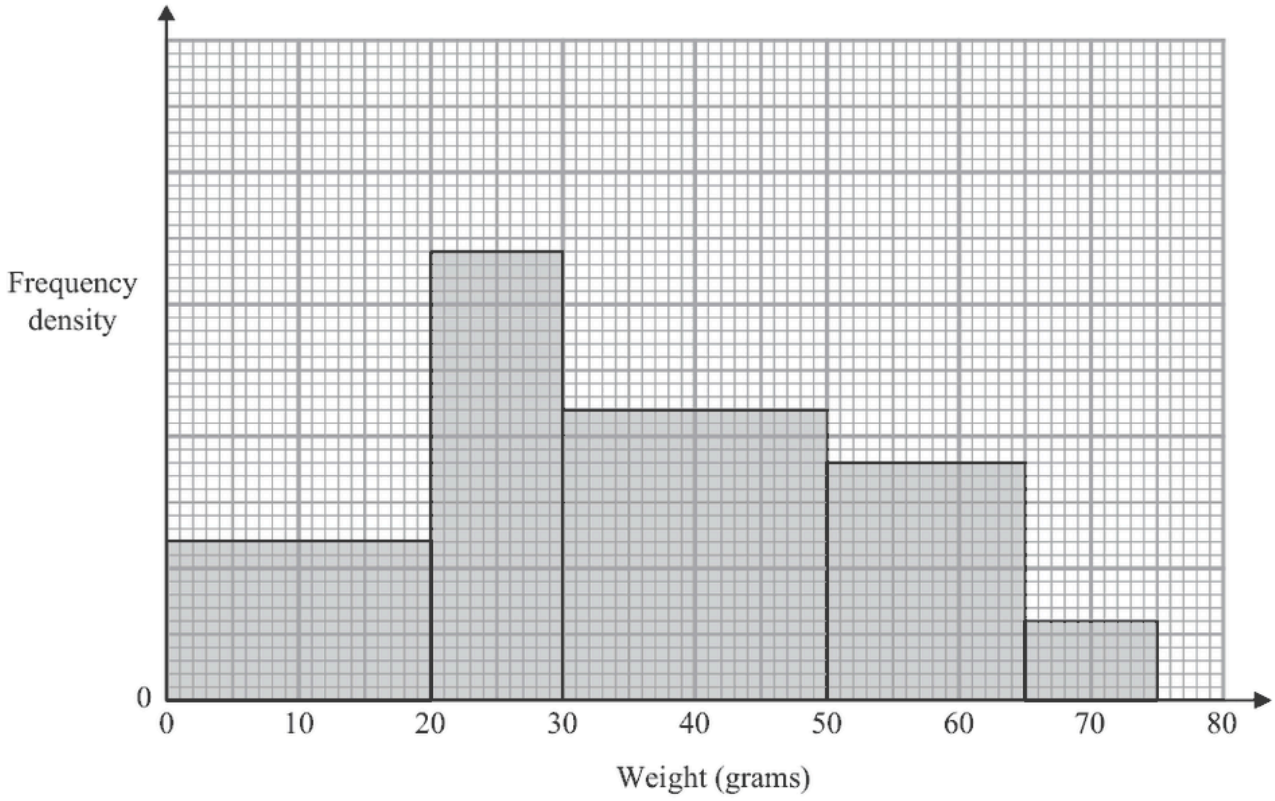
.....%

(Total for Question 22 is 4 marks)

Question 17

3 marks | Histograms

17 The histogram gives information about the weights, in grams, of some oranges in a box.



24 of these oranges weigh less than 20 grams.

Medium oranges weigh between 35 grams and 55 grams.

Work out an estimate for the number of medium oranges in the box.

(Total for Question 17 is 3 marks)

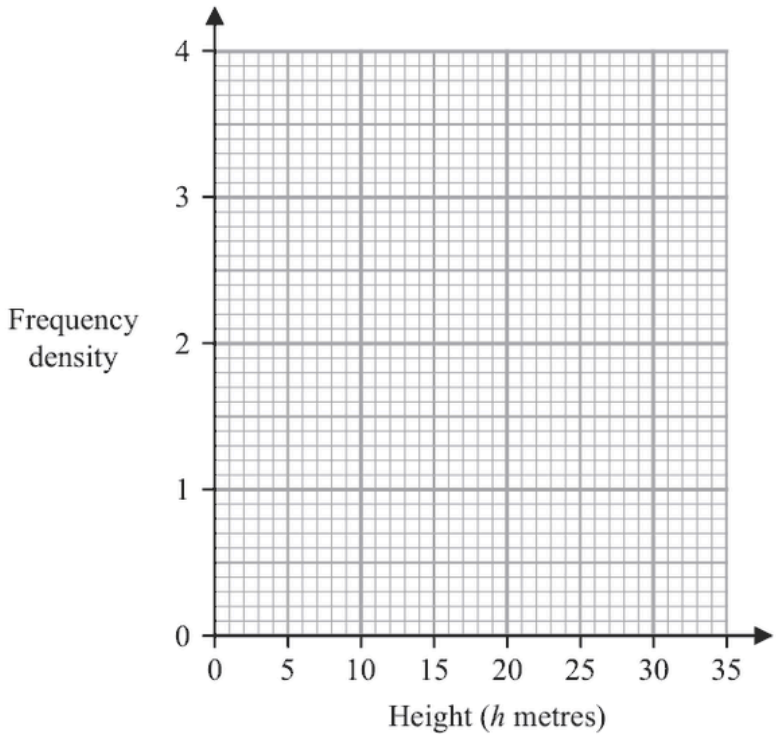
Question 16

3 marks | Histograms

16 The table gives information about the heights, in metres, of the trees in a park.

Height (h metres)	Frequency
$0 < h \leqslant 2$	5
$2 < h \leqslant 5$	12
$5 < h \leqslant 10$	18
$10 < h \leqslant 20$	14
$20 < h \leqslant 35$	9

On the grid, draw a histogram for this information.

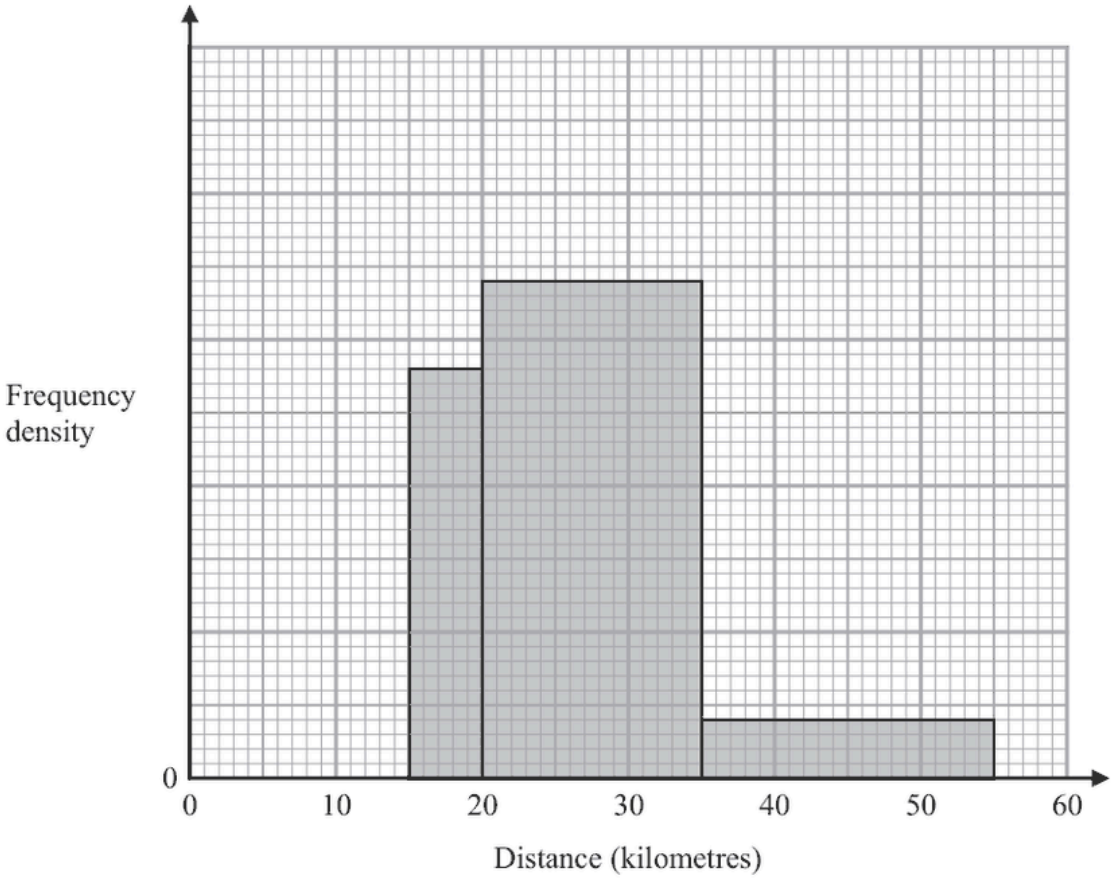


(Total for Question 16 is 3 marks)

Question 22

3 marks | Histograms

22 The incomplete histogram shows some information about the distances, in kilometres, that 100 adults ran last week.



All of the adults ran at least 5 kilometres.
None of the adults ran more than 55 kilometres.
14 adults ran between 15 kilometres and 20 kilometres.

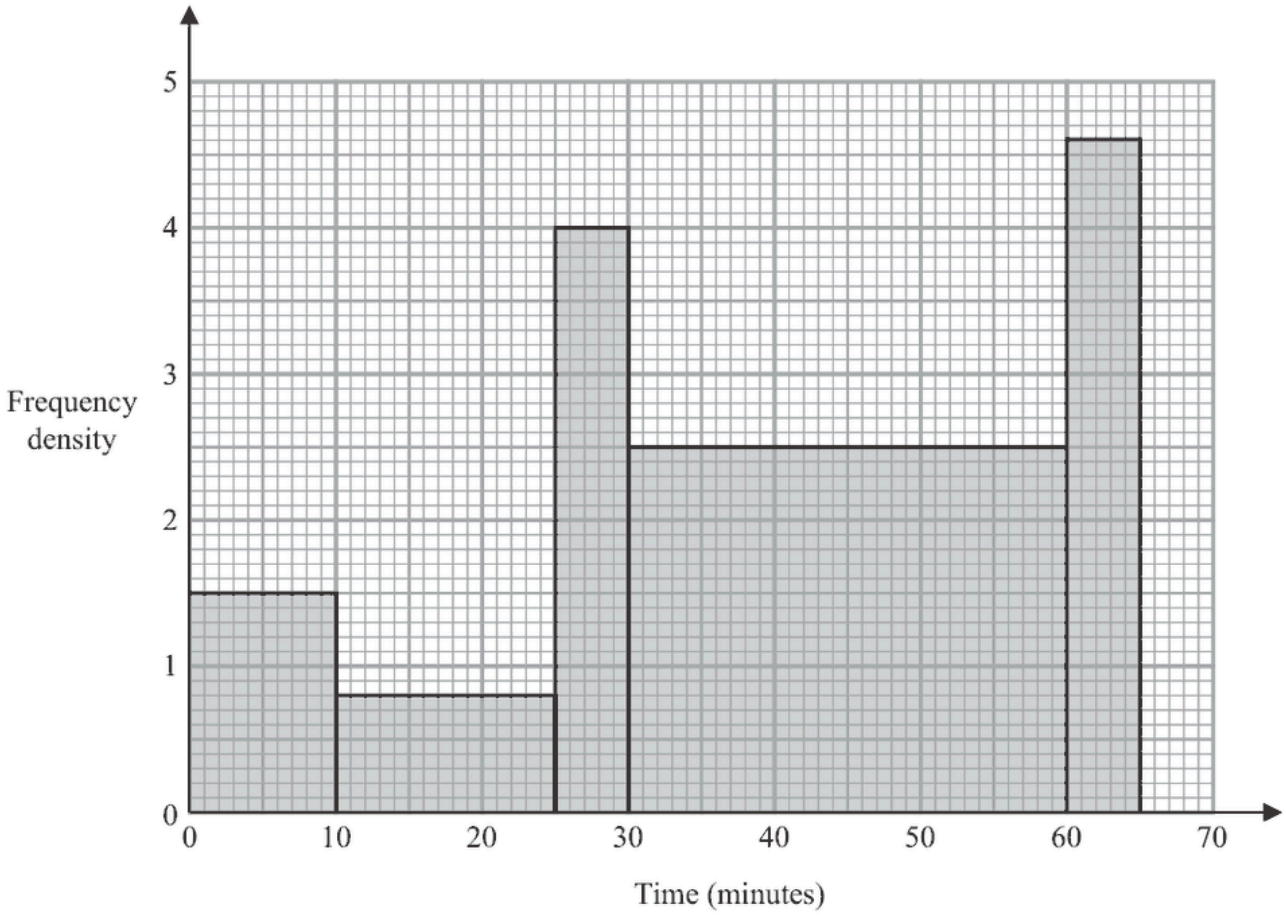
Complete the histogram.

(Total for Question 22 is 3 marks)

Question 18

4 marks | Histograms

18 The histogram shows information about the times some students took to complete a puzzle.



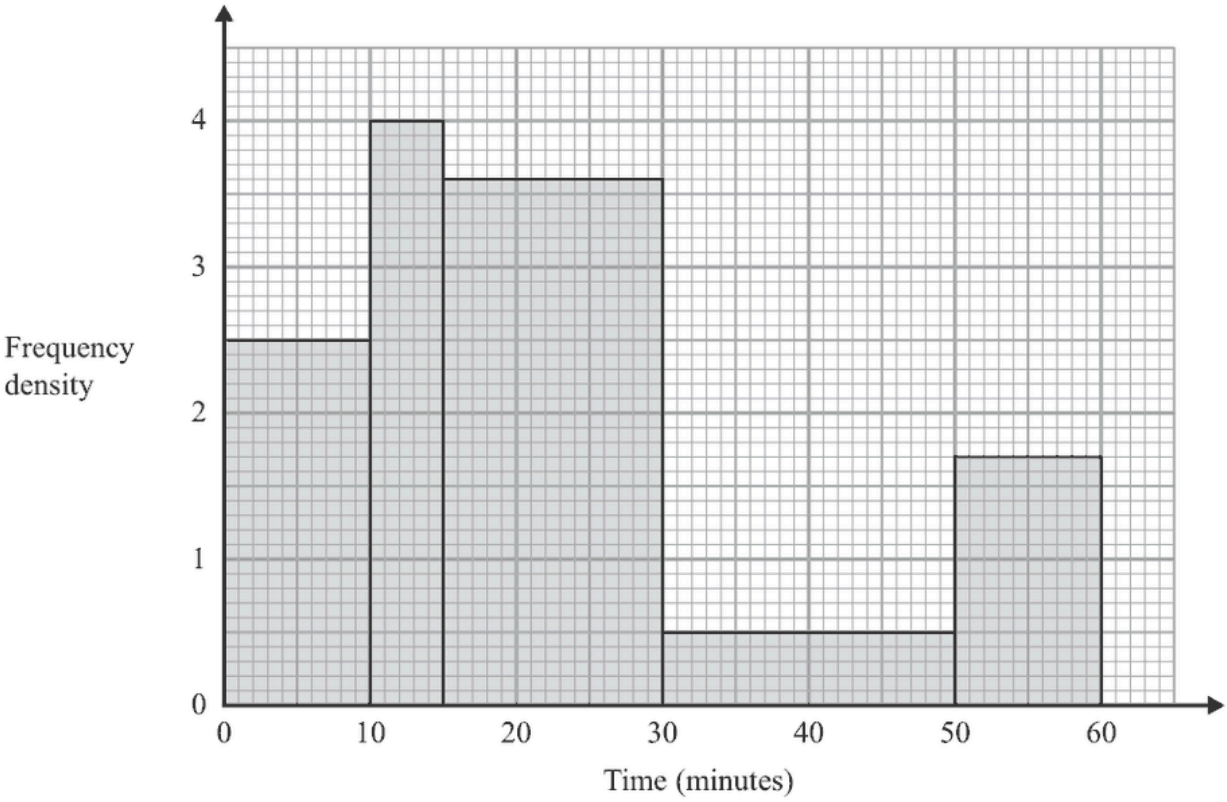
Work out an estimate for the fraction of these students who took between 20 minutes and 60 minutes to complete the puzzle.

(Total for Question 18 is 4 marks)

Question 17

3 marks | Histograms

17 The histogram shows information about the times, in minutes, that some people were in a shop.



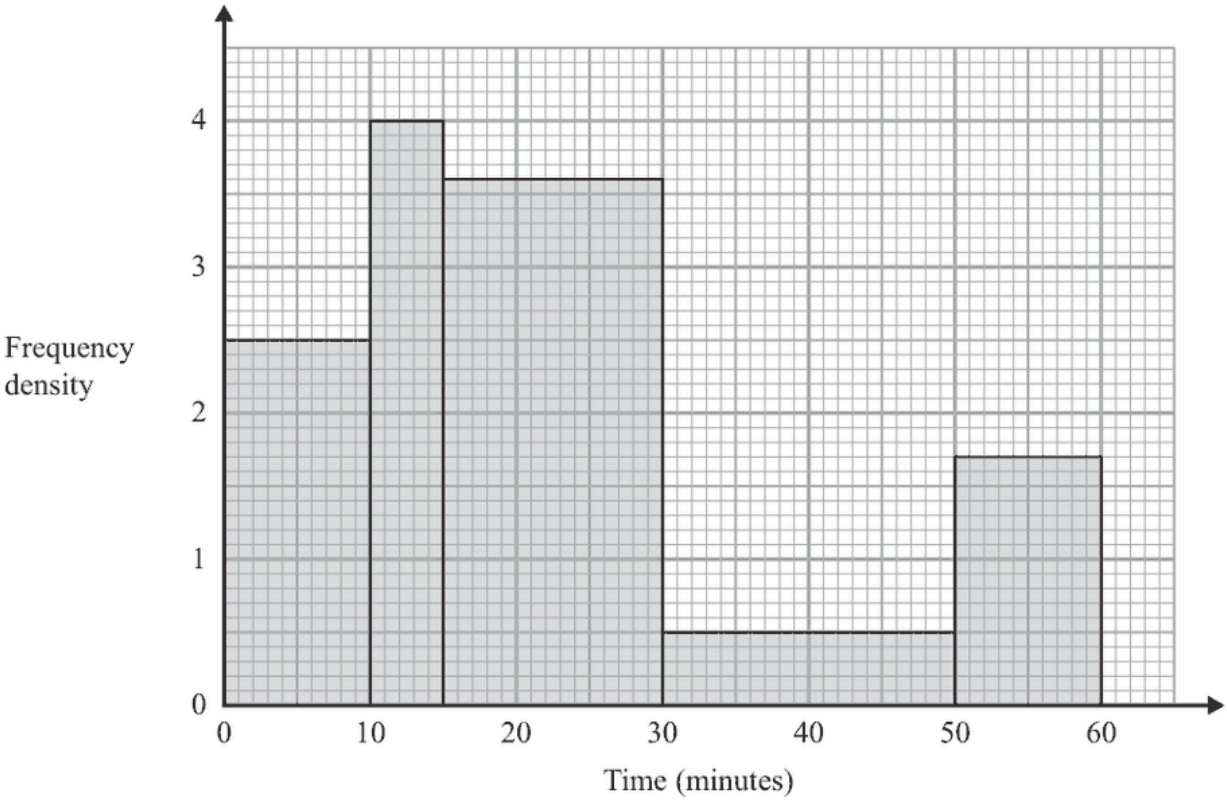
Work out an estimate for the proportion of these people who were in the shop for more than 40 minutes.

(Total for Question 17 is 3 marks)

Question 18

3 marks | Histograms

18 The histogram shows information about the times, in minutes, that some people were in a shop.



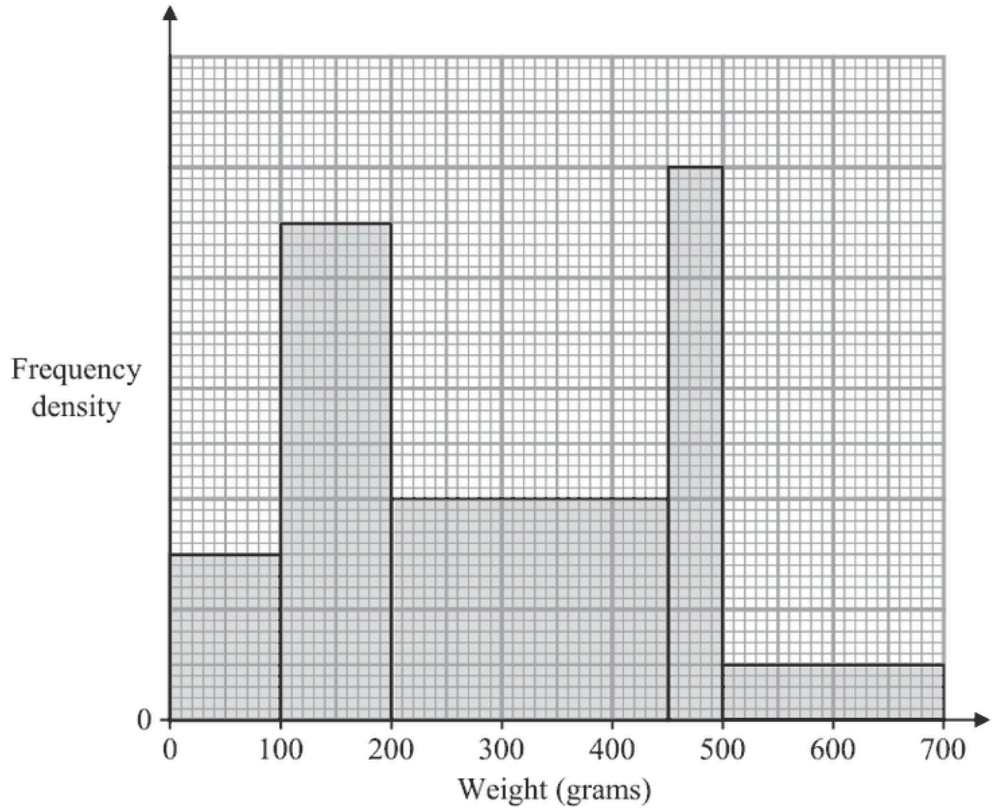
Work out an estimate for the proportion of these people who were in the shop for more than 40 minutes.

(Total for Question 18 is 3 marks)

Question 20

4 marks | Histograms

20 The histogram gives some information about the weights, in grams, of some books.



75 books weigh less than 100 grams.

A book is chosen at random.

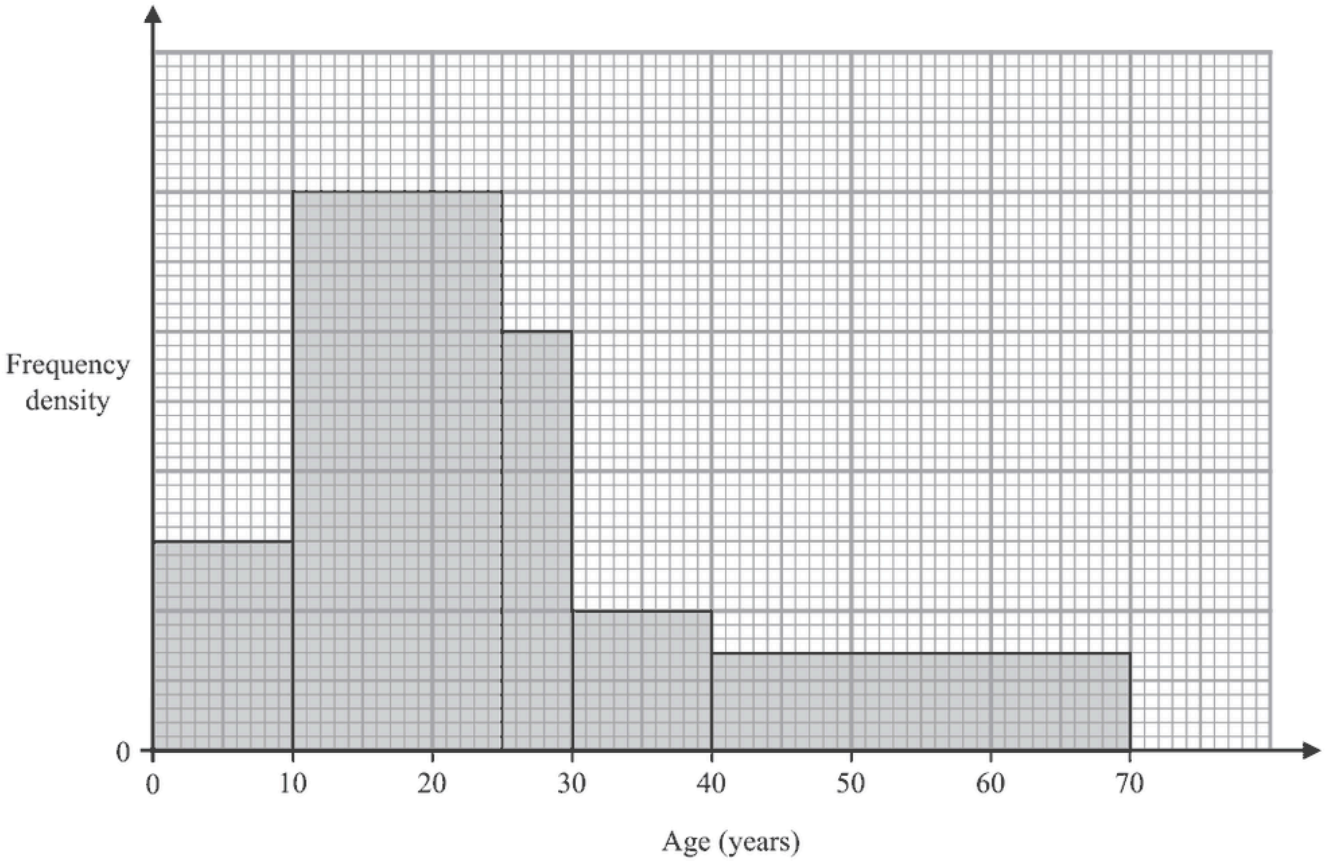
Find an estimate for the probability that this book weighs between 400 grams and 600 grams.

(Total for Question 20 is 4 marks)

Question 21

3 marks | Histograms

21 The histogram shows information about the ages of the members of a chess club.



There are 60 members aged between 10 and 25
There are no members older than 70

Work out an estimate for the number of members who are over 35 years of age.

(Total for Question 21 is 3 marks)

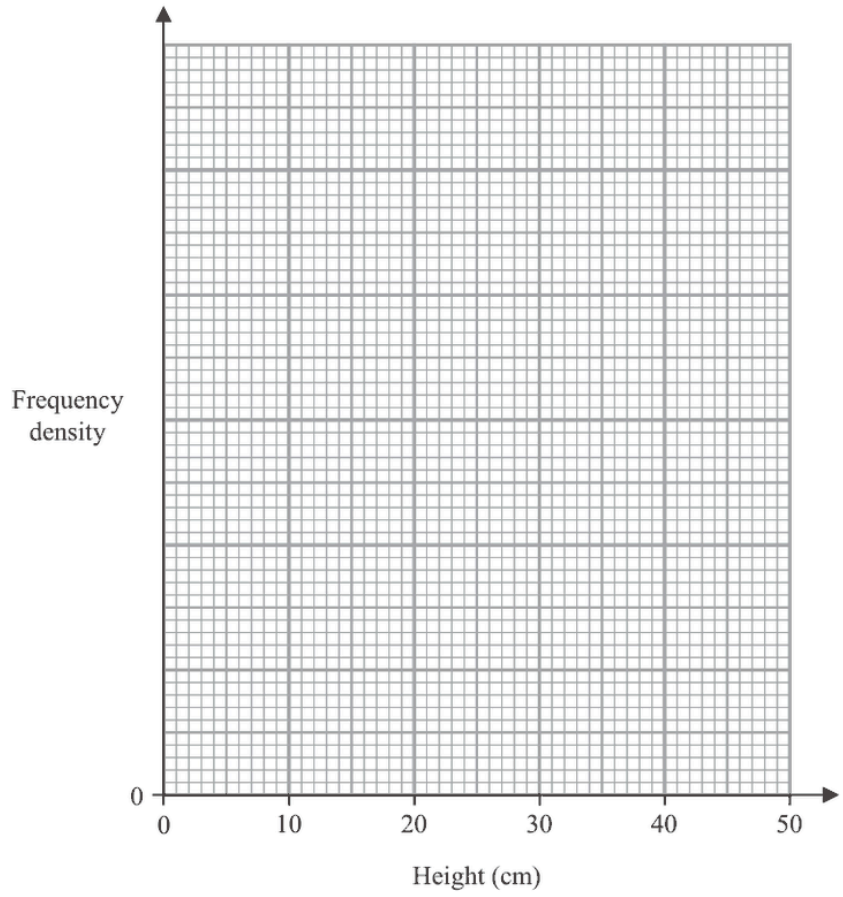
Question 20

3 marks | Histograms

20 The table gives information about the heights, in centimetres, of some plants.

Height (h cm)	Frequency
$0 < h \leqslant 5$	12
$5 < h \leqslant 15$	34
$15 < h \leqslant 30$	45
$30 < h \leqslant 50$	28

On the grid, draw a histogram for this information.
You must include a scale on the vertical axis.

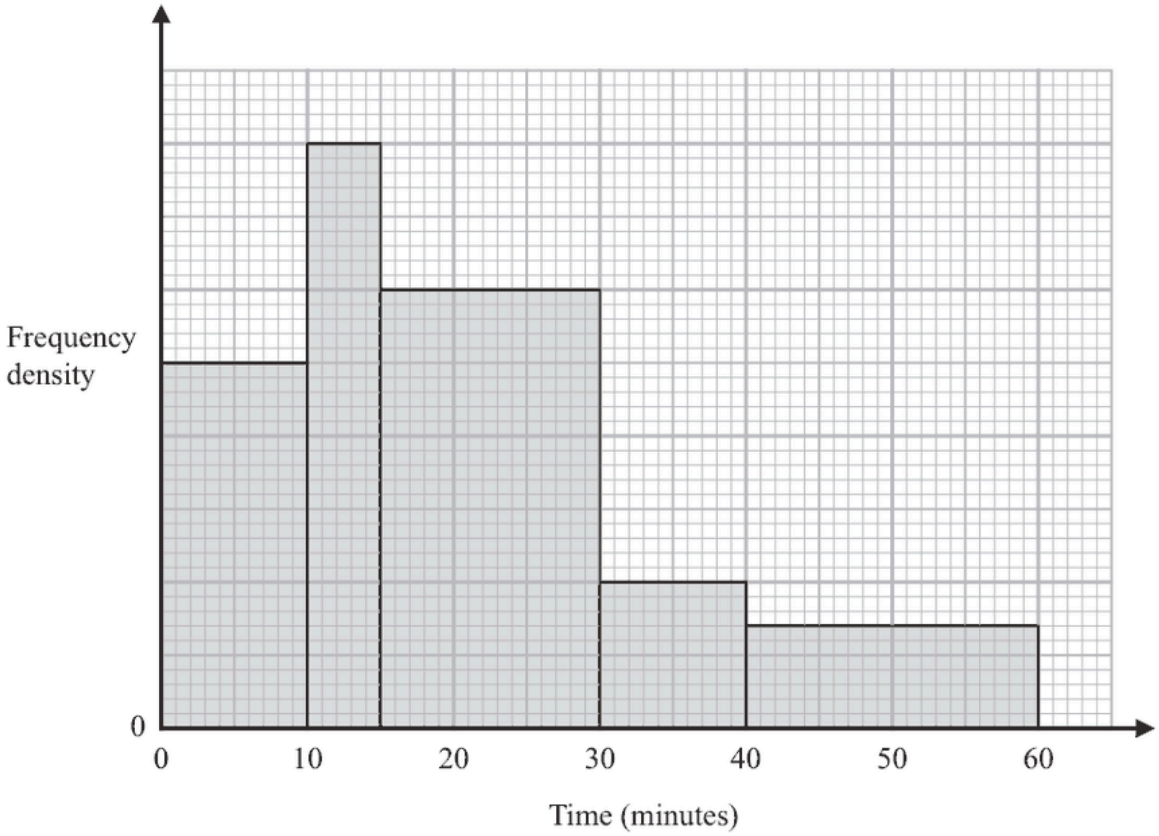


(Total for Question 20 is 3 marks)

Question 21

3 marks | Histograms

21 The histogram shows information about the times, in minutes, that some trains arrived late at a station one day.



20 of these trains arrived between 10 minutes late and 15 minutes late.

No trains arrived more than 60 minutes late.

Work out an estimate for the number of these trains that arrived at least 25 minutes late.

(Total for Question 21 is 3 marks)

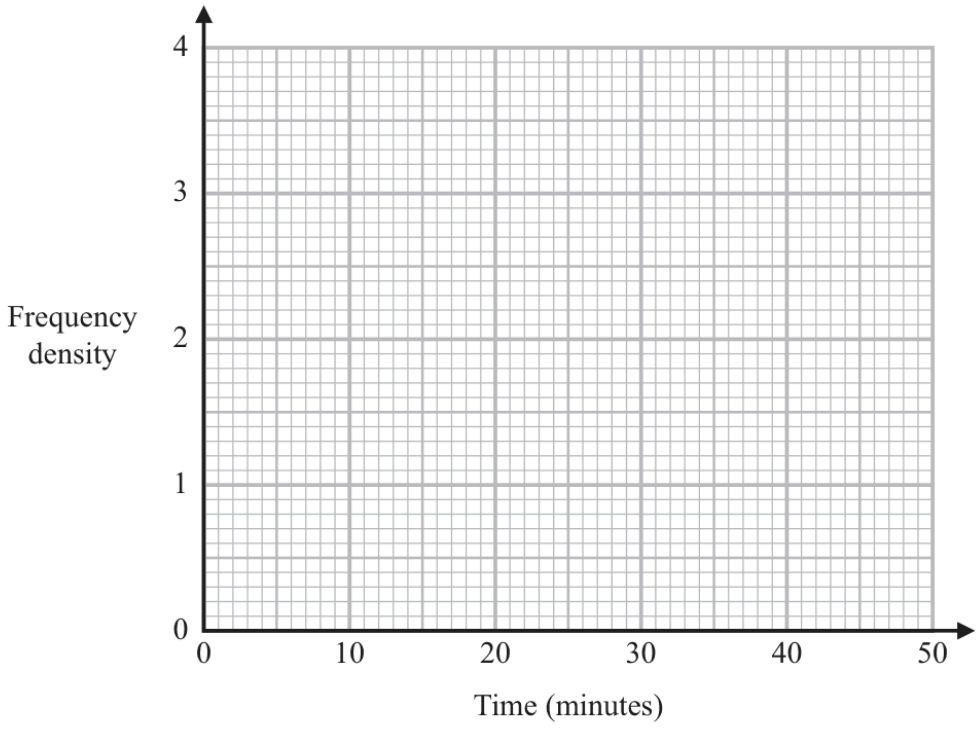
Question 19

3 marks | Histograms

19 The table gives information about the times, in minutes, some people spent waiting to go on a rollercoaster.

Time (t minutes)	Frequency
$0 < t \leqslant 20$	14
$20 < t \leqslant 25$	12
$25 < t \leqslant 35$	32
$35 < t \leqslant 50$	30

On the grid, draw a histogram for this information.

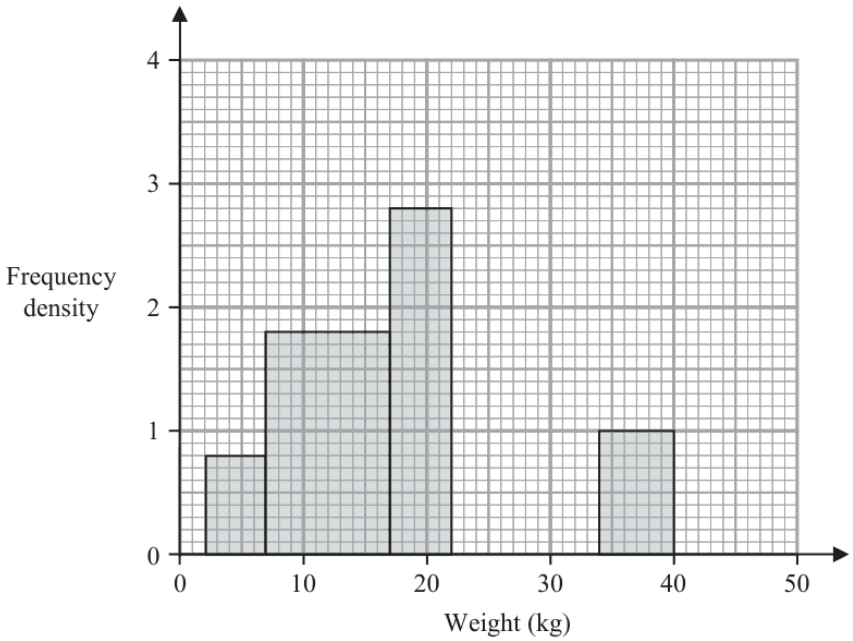


(Total for Question 19 is 3 marks)

Question 21

3 marks | Histograms

21 The incomplete histogram shows information about the weights, in kg, of some parcels.



No parcels weigh less than 2 kg
No parcels weigh more than 40 kg
Half of the parcels weigh between 22 kg and 34 kg

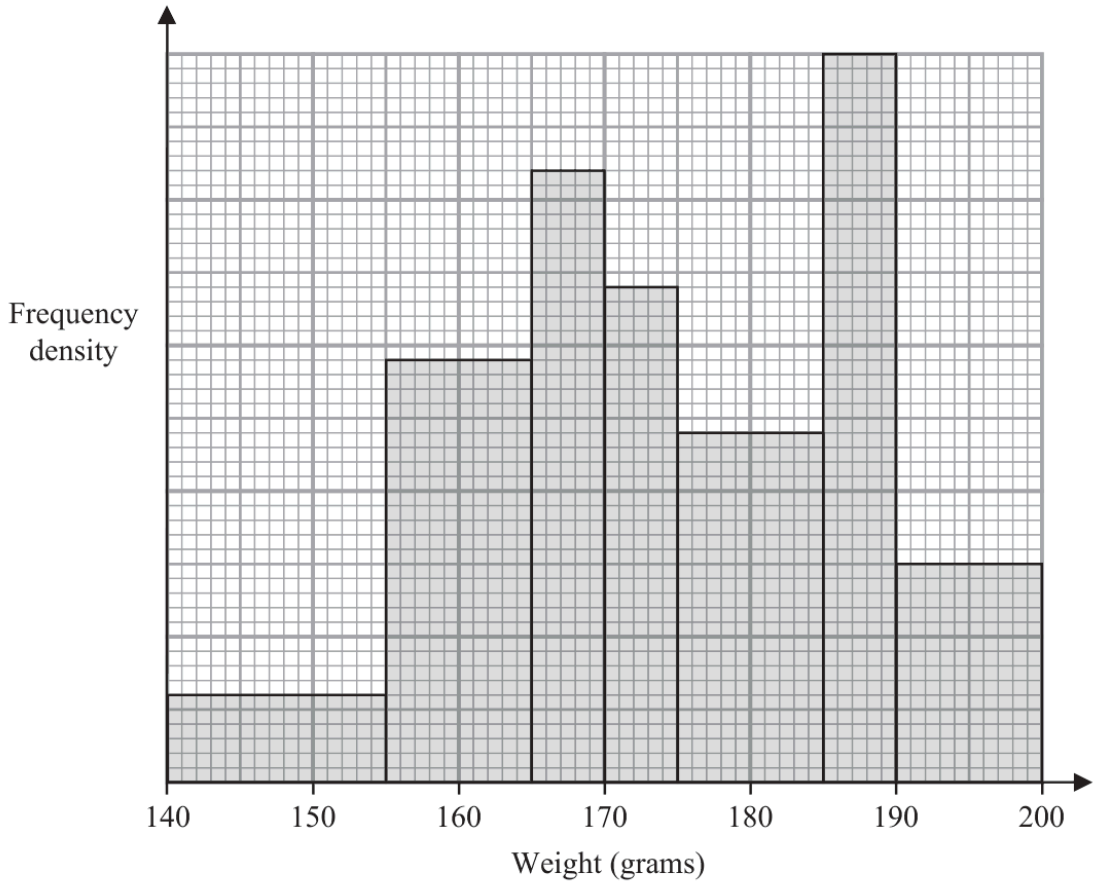
Complete the histogram by drawing a bar to represent the parcels that weigh between 22 kg and 34 kg

(Total for Question 21 is 3 marks)

Question 22

5 marks | Histograms

22 The histogram gives information about the weights, in grams, of all the apples in a shop.



There are 9 apples with a weight between 140 grams and 155 grams.

(a) Work out the number of apples with a weight less than 175 grams.

.....

(3)

An apple is classified as a large apple if it has a weight of more than 180 grams.
One of the large apples is chosen at random.

(b) Work out the probability that it has a weight of more than 190 grams.

.....

(2)

(Total for Question 22 is 5 marks)

TOPIC

Cumulative Frequency Diagrams

Every past-paper question on this topic, 2020 to 2026.

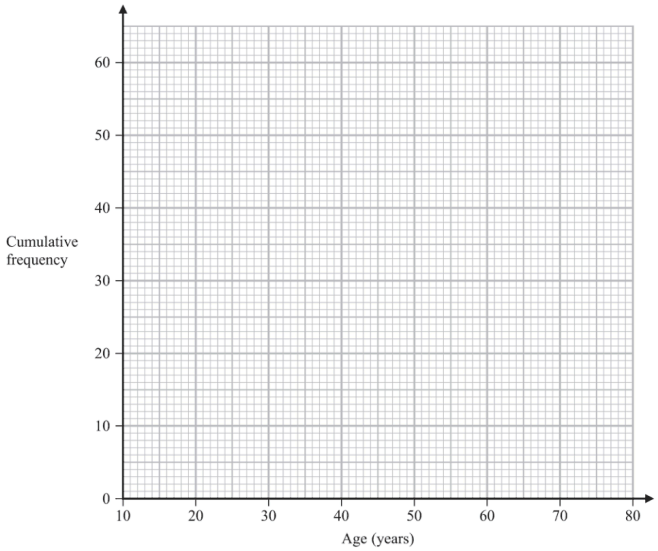
Question 15

7 marks | Cumulative Frequency Diagrams

15 The cumulative frequency table shows information about the ages of 60 people who went to a gym on Saturday.

Age (a years)	Cumulative frequency
$10 < a \leqslant 20$	13
$10 < a \leqslant 30$	36
$10 < a \leqslant 40$	42
$10 < a \leqslant 50$	47
$10 < a \leqslant 60$	52
$10 < a \leqslant 70$	56
$10 < a \leqslant 80$	60

(a) On the grid, draw a cumulative frequency graph for the information in the table.



(2)

(b) Use your graph to find an estimate for the median of the ages of these people.

..... years

(1)

(c) Use your graph to find an estimate for the interquartile range of the ages of these people.

..... years

(2)

(d) Use your graph to find an estimate for the number of these people who are older than 55 years.

.....

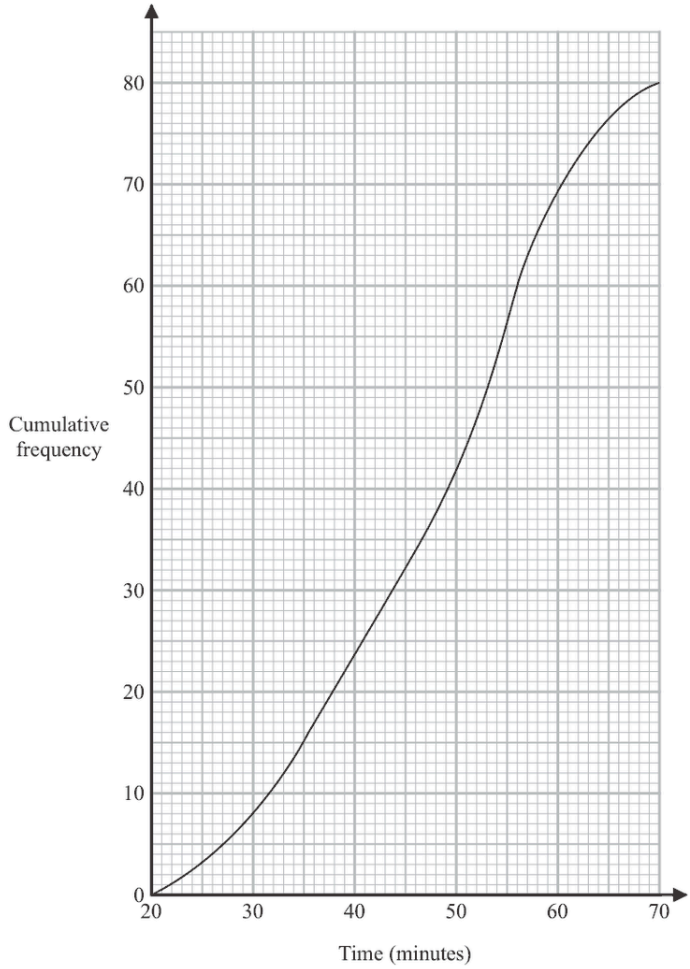
(2)

(Total for Question 15 is 7 marks)

Question 12

5 marks | Cumulative Frequency Diagrams

12 A total of 80 men and women took part in a race.
The cumulative frequency graph gives information about the times, in minutes, they took for the race.



(a) Use the graph to find an estimate for the interquartile range.

..... minutes
(2)

60% of the men took 50 minutes or less for the race.
No women took 50 minutes or less for the race.

(b) Work out an estimate for the number of men who took part in the race.

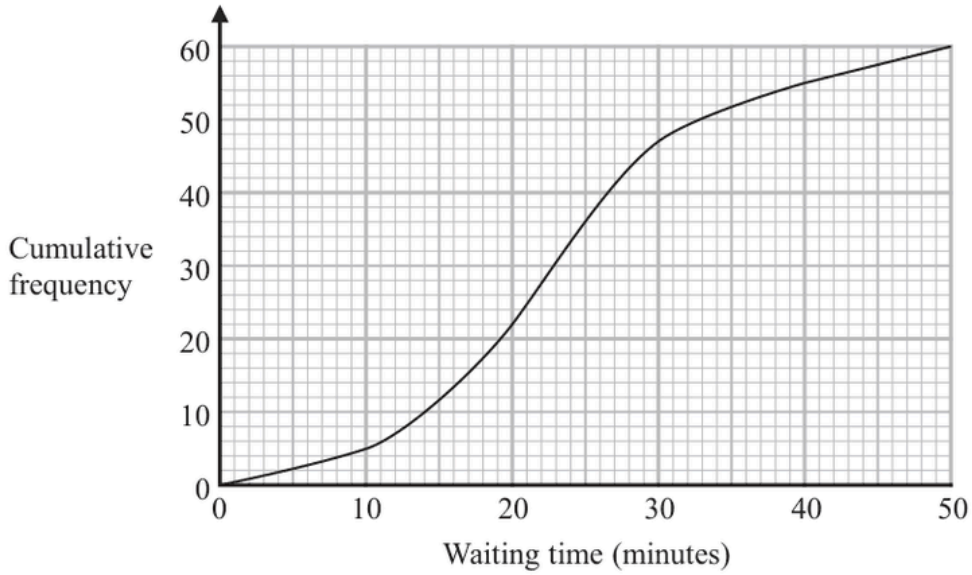
.....
(3)

(Total for Question 12 is 5 marks)

Question 12

5 marks | Cumulative Frequency Diagrams

12 The cumulative frequency graph gives information about the waiting times, in minutes, of people with appointments at Hospital A.



(a) Use the graph to find an estimate of the median waiting time at Hospital A.

..... minutes

(1)

(b) Use the graph to find an estimate of the interquartile range of the waiting times at Hospital A.

..... minutes

(2)

At a different hospital, Hospital B, the median waiting time is 28 minutes and the interquartile range of the waiting times is 19 minutes.

(c) Compare the waiting times at Hospital A with the waiting times at Hospital B.

.....

(2)

(Total for Question 12 is 5 marks)

Question 11

5 marks | Cumulative Frequency Diagrams

11 The frequency table gives information about the ages of the 80 people in a train carriage.

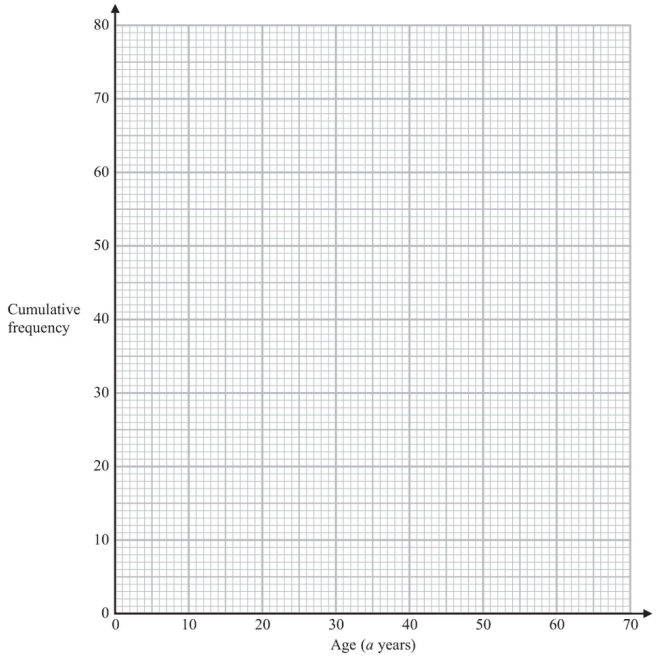
Age (a years)	Frequency
$0 < a \leqslant 20$	9
$20 < a \leqslant 30$	19
$30 < a \leqslant 40$	17
$40 < a \leqslant 50$	18
$50 < a \leqslant 60$	13
$60 < a \leqslant 70$	4

(a) Complete the cumulative frequency table.

Age (a years)	Cumulative frequency
$0 < a \leqslant 20$	
$0 < a \leqslant 30$	
$0 < a \leqslant 40$	
$0 < a \leqslant 50$	
$0 < a \leqslant 60$	
$0 < a \leqslant 70$	

(1)

(b) On the grid, draw a cumulative frequency graph for your table.



(2)

(c) Use your graph to find an estimate for the median age of the people in the train carriage.

..... years

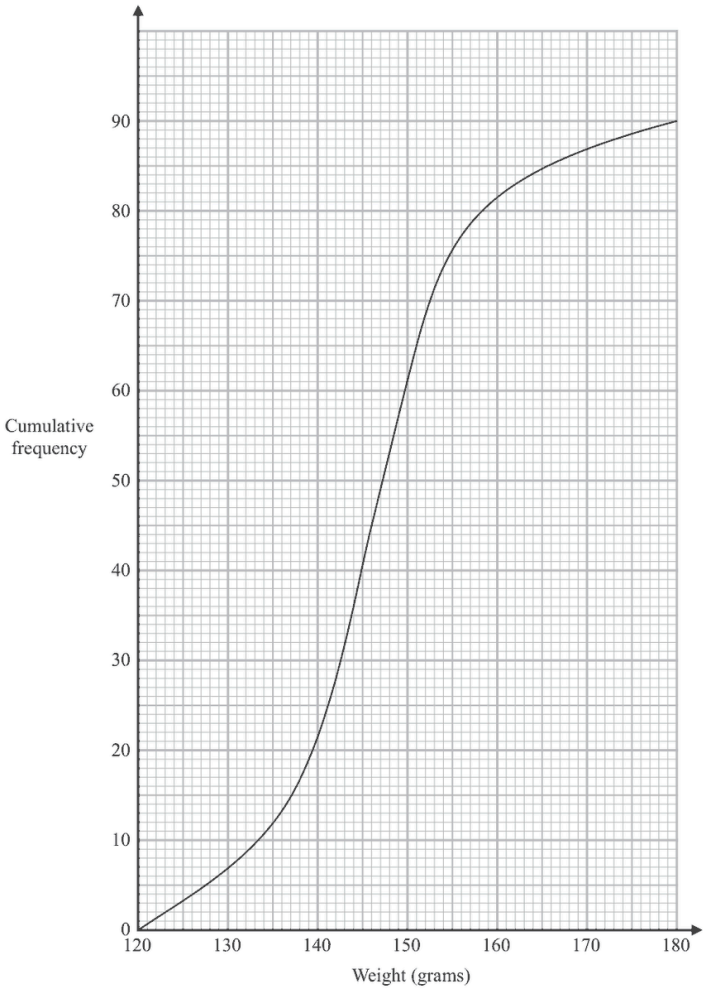
(2)

(Total for Question 11 is 5 marks)

Question 11

5 marks | Cumulative Frequency Diagrams

11 The cumulative frequency graph gives information about the weights, in grams, of 90 bags of sweets.



(a) Find an estimate for the median of the weights of these bags of sweets.

..... grams

(2)

Roberto sells the bags of sweets to raise money for charity.
Bags with a weight greater than d grams are labelled large bags and sold for 3.75 euros each bag.

The total amount of money he receives by selling all the large bags is 93.75 euros.

(b) Find the value of d.

$d =$ .....

(3)

(Total for Question 11 is 5 marks)

Question 11

6 marks | Cumulative Frequency Diagrams

11 The manager of a call centre asked the 120 people, who rang the call centre last week, how long they each waited before their call was answered.

The table gives information about their replies.

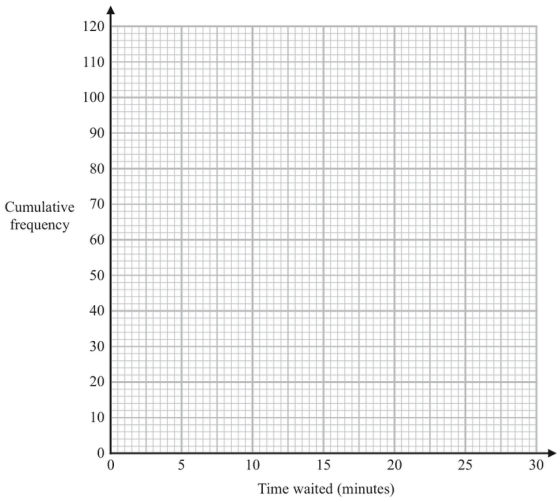
Time waited (t minutes)	Frequency
$0 < t \leqslant 5$	8
$5 < t \leqslant 10$	15
$10 < t \leqslant 15$	17
$15 < t \leqslant 20$	28
$20 < t \leqslant 25$	33
$25 < t \leqslant 30$	19

(a) Complete the cumulative frequency table.

Time waited (t minutes)	Cumulative frequency
$0 < t \leqslant 5$	
$0 < t \leqslant 10$	
$0 < t \leqslant 15$	
$0 < t \leqslant 20$	
$0 < t \leqslant 25$	
$0 < t \leqslant 30$	

(1)

(b) On the grid below, draw a cumulative frequency graph for your table.



(2)

(c) Use your graph to find an estimate for the median of the times waited.

..... minutes

(1)

(d) Using your graph, find an estimate for the percentage of the 120 people who said that they waited longer than 23 minutes before their call was answered.
Show your working clearly.

.....%

(2)

(Total for Question 11 is 6 marks)

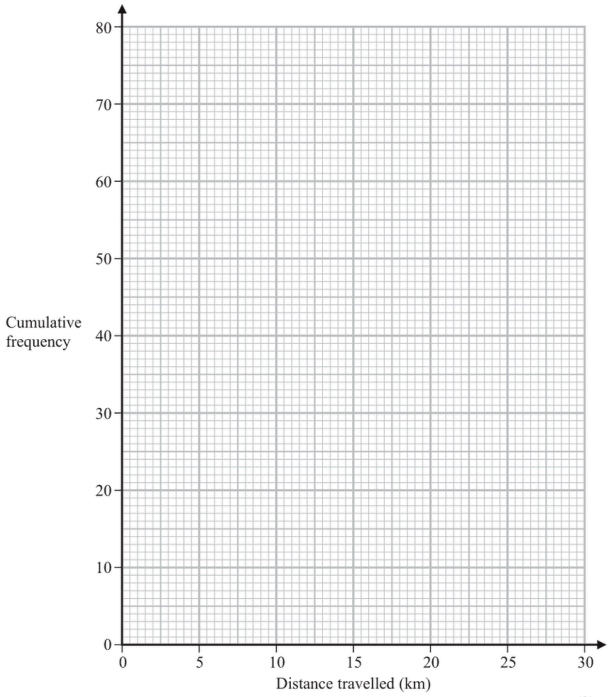
Question 12

7 marks | Cumulative Frequency Diagrams

12 The cumulative frequency table gives information about the distance, in kilometres, that each of 80 workers travel from home to work at Office *A*.

Distance travelled (d km)	Cumulative frequency
$0 < d \leqslant 5$	17
$0 < d \leqslant 10$	32
$0 < d \leqslant 15$	57
$0 < d \leqslant 20$	70
$0 < d \leqslant 25$	76
$0 < d \leqslant 30$	80

(a) On the grid below, draw a cumulative frequency graph for the information in the table.



(2)

(b) Use your graph to find an estimate for the median distance travelled.

..... km

(1)

(c) Use your graph to find an estimate for the interquartile range of the distances travelled.

..... km

(2)

For Office *B*, the median distance workers travel from home to work is 15 km and the interquartile range is 5 km.

(d) Use the information above to compare the distances that workers at Office *A* and workers at Office *B* travel from home to work.
Write down **two** comparisons.

1 .....

2 .....

.....

(2)

(Total for Question 12 is 7 marks)

Question 11

5 marks | Cumulative Frequency Diagrams

11 The table gives information about the times taken by 90 runners to complete a 10 km race.

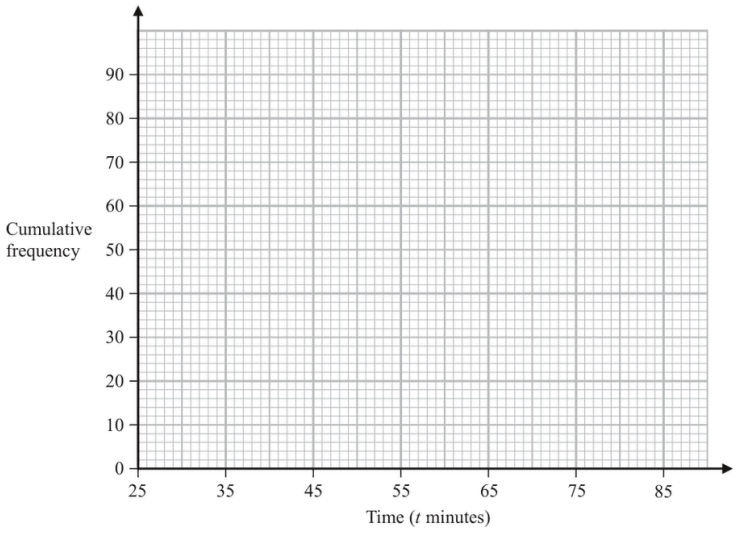
Time (t minutes)	Frequency
$25 < t \leqslant 35$	12
$35 < t \leqslant 45$	24
$45 < t \leqslant 55$	28
$55 < t \leqslant 65$	12
$65 < t \leqslant 75$	10
$75 < t \leqslant 85$	4

(a) Complete the cumulative frequency table.

Time (t minutes)	Cumulative frequency
$25 < t \leqslant 35$	12
$25 < t \leqslant 45$	
$25 < t \leqslant 55$	
$25 < t \leqslant 65$	
$25 < t \leqslant 75$	
$25 < t \leqslant 85$	

(1)

(b) On the grid below, draw a cumulative frequency graph for your table.



(2)

Any runner who completed the race in a time T minutes such that $42 < T \leqslant 52$ minutes was awarded a silver medal.

(c) Use your graph to find an estimate for the number of runners who were awarded a silver medal.

..... runners

(2)

(Total for Question 11 is 5 marks)

Question 12

6 marks | Cumulative Frequency Diagrams

12 The table gives information about the times, in minutes, taken by 80 customers to do their shopping in a supermarket.

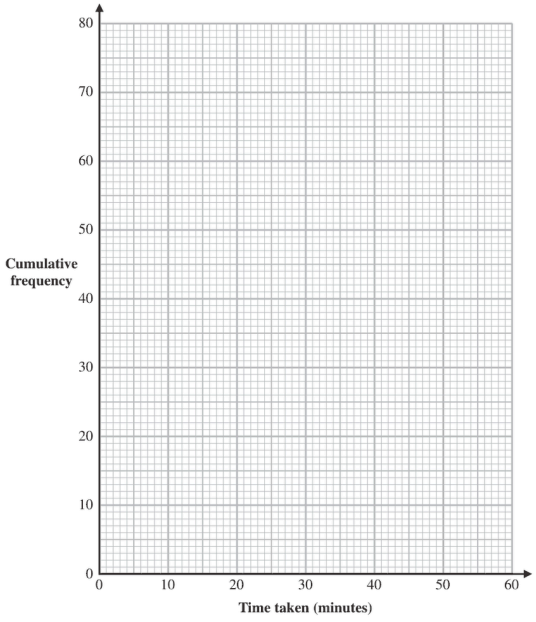
Time taken (t minutes)	Frequency
$0 < t \leqslant 10$	7
$10 < t \leqslant 20$	26
$20 < t \leqslant 30$	24
$30 < t \leqslant 40$	14
$40 < t \leqslant 50$	7
$50 < t \leqslant 60$	2

(a) Complete the cumulative frequency table.

Time taken (t minutes)	Cumulative frequency
$0 < t \leqslant 10$	
$0 < t \leqslant 20$	
$0 < t \leqslant 30$	
$0 < t \leqslant 40$	
$0 < t \leqslant 50$	
$0 < t \leqslant 60$	

(1)

(b) On the grid opposite, draw a cumulative frequency graph for your table.



(2)

(c) Use your graph to find an estimate for the median time taken.

..... minutes

(1)

One of the 80 customers is chosen at random.

(d) Use your graph to find an estimate for the probability that the time taken by this customer was more than 42 minutes.

.....

(2)

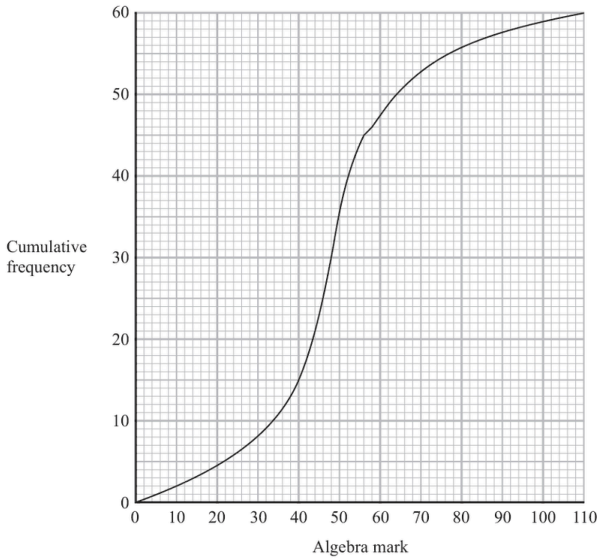
(Total for Question 12 is 6 marks)

Question 14

8 marks | Cumulative Frequency Diagrams

14 A group of 60 students each sat an algebra test and a geometry test.
Each test was marked out of 110

The cumulative frequency graph gives information about the marks gained by the 60 students in the algebra test.



(a) Use the graph to find an estimate for the median mark in the algebra test.

.....

(1)

(b) Use the graph to find an estimate for the number of students who gained 58 marks or less in the algebra test.

.....

(1)

(c) Use the graph to find an estimate for the interquartile range of the marks gained in the algebra test.

.....

(2)

The interquartile range of the marks gained in the geometry test is 9

Luis says

"The students' marks are more spread out in the algebra test than in the geometry test."

(d) Is Luis correct?
Give a reason for your answer.

.....

.....

(1)

To be awarded a grade A in the algebra test, a student had to gain a mark greater than 64

Two students are to be selected at random from the 60 students in the group.

(e) Use the graph to find an estimate for the probability that both of these students were awarded a grade A in the algebra test.

.....

(3)

(Total for Question 14 is 8 marks)

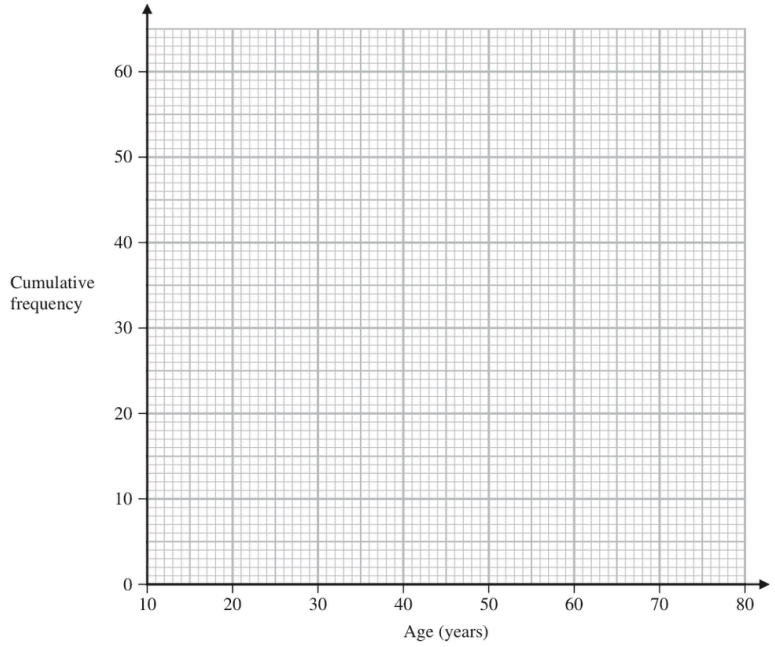
Question 11

7 marks | Cumulative Frequency Diagrams

11 The cumulative frequency table shows information about the ages of 60 people who went to a gym on Saturday.

Age (a years)	Cumulative frequency
$10 < a \leqslant 20$	13
$10 < a \leqslant 30$	36
$10 < a \leqslant 40$	42
$10 < a \leqslant 50$	47
$10 < a \leqslant 60$	52
$10 < a \leqslant 70$	56
$10 < a \leqslant 80$	60

(a) On the grid, draw a cumulative frequency graph for the information in the table.



(2)

Question 11 continued

(b) Use your graph to find an estimate for the median of the ages of these people.

..... years

(1)

(c) Use your graph to find an estimate for the interquartile range of the ages of these people.

..... years

(2)

(d) Use your graph to find an estimate for the number of these people who are older than 55 years.

.....

(2)

(Total for Question 11 is 7 marks)

Question 13

7 marks | Cumulative Frequency Diagrams

13 The table gives information about the ages, in years, of 80 people in a train carriage.

Age (a years)	Frequency
$0 < a \leqslant 20$	7
$20 < a \leqslant 30$	25
$30 < a \leqslant 40$	20
$40 < a \leqslant 50$	14
$50 < a \leqslant 60$	8
$60 < a \leqslant 70$	6

(a) Complete the cumulative frequency table.

Age (a years)	Cumulative frequency
$0 < a \leqslant 20$	
$0 < a \leqslant 30$	
$0 < a \leqslant 40$	
$0 < a \leqslant 50$	
$0 < a \leqslant 60$	
$0 < a \leqslant 70$	

(1)

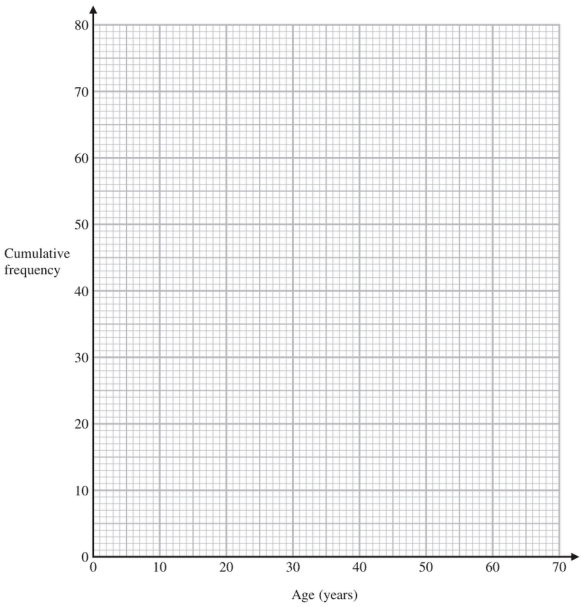
(b) On the grid opposite, draw a cumulative frequency graph for your table.

(2)

(c) Use your graph to find an estimate for the median age of the 80 people.

..... years

(1)



Of the people in the train carriage, 60% of those who are aged between 18 and 65 are going to work. None of the other people in the train carriage are going to work.

(d) Use your graph to find an estimate for the number of people in the train carriage who are going to work.

.....

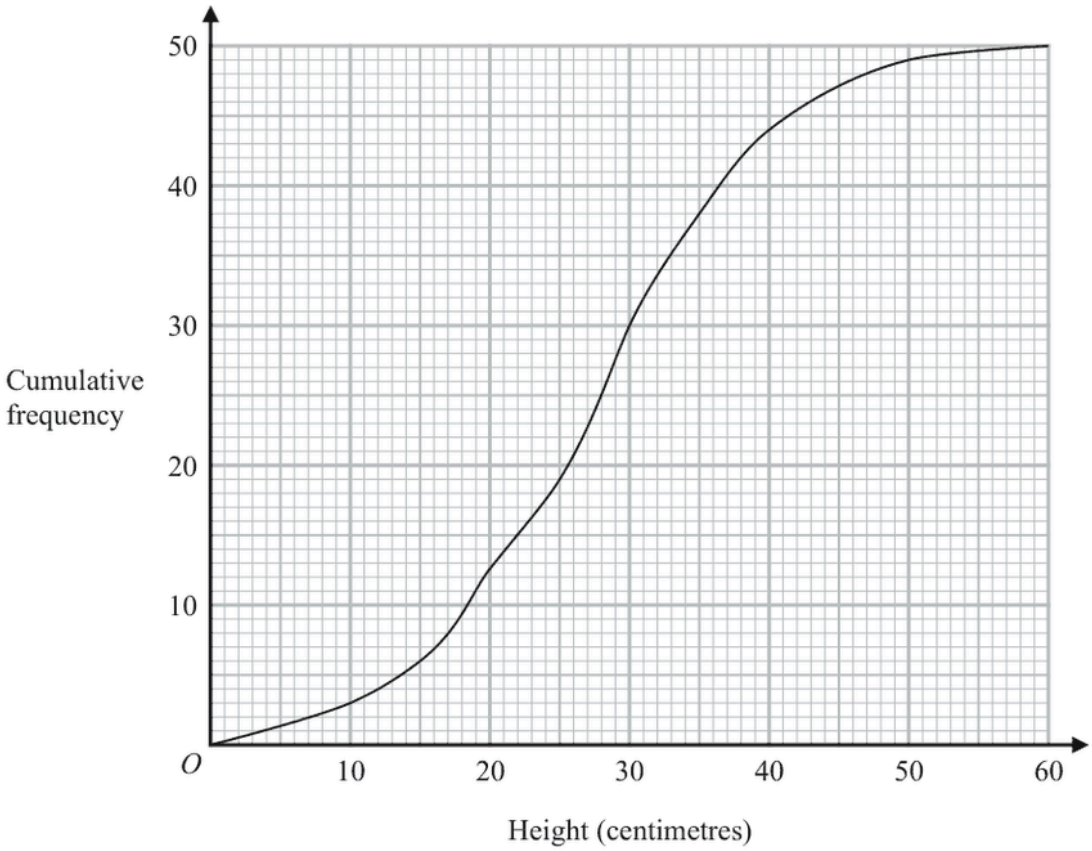
(3)

(Total for Question 13 is 7 marks)

Question 12

4 marks | Cumulative Frequency Diagrams

12 The cumulative frequency graph shows information about the heights, in centimetres, of 50 plants in a flowerbed.



(a) Use the graph to find an estimate for the median height of these plants.

..... centimetres

(1)

(b) Use the graph to find the frequency for the class interval $30 < \text{Height} \leqslant 40$

.....

(1)

(c) Use the graph to find an estimate for the number of plants with a height greater than 35 centimetres.

.....

(2)

(Total for Question 12 is 4 marks)

Question 14

6 marks | Cumulative Frequency Diagrams

14 The table gives information about the times taken by 80 people to run a race.

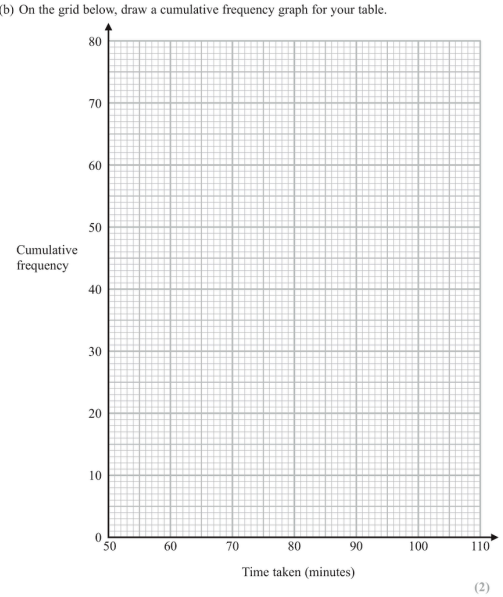
Time taken (t minutes)	Frequency
$50 < t \leqslant 60$	15
$60 < t \leqslant 70$	16
$70 < t \leqslant 80$	21
$80 < t \leqslant 90$	14
$90 < t \leqslant 100$	8
$100 < t \leqslant 110$	6

(a) Complete the cumulative frequency table.

Time taken (t minutes)	Cumulative frequency
$50 < t \leqslant 60$	
$50 < t \leqslant 70$	
$50 < t \leqslant 80$	
$50 < t \leqslant 90$	
$50 < t \leqslant 100$	
$50 < t \leqslant 110$	

(1)

(b) On the grid below, draw a cumulative frequency graph for your table.



(2)

(c) Use your graph to find an estimate for the median time taken.

..... minutes

(1)

(d) Use your graph to find an estimate for the interquartile range of the times taken.

..... minutes

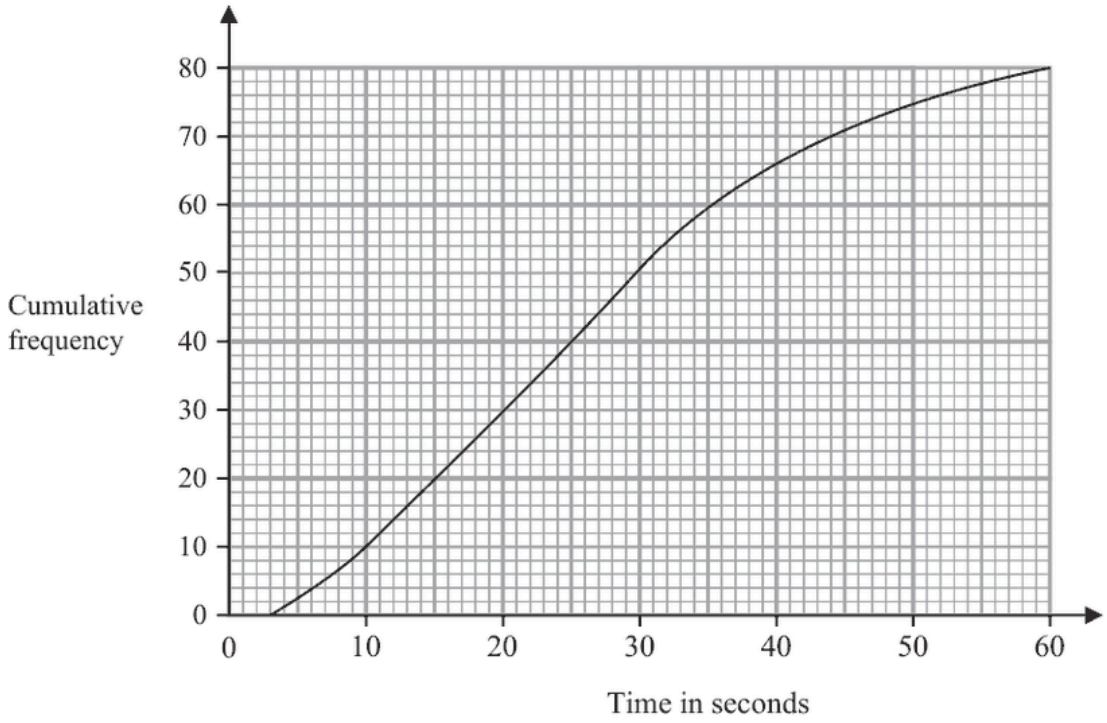
(2)

(Total for Question 14 is 6 marks)

Question 13

4 marks | Cumulative Frequency Diagrams

13 The cumulative frequency graph gives information about the times, in seconds, that 80 adults took to log in to an online bank.



(a) Find an estimate for the median time.

..... seconds

(1)

(b) Work out the percentage of these adults that took longer than 50 seconds to log in.
Show your working clearly.

.....%

(3)

(Total for Question 13 is 4 marks)

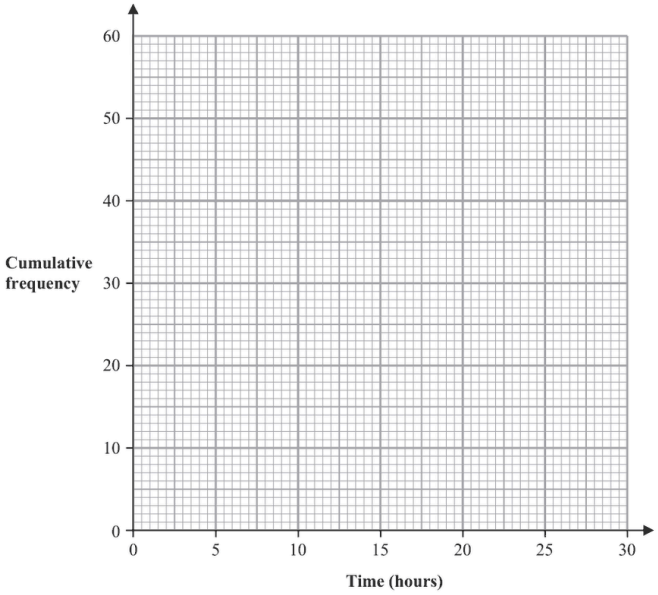
Question 11

7 marks | Cumulative Frequency Diagrams

11 The cumulative frequency table gives information about the time, in hours, that each of 60 workers spent working from home in one week.

Time (t hours)	Cumulative frequency
$0 < t \leqslant 5$	6
$0 < t \leqslant 10$	17
$0 < t \leqslant 15$	27
$0 < t \leqslant 20$	42
$0 < t \leqslant 25$	53
$0 < t \leqslant 30$	60

(a) On the grid below, draw a cumulative frequency graph for the information in the table.



(2)

(b) Use your graph to find an estimate for the interquartile range of the times.

..... hours

(2)

25 workers spent more than W hours working from home.

(c) Use your graph to find an estimate for the value of W

$W =$ .....

(2)

One of the 60 workers is chosen at random.
This worker spent H hours working from home.

(d) Find the probability that $5 < H \leqslant 10$

.....

(1)

(Total for Question 11 is 7 marks)

Question 13

7 marks | Cumulative Frequency Diagrams

13 The table gives information about the distances, in km, that 70 teachers travel to school.

Distance (d km)	Frequency
$0 < d \leqslant 10$	7
$10 < d \leqslant 20$	17
$20 < d \leqslant 30$	18
$30 < d \leqslant 40$	14
$40 < d \leqslant 50$	10
$50 < d \leqslant 60$	4

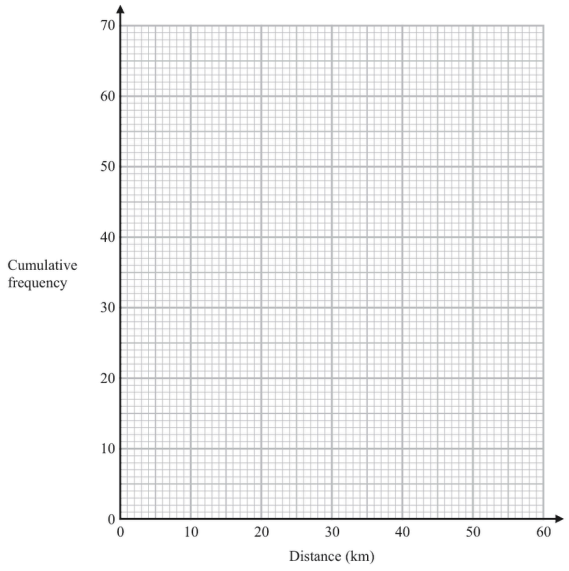
(a) Complete the cumulative frequency table.

Distance (d km)	Cumulative frequency
$0 < d \leqslant 10$	
$0 < d \leqslant 20$	
$0 < d \leqslant 30$	
$0 < d \leqslant 40$	
$0 < d \leqslant 50$	
$0 < d \leqslant 60$	

(1)

(b) On the grid opposite, draw a cumulative frequency graph for your table.

(2)



(c) Use your graph to find an estimate for the interquartile range of the distances.

..... km

(2)

(d) Use your graph to find an estimate for the number of teachers who travel more than 46 km.

.....

(2)

(Total for Question 13 is 7 marks)

Question 13

6 marks | Cumulative Frequency Diagrams

13 The frequency table gives information about the weights, in kilograms, of 60 parcels in a delivery van.

Weight (w kilograms)	Frequency
$0 < w \leqslant 1$	4
$1 < w \leqslant 2$	15
$2 < w \leqslant 3$	20
$3 < w \leqslant 4$	11
$4 < w \leqslant 5$	6
$5 < w \leqslant 6$	4

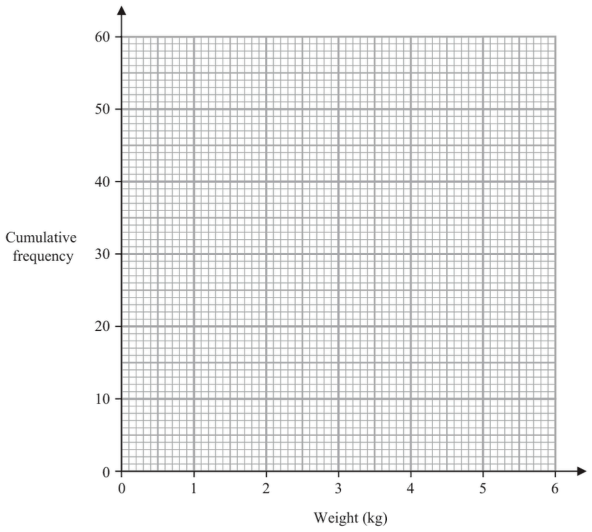
(a) Complete the cumulative frequency table.

Weight (w kilograms)	Cumulative frequency
$0 < w \leqslant 1$	
$0 < w \leqslant 2$	
$0 < w \leqslant 3$	
$0 < w \leqslant 4$	
$0 < w \leqslant 5$	
$0 < w \leqslant 6$	

(1)

(b) On the grid opposite, draw a cumulative frequency graph for your table.

(2)



(c) Use your graph to find an estimate for the median weight of the 60 parcels.

..... kilograms

(1)

(d) Use your graph to find an estimate for the number of these parcels that weigh more than 3.7 kilograms.

.....

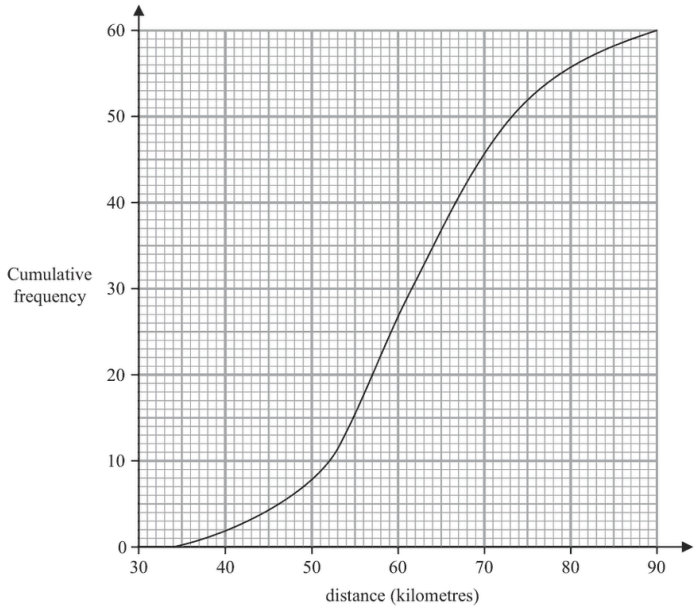
(2)

(Total for Question 13 is 6 marks)

Question 11

7 marks | Cumulative Frequency Diagrams

11 The cumulative frequency graph shows information about the distance, in kilometres, Ehrick drives each day for 60 days.



(a) Use the graph to find an estimate for the median of the distances.

..... kilometres
(1)

(b) Use the graph to find an estimate for the interquartile range of the distances.

..... kilometres
(2)

(c) Work out the percentage of days that Ehrick drives for more than 75 kilometres.
Give your answer correct to one decimal place.
Show your working clearly.

..... %
(3)

Tomas and Alison record the number of kilometres that they drive each day for 60 days.
The table gives information about their results.

	Interquartile range
Tomas	28 kilometres
Alison	15 kilometres

(d) Which of Tomas or Alison is more consistent in the number of kilometres that they drive.
Give a reason for your answer.

.....
(1)

(Total for Question 11 is 7 marks)

Question 12

6 marks | Cumulative Frequency Diagrams

12 The table gives information about the ages of 80 people in a cinema.

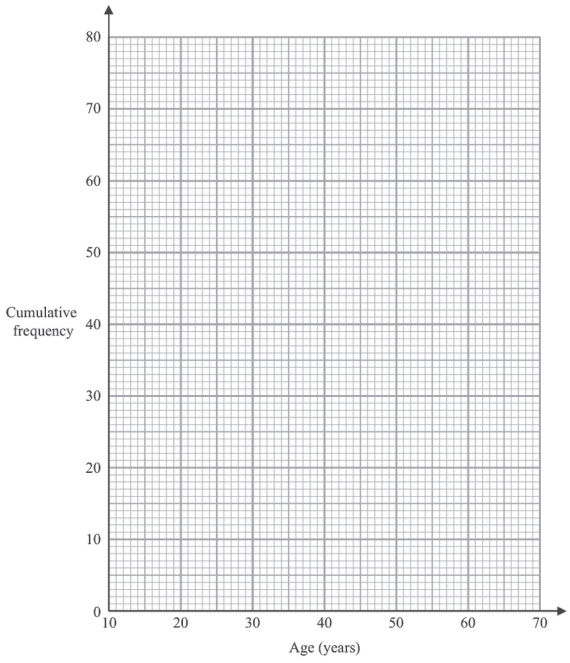
Age (n years)	Frequency
$10 < n \leqslant 20$	12
$20 < n \leqslant 30$	15
$30 < n \leqslant 40$	20
$40 < n \leqslant 50$	18
$50 < n \leqslant 60$	9
$60 < n \leqslant 70$	6

(a) Complete the cumulative frequency table.

Age (n years)	Cumulative frequency
$10 < n \leqslant 20$	
$10 < n \leqslant 30$	
$10 < n \leqslant 40$	
$10 < n \leqslant 50$	
$10 < n \leqslant 60$	
$10 < n \leqslant 70$	

(1)

(b) On the grid below, draw a cumulative frequency graph for your table.



(2)

(c) Use your graph to find an estimate for the percentage of the 80 people who are more than 46 years of age.
Give your answer correct to the nearest whole number.

.....%

(3)

(Total for Question 12 is 6 marks)

Question 13

6 marks | Cumulative Frequency Diagrams

13 The frequency table gives information about the times, in minutes, that 60 people took to complete a puzzle.

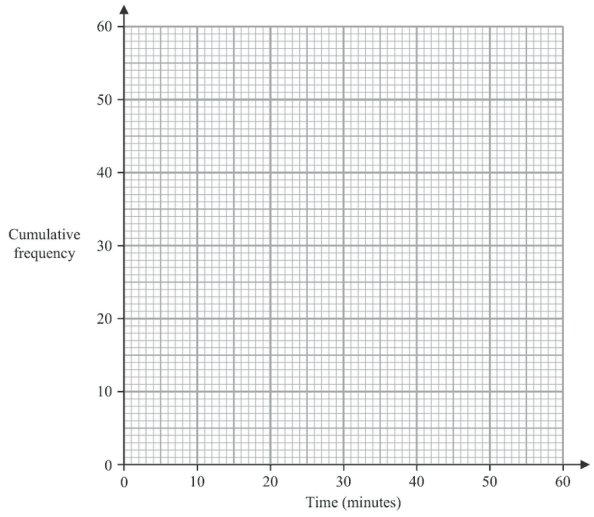
Time (t minutes)	Frequency
$0 < t \leqslant 10$	8
$10 < t \leqslant 20$	13
$20 < t \leqslant 30$	12
$30 < t \leqslant 40$	17
$40 < t \leqslant 50$	7
$50 < t \leqslant 60$	3

(a) Complete the cumulative frequency table.

Time (t minutes)	Cumulative frequency
$0 < t \leqslant 10$	
$0 < t \leqslant 20$	
$0 < t \leqslant 30$	
$0 < t \leqslant 40$	
$0 < t \leqslant 50$	
$0 < t \leqslant 60$	

(1)

(b) On the grid opposite, draw a cumulative frequency graph for your table.



(2)

(c) Use your graph to find an estimate for the median time.

..... minutes

(1)

(d) Use your graph to find an estimate for the number of these people who took more than 45 minutes to complete the puzzle.

.....

(2)

(Total for Question 13 is 6 marks)

Question 14

6 marks | Cumulative Frequency Diagrams

14 The frequency table gives information about the times, in minutes, that 60 people took to complete a puzzle.

Time (t minutes)	Frequency
$0 < t \leqslant 10$	8
$10 < t \leqslant 20$	13
$20 < t \leqslant 30$	12
$30 < t \leqslant 40$	17
$40 < t \leqslant 50$	7
$50 < t \leqslant 60$	3

(a) Complete the cumulative frequency table.

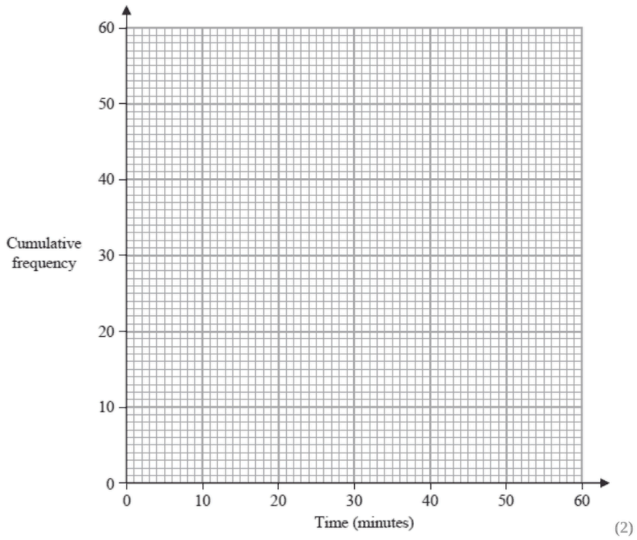
Time (t minutes)	Cumulative frequency
$0 < t \leqslant 10$	
$10 < t \leqslant 20$	
$20 < t \leqslant 30$	
$30 < t \leqslant 40$	
$40 < t \leqslant 50$	
$50 < t \leqslant 60$	

(1)

(b) On the grid on the next page, draw a cumulative frequency graph for your table.

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(2)

(c) Use your graph to find an estimate for the median time.

..... minutes

(1)

(d) Use your graph to find an estimate for the number of these people who took more than 45 minutes to complete the puzzle.

.....

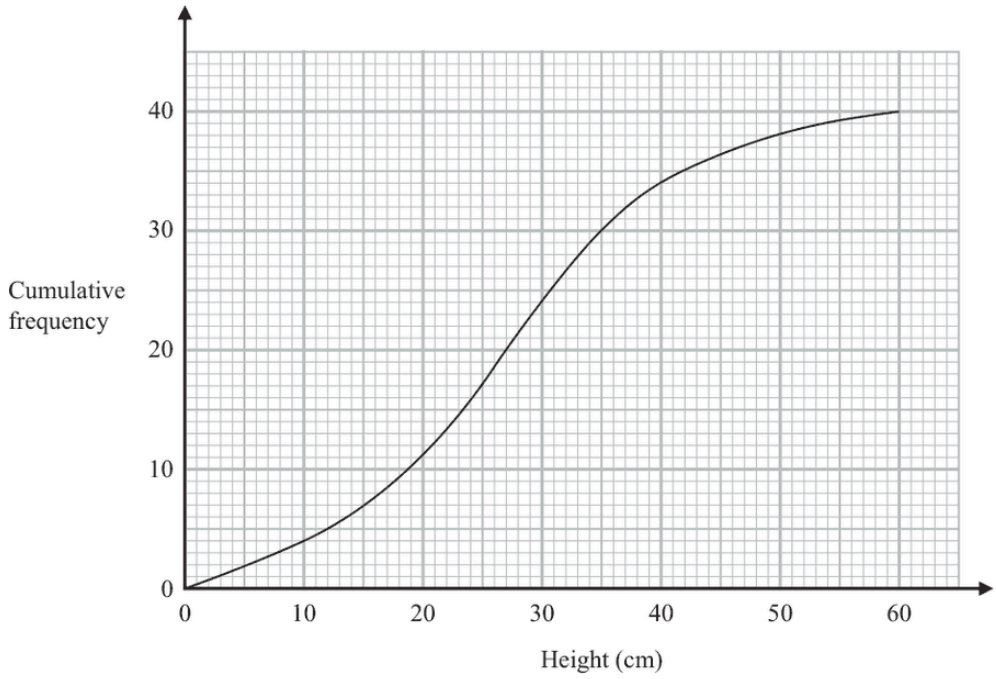
(2)

(Total for Question 14 is 6 marks)

Question 14

5 marks | Cumulative Frequency Diagrams

14 The cumulative frequency graph shows information about the heights of 40 plants that Greta has grown.



(a) Use the graph to find an estimate for the median height.

..... cm

(1)

(b) Use the graph to find an estimate for the interquartile range of the heights.

..... cm

(2)

Plants with a height greater than 40 cm are premium plants.
Greta sells all the premium plants for 30 euros each.

(c) Work out the total amount of money Greta receives for the premium plants.

..... euros

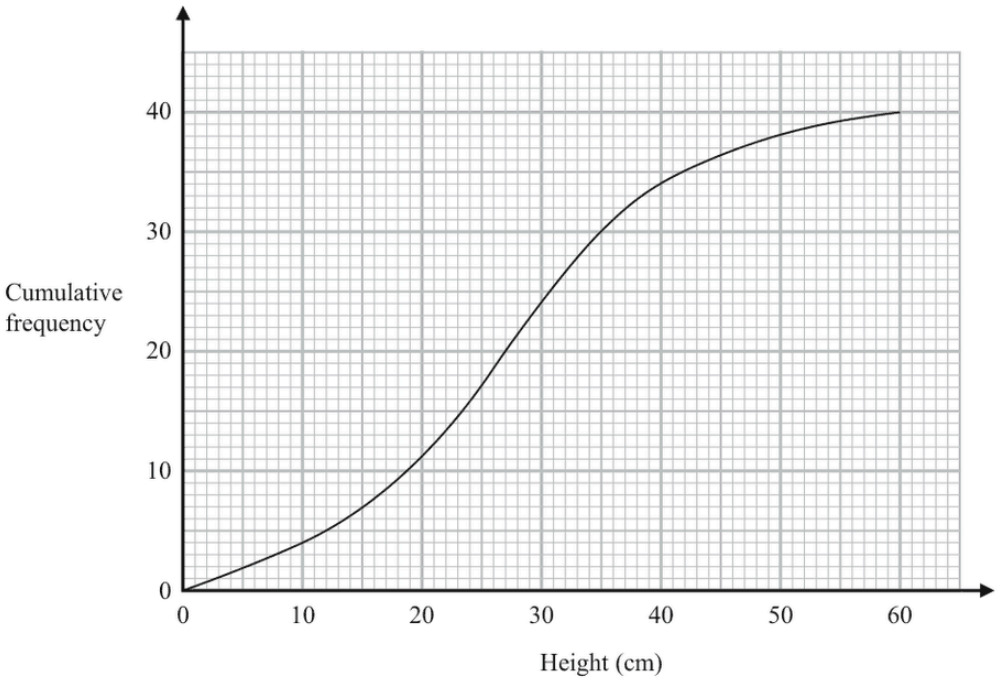
(2)

(Total for Question 14 is 5 marks)

Question 14

5 marks | Cumulative Frequency Diagrams

14 The cumulative frequency graph shows information about the heights of 40 plants that Greta has grown.



(a) Use the graph to find an estimate for the median height.

..... cm

(1)

(b) Use the graph to find an estimate for the interquartile range of the heights.

..... cm

(2)

Plants with a height greater than 40 cm are premium plants.
Greta sells all the premium plants for 30 euros each.

(c) Work out the total amount of money Greta receives for the premium plants.

..... euros

(2)

(Total for Question 14 is 5 marks)

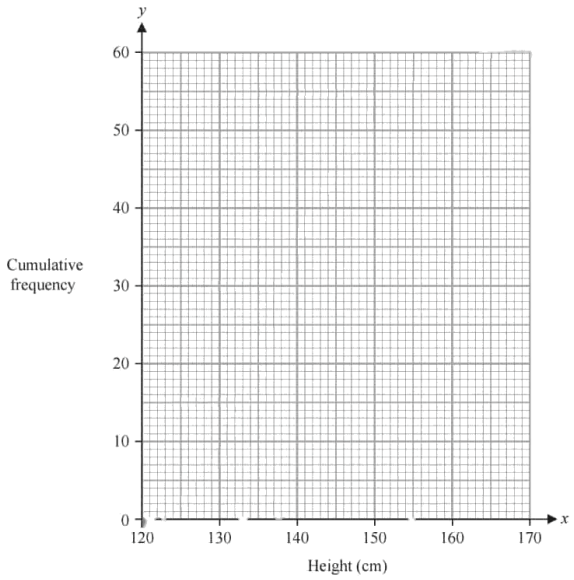
Question 13

6 marks | Cumulative Frequency Diagrams

13 The cumulative frequency table shows information about the heights, in centimetres, of 60 plants.

Height (h cm)	Cumulative frequency
$120 \leqslant h < 130$	8
$120 \leqslant h < 140$	35
$120 \leqslant h < 150$	52
$120 \leqslant h < 160$	58
$120 \leqslant h < 170$	60

(a) On the grid, draw a cumulative frequency graph for this information.



(2)

(b) Use your graph to find an estimate for the median.

..... cm

(1)

(c) Use your graph to find an estimate for the lower quartile.

..... cm

(1)

(d) Use your graph to find an estimate for the number of plants with a height greater than 155 cm

.....

(2)

(Total for Question 13 is 6 marks)

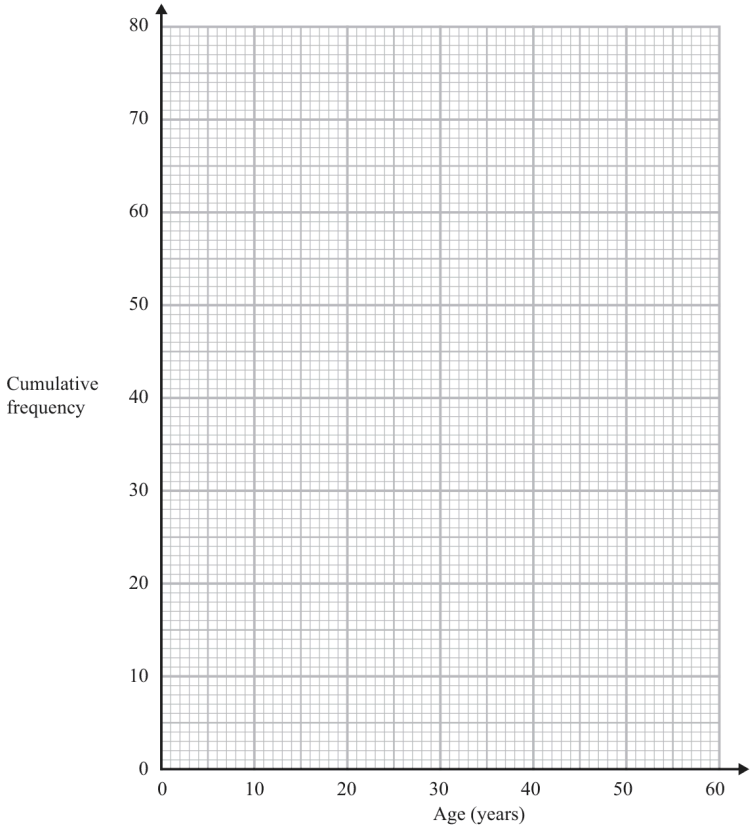
Question 14

4 marks | Cumulative Frequency Diagrams

14 The cumulative frequency table gives information about the ages, in years, of 80 people who went to a cinema on Saturday.

Age (a years)	Cumulative frequency
$0 < a \leqslant 10$	19
$0 < a \leqslant 20$	37
$0 < a \leqslant 30$	52
$0 < a \leqslant 40$	63
$0 < a \leqslant 50$	73
$0 < a \leqslant 60$	80

(a) On the grid below, draw a cumulative frequency graph for this information.



(2)

(b) Use your graph to find an estimate for the median age of the 80 people.

..... years

(1)

(c) Use your graph to find an estimate for the number of the 80 people aged 16 and under.

.....

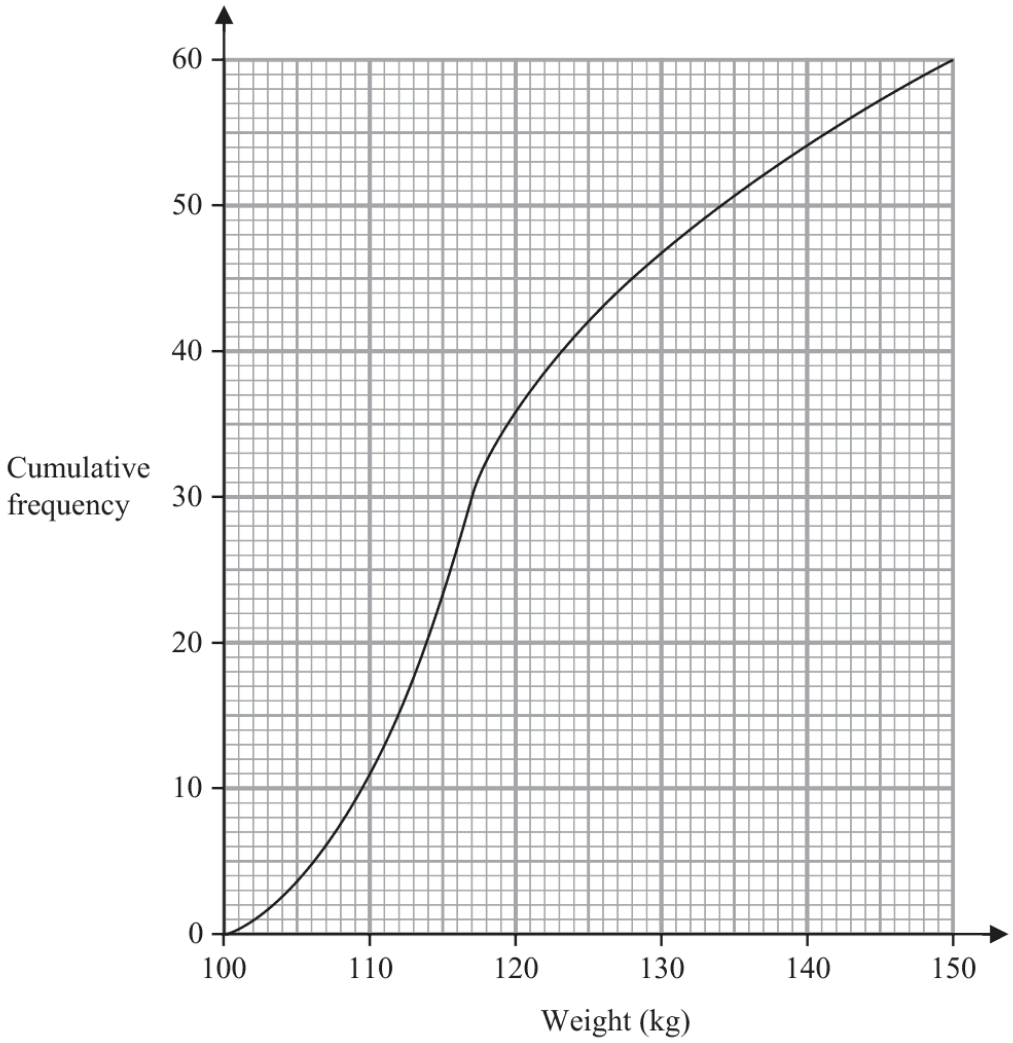
(1)

(Total for Question 14 is 4 marks)

Question 14

3 marks | Cumulative Frequency Diagrams

14 The cumulative frequency graph gives information about the weights, in kg, of 60 crates.



(a) Use the graph to find an estimate for the median weight.

..... kg

(1)

(b) Use the graph to find an estimate for the interquartile range.

..... kg

(2)

(Total for Question 14 is 3 marks)

TOPIC

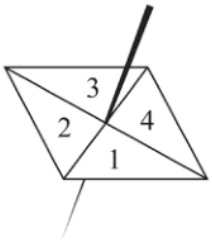
Probability Toolkit

Every past-paper question on this topic, 2020 to 2026.

Question 3

4 marks | Probability Toolkit

3 Here is a biased 4-sided spinner.



The table gives the probabilities that, when the spinner is spun once, it will land on 1 or it will land on 3

Number	1	2	3	4
Probability	0.26		0.18	

The probability that the spinner will land on 2 is equal to the probability that the spinner will land on 4

Priya is going to spin the spinner 250 times.

Work out an estimate for the number of times the spinner will land on a 1 or a 2

.....

(Total for Question 3 is 4 marks)

Question 6

4 marks | Probability Toolkit

6 A bag contains only red beads, blue beads, green beads and yellow beads.

The table gives the probabilities that, when a bead is taken at random from the bag, the bead will be blue or the bead will be yellow.

Colour	**red**	**blue**	**green**	**yellow**
Probability		0.24		0.31

The probability that the bead will be green is twice the probability that the bead will be red.

Sofia takes at random a bead from the bag.
She writes down the colour of the bead and puts the bead back into the bag.

She does this 180 times.

Work out an estimate for the number of times she takes a red bead from the bag.

(Total for Question 6 is 4 marks)

Question 18

4 marks | Probability Toolkit

18 There are 16 sweets in a bowl.

4 of the sweets are blackcurrant.
5 of the sweets are lemon.
7 of the sweets are orange.

Anna, Ravi and Sam each take at random one sweet from the bowl.

Work out the probability that the 5 lemon sweets are still in the bowl.

(Total for Question 18 is 4 marks)

Question 2

4 marks | Probability Toolkit

2 Toy cars are made in a factory.
The toy cars are made for 15 hours each day.
5 toy cars are made every 12 seconds.

For the toy cars made each day, the probability of a toy car being faulty is 0.002

Work out an estimate of the number of faulty toy cars that are made each day.

(Total for Question 2 is 4 marks)

Question 23

4 marks | Probability Toolkit

23 In a bag, there are only

3 blue beads
4 white beads
and x orange beads.

Jean is going to take at random two beads from the bag.

The probability that Jean will take two beads of the same colour is $\frac{3}{8}$

Find the total number of beads in the bag.
Show clear algebraic working.

(Total for Question 23 is 4 marks)

Question 21

6 marks | Probability Toolkit

21 A bag contains n beads.
6 of the beads are red and the rest are blue.

Ravi is going to take at random 2 beads from the bag.

The probability that the 2 beads will be of the same colour is $\frac{9}{17}$

Using algebra, and showing each stage of your working, calculate the value of n.

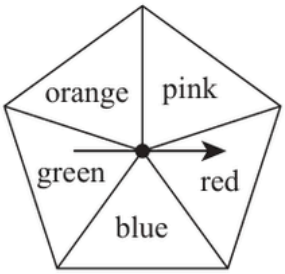
$n =$ .....

(Total for Question 21 is 6 marks)

Question 6

5 marks | Probability Toolkit

6 Grace has a biased 5-sided spinner.



Grace is going to spin the arrow on the spinner once.

The table below gives the probabilities that the spinner will land on red or on blue or on green.

Colour	Red	Blue	Green	Orange	Pink
Probability	0.20	0.12	0.08		

The probability that the spinner will land on orange is 3 times the probability that the spinner will land on pink.

(a) Work out the probability that the spinner will land on orange.

.....

(3)

Grace spins the arrow on the spinner 150 times.

(b) Work out an estimate for the number of times the spinner lands on blue.

.....

(2)

(Total for Question 6 is 5 marks)

Question 23

5 marks | Probability Toolkit

23 Pippa has a box containing N pens.

There are only black pens and red pens in the box.
The number of black pens in the box is 3 more than the number of red pens.

Pippa is going to take at random 2 pens from the box.

The probability that she will take a black pen **followed** by a red pen is $\frac{9}{35}$

Find the possible values of N.
Show clear algebraic working.

(Total for Question 23 is 5 marks)

Question 3

4 marks | Probability Toolkit

3 There are 54 fish in a tank.
Some of the fish are white and the rest of the fish are red.

Jeevan takes at random a fish from the tank.
The probability that he takes a white fish is $\frac{4}{9}$

(a) Work out the number of white fish originally in the tank.

.....

(2)

Jeevan puts the fish he took out, back into the tank.
He puts some more white fish into the tank.

Jeevan takes at random a fish from the tank.
The probability that he takes a white fish is now $\frac{1}{2}$

(b) Work out the number of white fish Jeevan put into the tank.

.....

(2)

(Total for Question 3 is 4 marks)

Question 1

4 marks | Probability Toolkit

1 A tin contains tea bags with a choice of four different flavours of tea.
The four flavours of tea are Assam or Darjeeling or Nilgiri or Rize.

Sara takes at random a tea bag from the tin.

The table shows each of the probabilities that the flavour of the tea Sara takes is Assam or Darjeeling or Rize.

Flavour of tea	Assam	Darjeeling	Nilgiri	Rize
Probability	0.38	0.24		0.16

(a) Work out the probability that the flavour of the tea Sara takes is Nilgiri.

.....

(2)

(b) Work out the probability that the flavour of the tea Sara takes is either Darjeeling or Rize.

.....

(2)

(Total for Question 1 is 4 marks)

Question 2

2 marks | Probability Toolkit

2 Each time John plays a game, the probability that he wins the game is 0.65

John is going to play the game 300 times.

Work out an estimate for the number of games that John wins.

(Total for Question 2 is 2 marks)

Question 6

5 marks | Probability Toolkit

6 A bag contains only pink sweets, white sweets, green sweets and red sweets.

The table gives each of the probabilities that, when a sweet is taken at random from the bag, the sweet will be green or the sweet will be red.

Sweet	pink	white	green	red
Probability			0.2	0.35

The ratio
number of pink sweets : number of white sweets = 2 : 1

There are 28 red sweets in the bag.

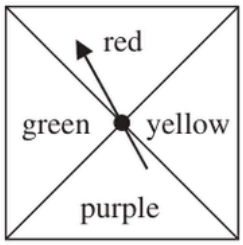
Work out the number of white sweets in the bag.

(Total for Question 6 is 5 marks)

Question 1

4 marks | Probability Toolkit

1 Here is a biased spinner.



When the spinner is spun once, the probabilities that it lands on red or on yellow or on green are given in the table.

Colour	red	yellow	purple	green
Probability	0.25	0.2		0.2

(a) Work out the probability that the spinner lands on red or on yellow.

.....

(1)

Yang is going to spin the spinner 300 times.

(b) Work out an estimate for the number of times the spinner will land on purple.

.....

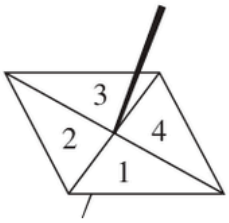
(3)

(Total for Question 1 is 4 marks)

Question 2

4 marks | Probability Toolkit

2 Here is a biased 4-sided spinner.



The table gives the probabilities that, when the spinner is spun once, it will land on 1 or it will land on 3

Number	1	2	3	4
Probability	0.26		0.18	

The probability that the spinner will land on 2 is equal to the probability that the spinner will land on 4

Ravina is going to spin the spinner a number of times.

Ravina works out that an estimate for the number of times the spinner will land on 3 is 45

Work out an estimate for the number of times the spinner will land on 4

(Total for Question 2 is 4 marks)

Question 15

4 marks | Probability Toolkit

15 Abraham is going to play a computer game.
Abraham can win the game, draw the game or lose the game.

For any game that Abraham plays

the probability that he wins the game is 0.3
the probability that he draws the game is 0.5
the probability that he loses the game is 0.2

When Abraham wins a game, he scores +10 points.
When Abraham draws a game, he scores 0 points.
When Abraham loses a game, he scores −5 points.

Abraham plays 3 games and the points he scores in each of the 3 games are added together to get his total score.

Work out the probability that when he has played 3 games his total score is 0 points.

(Total for Question 15 is 4 marks)

Question 24

5 marks | Probability Toolkit

24 Elliot has x counters.

Each counter has one red face and one green face.

Elliot spreads all the counters out on a table and sees that the number of counters showing a red face is 5

Elliot then picks at random one of the counters and turns the counter over.
He then picks at random a second counter and turns the counter over.

The probability that there are still 5 counters showing a red face is $\frac{19}{32}$

Work out the value of x
Show clear algebraic working.

$x =$ .....

(Total for Question 24 is 5 marks)

Question 2

3 marks | Probability Toolkit

2 A biased spinner can land on green or on yellow or on brown or on pink.

The table gives the probabilities that, when the spinner is spun, it will land on green or on yellow or on brown.

Colour	**green**	**yellow**	**brown**	**pink**
Probability	0.32	0.13	0.28	

Timucin spins the spinner 200 times.

Work out an estimate for the number of times the spinner lands on pink.

(Total for Question 2 is 3 marks)

Question 5

2 marks | Probability Toolkit

5 Each time Evie plays a game against her computer, she will win or lose.

For each game, the probability that Evie will win is 0.74
Evie is going to play 300 games against her computer.

Work out an estimate for the number of games that Evie will lose.

(Total for Question 5 is 2 marks)

Question 15

3 marks | Probability Toolkit

15 Osvaldo has a biased coin.
He spins the coin three times.

The probability that the coin lands on a head three times is $\frac{27}{64}$

Work out the probability that the coin will land on a tail three times.

(Total for Question 15 is 3 marks)

4MA1/2HR JUNE 2023

Question 19

4 marks | Probability Toolkit

19 30 adults booked to stay in a hotel.

19 adults booked breakfast
15 adults booked dinner
4 adults did not book breakfast or dinner

Some adults booked breakfast **and** dinner.

Meihui chooses at random two of the 30 adults.

Work out the probability that these two adults each booked breakfast **and** dinner.

(Total for Question 19 is 4 marks)

Question 4

4 marks | Probability Toolkit

4 A biased spinner has three sections each of a different colour.

The table shows the probability that, when the spinner is spun once, it will land on blue or on orange or on white.

Colour	blue	orange	white
Probability	0.58	$2x$	x

(a) Work out the value of x

$x =$ .....

(2)

The spinner is spun 250 times.

(b) Work out an estimate for the number of times the spinner will land on blue.

.....

(2)

(Total for Question 4 is 4 marks)

Question 20

4 marks | Probability Toolkit

20 A bag contains only 10 cent coins and 20 cent coins.

Josip takes at random a coin from the bag, records its value and replaces it in the bag.
He then takes at random a second coin from the bag, records its value and replaces it in the bag.

Josip finds the mean value of the two coins.

The probability that the two coins have a mean value of 10 cents is $\frac{49}{121}$

Work out the probability that the two coins have a mean value of 15 cents.

(Total for Question 20 is 4 marks)

Question 2

4 marks | Probability Toolkit

2 450 students were asked how they travelled to school on Monday.
Each student walked or travelled by bus or travelled by car or travelled by bicycle.
Each student used just one method of travel.

One of these students is chosen at random.
The table shows information about the probability of each method of travel.

Method of travel	walk	bus	car	bicycle
Probability	0.20	x	$2x$	0.26

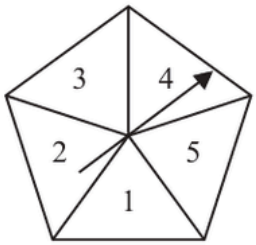
Work out how many of the 450 students travelled by car.

(Total for Question 2 is 4 marks)

Question 2

4 marks | Probability Toolkit

2 Here is a biased spinner.



The table gives information about the probability that, when the spinner is spun once, it will land on each number.

Number	1	2	3	4	5
Probability	$2x$	0.27	0.04	x	0.12

Alexis is going to spin the spinner 400 times.

Work out an estimate for the number of times the spinner will land on an odd number.

(Total for Question 2 is 4 marks)

Question 14

3 marks | Probability Toolkit

14 Adriana is going to roll a biased dice and spin a biased coin.

The probability that the coin will land on Heads is 0.8
The probability that the dice will land on 6 and the coin will land on Heads is 0.24

Work out the probability that the dice will land on 6 and the coin will land on Tails.

(Total for Question 14 is 3 marks)

Question 21

5 marks | Probability Toolkit

21 There are 25 counters in a bag such that

6 counters are blue
x counters are orange, where $x > 9$
the rest of the counters are pink

Maalam takes at random two of the counters from the bag.

The probability that Maalam takes one orange counter and one pink counter is $\frac{22}{75}$

Calculate the probability that Maalam takes 2 pink counters from the bag.
Show clear algebraic working.

(Total for Question 21 is 5 marks)

Question 5

4 marks | Probability Toolkit

5 Cody has a biased 5-sided spinner, numbered 1, 2, 3, 4, 5

The table gives the probabilities that when the spinner is spun it will land on 2 or on 3 or on 5

Number	1	2	3	4	5
Probability		0.14	0.17		0.21

The probability that the spinner will land on 1 is the same as the probability that the spinner will land on 4

Cody is going to spin the spinner 400 times.

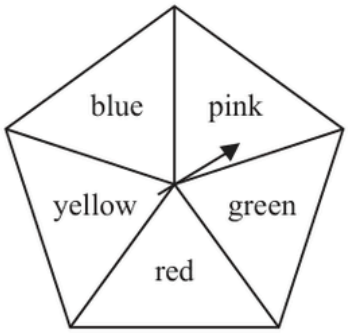
Work out an estimate for the number of times the spinner will land on 4

(Total for Question 5 is 4 marks)

Question 3

4 marks | Probability Toolkit

3 Here is a biased spinner.
The spinner can land on pink or on green or on red or on yellow or on blue.



The table gives information about the probability that, when the spinner is spun, it will land on each colour.

Colour	pink	green	red	yellow	blue
Probability	0.14	0.23	$2x$	0.18	$7x$

Jim is going to spin the spinner 500 times.

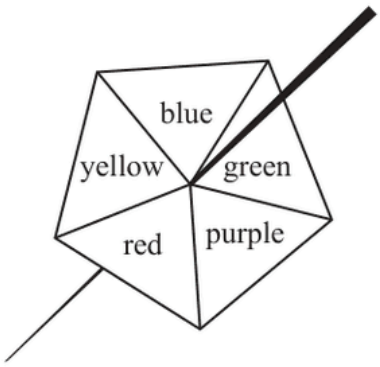
Work out the expected number of times the spinner will land on blue.

(Total for Question 3 is 4 marks)

Question 3

5 marks | Probability Toolkit

3 Here is a biased 5-sided spinner.
When the spinner is spun, it can land on blue or on green or on purple or on red or on yellow.



The table gives information about the probability of the spinner landing on each colour.

Colour	blue	green	purple	red	yellow
Probability	0.12	0.20	0.38	$4x$	x

Sophie spins the spinner once.

(a) Work out the probability that the spinner lands on blue or on green or on purple.

.....

(1)

Max spins the spinner 350 times.

(b) Work out an estimate for the number of times the spinner lands on red.

.....

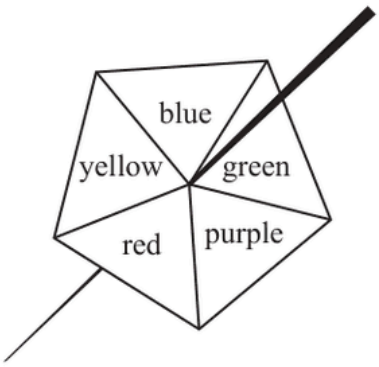
(4)

(Total for Question 3 is 5 marks)

Question 4

5 marks | Probability Toolkit

4 Here is a biased 5-sided spinner.
When the spinner is spun, it can land on blue or on green or on purple or on red or on yellow.



The table gives information about the probability of the spinner landing on each colour.

Colour	blue	green	purple	red	yellow
Probability	0.12	0.20	0.38	$4x$	x

Sophie spins the spinner once.

(a) Work out the probability that the spinner lands on blue or on green or on purple.

.....

(1)

Max spins the spinner 350 times.

(b) Work out an estimate for the number of times the spinner lands on red.

.....

(4)

(Total for Question 4 is 5 marks)

Question 11

3 marks | Probability Toolkit

11 Khalid has a box of counters.

17 of the counters are red
28 of the counters are blue
the rest of the counters are orange

Khalid is going to take at random a counter from the box.

The probability that Khalid will take an orange counter is $\frac{4}{9}$

Work out the number of orange counters that are in the box.

(Total for Question 11 is 3 marks)

Question 17

3 marks | Probability Toolkit

17 Kannika has 9 counters.
There is a number on each counter.



Kannika puts the 9 counters in a bag.
She takes at random a counter from the bag and does not replace the counter.
She then takes at random a second counter from the bag.

Work out the probability that the sum of the numbers on the two counters is less than 5

(Total for Question 17 is 3 marks)

Question 19

3 marks | Probability Toolkit

19 Kannika has 9 counters.
There is a number on each counter.



Kannika puts the 9 counters in a bag.
She takes at random a counter from the bag and does not replace the counter.
She then takes at random a second counter from the bag.

Work out the probability that the sum of the numbers on the two counters is less than 5

(Total for Question 19 is 3 marks)

Question 21

3 marks | Probability Toolkit

21 A box contains 20 counters.

9 of the counters are red
7 of the counters are yellow
4 of the counters are green

Alex takes at random three counters from the box.

Work out the probability that exactly two of the three counters are the same colour.

(Total for Question 21 is 3 marks)

Question 22

3 marks | Probability Toolkit

22 A box contains 20 counters.

9 of the counters are red
7 of the counters are yellow
4 of the counters are green

Alex takes at random three counters from the box.

Work out the probability that exactly two of the three counters are the same colour.

(Total for Question 22 is 3 marks)

Question 5

5 marks | Probability Toolkit

5 All students at a school are asked which sport they prefer from football, tennis, rugby and cricket.

The table gives information about the probabilities that, when a student is chosen at random, the student prefers football or tennis or rugby or cricket.

Favourite sport	football	tennis	rugby	cricket
Probability	$2x$	0.2	x	0.35

One of the students at the school is chosen at random.

(a) Work out the probability that this student prefers tennis or cricket.

.....

(1)

There are 700 students at the school.

(b) Work out how many students prefer football.

.....

(4)

(Total for Question 5 is 5 marks)

Question 9

3 marks | Probability Toolkit

9 Mark has three bags, bag A, bag B and bag C

Bag A contains 120 counters.
The probability of taking at random a red counter from bag A is 0.45

Bag B contains 80 counters.
The probability of taking at random a red counter from bag B is 0.3

Bag C is empty.

Mark puts all the counters from bag A and bag B into bag C

Mark takes at random a counter from bag C

Work out the probability that he takes a red counter.

.....

(Total for Question 9 is 3 marks)

Question 5

4 marks | Probability Toolkit

5 A bag contains only blue counters, green counters, red counters and yellow counters.

Danny takes a counter at random from the bag.

The table gives information about the probabilities that he takes a blue counter or a green counter or a red counter or a yellow counter.

Colour	blue	green	red	yellow
Probability	0.45	0.31	$5x$	x

There are 400 counters in the bag.

Work out the number of red counters in the bag.

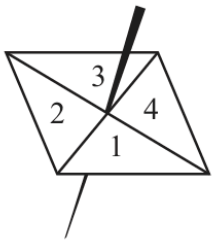
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(Total for Question 5 is 4 marks)

Question 7

4 marks | Probability Toolkit

7 Here is a biased 4-sided spinner.



The table gives information about the probability that, when the spinner is spun once, it will land on each number.

Number	1	2	3	4
Probability	0.12	x	$2x$	0.16

Nevan spins the spinner 500 times.

Work out the expected number of times that the spinner lands on an even number.

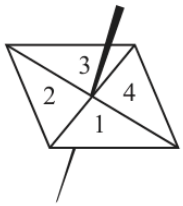
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(Total for Question 7 is 4 marks)

Question 7

4 marks | Probability Toolkit

7 Here is a biased 4-sided spinner.



The table gives information about the probability that, when the spinner is spun once, it will land on each number.

Number	1	2	3	4
Probability	0.12	x	$2x$	0.16

Nevan spins the spinner 500 times.

Work out the expected number of times that the spinner lands on an even number.

.....

(Total for Question 7 is 4 marks)

Question 11

3 marks | Probability Toolkit

11 There are 40 counters in a bag.

25 of the counters are green
7 of the counters are blue
8 of the counters are red

Ben puts some extra blue counters and some extra red counters into the bag.
The number of blue counters added to the bag is twice as many as the number of red counters added to the bag.

Ben takes at random a counter from the bag.

The probability that he takes a green counter is $\frac{5}{11}$

How many of the extra counters that Ben put into the bag were blue?

.....

(Total for Question 11 is 3 marks)

Question 20

3 marks | Probability Toolkit

20 A box only contains green counters and red counters.

Nuno chooses at random a counter from the box.
He puts the counter back into the box.

Nuno then chooses at random a second counter from the box.

The probability that Nuno chooses at least one red counter is $\frac{39}{64}$

Work out the probability that Nuno chooses exactly one red counter.

.....

(Total for Question 20 is 3 marks)

TOPIC

Tree Diagrams & Conditional Probability

Every past-paper question on this topic, 2020 to 2026.

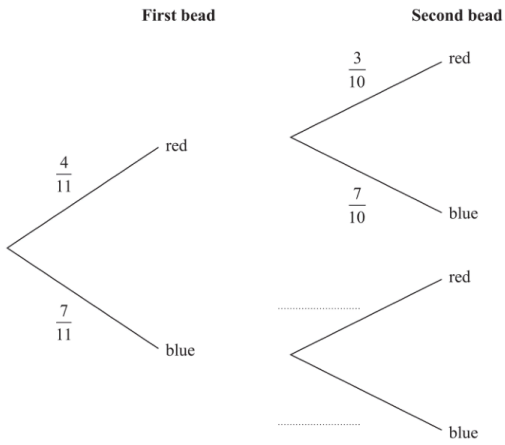
Question 11

6 marks | Tree Diagrams & Conditional Probability

11 Tess has a bag containing 11 beads.
4 of the beads are red.
7 of the beads are blue.

Tess takes at random a bead from the bag and keeps it.
Tess takes at random another bead from the bag and keeps it.

(a) Complete the probability tree diagram.



(1)

(b) Work out the probability that both of the beads are red.

.....

(2)

(c) Work out the probability that the two beads are of different colours.

.....

(3)

(Total for Question 11 is 6 marks)

Question 14

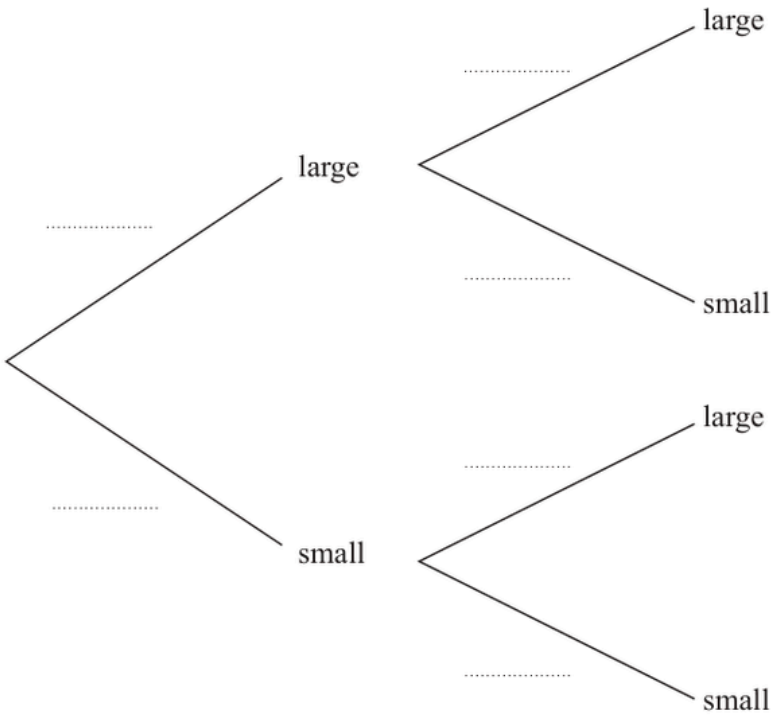
4 marks | Tree Diagrams & Conditional Probability

14 There are 20 glasses in a cupboard.

13 of the glasses are large
7 of the glasses are small

Roberto takes at random two glasses from the cupboard.

(a) Complete the probability tree diagram.



(2)

(b) Work out the probability that Roberto takes two small glasses.

.....

(2)

(Total for Question 14 is 4 marks)

Question 16

4 marks | Tree Diagrams & Conditional Probability

16 Steffi is going to play one game of tennis and one game of chess.

The probability that she will win the game of tennis is 0.6
The probability that she will win **both** games is 0.42

Work out the probability that she will **not** win either game.

(Total for Question 16 is 4 marks)

Question 16

8 marks | Tree Diagrams & Conditional Probability

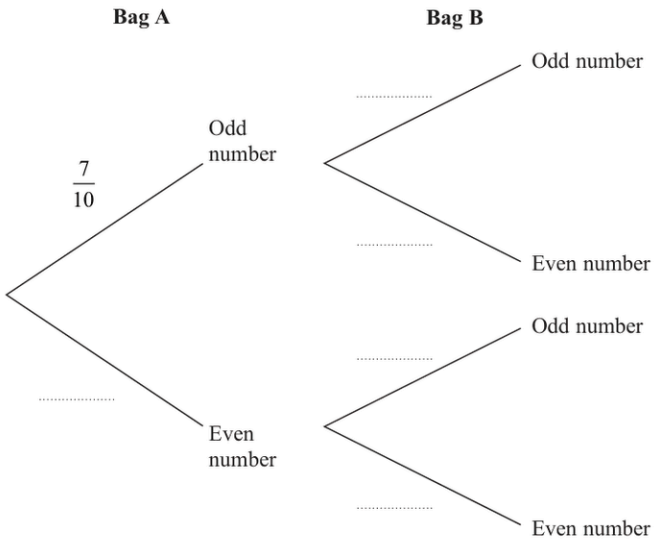
16 Cody has two bags of counters, bag **A** and bag **B**.

Each of the counters has either an odd number or an even number written on it.

There are 10 counters in bag **A** and 7 of these counters have an **odd** number written on them.
There are 12 counters in bag **B** and 7 of these counters have an **odd** number written on them.

Cody is going to take at random a counter from bag **A** and a counter from bag **B**.

(a) Complete the probability tree diagram.



(2)

(b) Calculate the probability that the total of the numbers on the two counters will be an odd number.

.....

(3)

Harriet also has a bag of counters.
Each of her counters also has either an odd number or an even number written on it.

Harriet is going to take at random a counter from her bag of counters.

The probability that the number on each of Cody's two counters **and** the number on Harriet's counter will all be even is $\frac{3}{100}$

(c) Find the least number of counters that Harriet has in her bag.
Show your working clearly.

.....

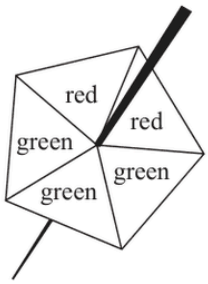
(3)

(Total for Question 16 is 8 marks)

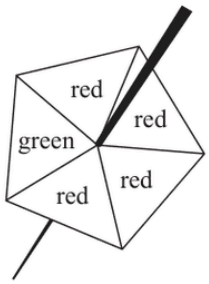
Question 15

5 marks | Tree Diagrams & Conditional Probability

15 Harry has two fair 5-sided spinners.



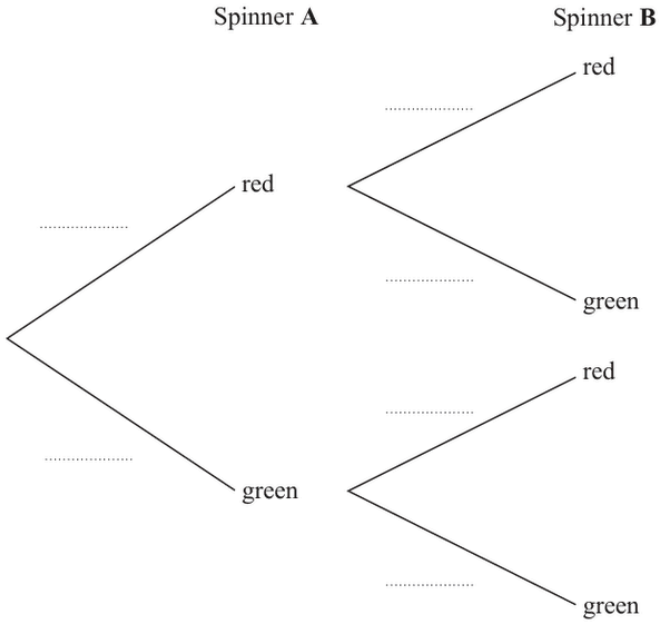
Spinner **A**



Spinner **B**

Harry is going to spin each spinner once.

(a) Complete the probability tree diagram.



(2)

(b) Work out the probability that at least one of the spinners will land on green.

.....

(3)

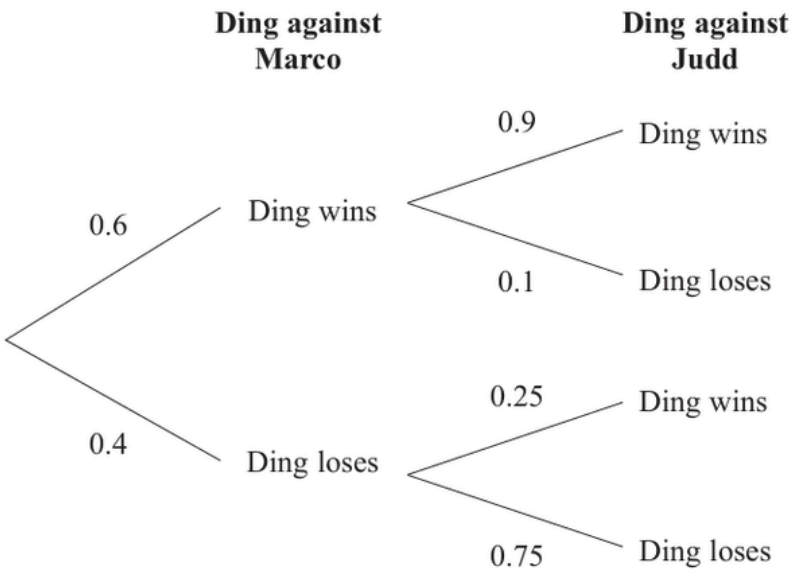
(Total for Question 15 is 5 marks)

Question 14

5 marks | Tree Diagrams & Conditional Probability

14 Ding is going to play one game of snooker against each of two of his friends, Marco and Judd.

The probability tree diagram gives information about the probabilities that Ding will win or lose each of these two games.



(a) Work out the probability that Ding will win both games.

.....

(2)

(b) Work out the probability that Ding will win exactly one of the games.

.....

(3)

(Total for Question 14 is 5 marks)

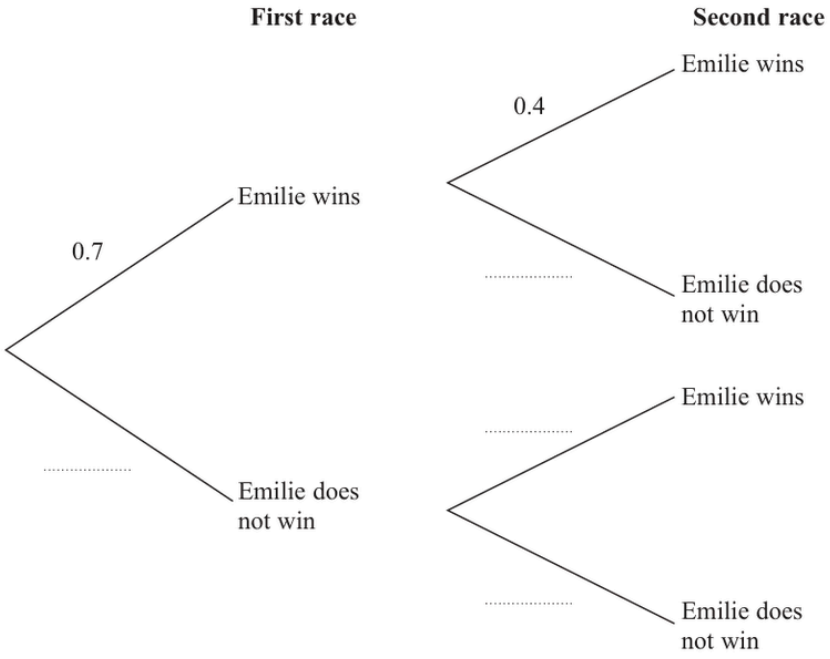
Question 13

8 marks | Tree Diagrams & Conditional Probability

13 Emilie takes part in two races.

The probability that she wins the first race is 0.7
The probability that she wins the second race is 0.4
The outcomes of the two races are independent.

(a) Complete the probability tree diagram.



(2)

(b) Work out the probability that Emilie wins exactly one of the two races.

.....

(3)

Emilie is going to take part in a third race.

If she wins both of the first two races, the probability that she will win the third race is 0.6

If she wins exactly one of the first two races, the probability that she will win the third race is 0.3

(c) Work out the probability that Emilie will win exactly two of the three races.

.....

(3)

(Total for Question 13 is 8 marks)

Question 15

8 marks | Tree Diagrams & Conditional Probability

15 Magnus and Garry play 2 games of chess against each other.

The probability that Magnus beats Garry in any game is $\frac{2}{9}$

The probability that any game between Magnus and Garry is drawn is $\frac{4}{9}$

The result of any game is independent of the result of any other game.

(a) Complete the probability tree diagram.



(2)

For each game of chess,

the winner gets 2 points and the loser gets 0 points,
when the game is drawn, each player gets 1 point.

(b) Work out the probability that, after 2 games, Magnus and Garry have the same number of points.

.....

(3)

Magnus and Garry now play a third game of chess.

(c) Work out the probability that, after 3 games, Magnus and Garry have the same number of points.

.....

(3)

(Total for Question 15 is 8 marks)

Question 16

3 marks | Tree Diagrams & Conditional Probability

16 A box contains 15 counters.

There are 4 red counters, 5 green counters and the rest are yellow counters.

Niklas takes at random a counter from the box and writes down the colour of his counter.
He then puts the counter back into the box.

Sasha then takes at random a counter from the box and writes down the colour of her counter.

Work out the probability that the counters taken by Niklas and Sasha both have the same colour.

(Total for Question 16 is 3 marks)

Question 13

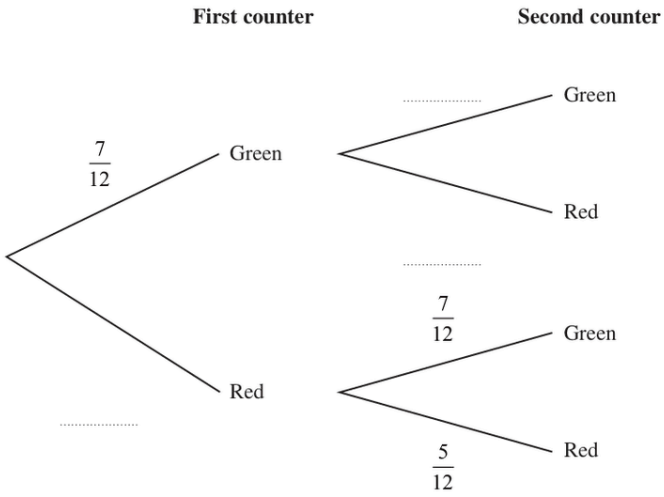
7 marks | Tree Diagrams & Conditional Probability

13 Hector has a bag that contains 12 counters.
There are 7 green counters and 5 red counters in the bag.

Hector takes at random a counter from the bag.
He looks at the counter and puts the counter back into the bag.

Hector then takes at random a second counter from the bag.
He looks at the counter and puts the counter back into the bag.

(a) Complete the probability tree diagram.



(2)

(b) Work out the probability that both counters are red.

.....

(2)

Meghan has a jar containing 15 counters.
There are only blue counters, green counters and red counters in the jar.

Hector is going to take at random one of the counters from his bag of 12 counters.
He will look at the counter and put the counter back into the bag.

Hector is then going to take at random a second counter from his bag.
He will look at the counter and put the counter back into the bag.

Meghan is then going to take at random one of the counters from her jar of counters.
She will look at the counter and put the counter back into the jar.

The probability that the 3 counters each have a different colour is $\frac{7}{24}$

(c) Work out how many blue counters there are in the jar.

.....

(3)

(Total for Question 13 is 7 marks)

Question 14

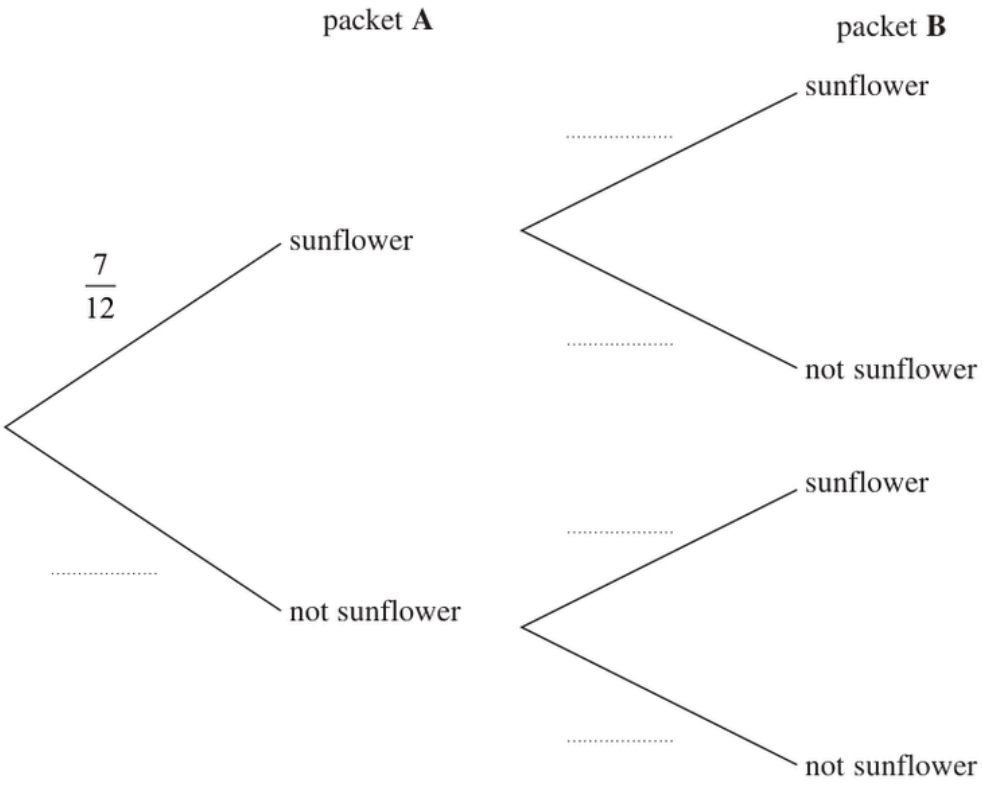
4 marks | Tree Diagrams & Conditional Probability

14 Aika has 2 packets of seeds, packet **A** and packet **B**

There are 12 seeds in packet **A** and 7 of these are sunflower seeds.
There are 15 seeds in packet **B** and 8 of these are sunflower seeds.

Aika is going to take at random a seed from packet **A** and a seed from packet **B**

(a) Complete the probability tree diagram.



(2)

(b) Calculate the probability that Aika will take two sunflower seeds.

.....

(2)

(Total for Question 14 is 4 marks)

Question 12

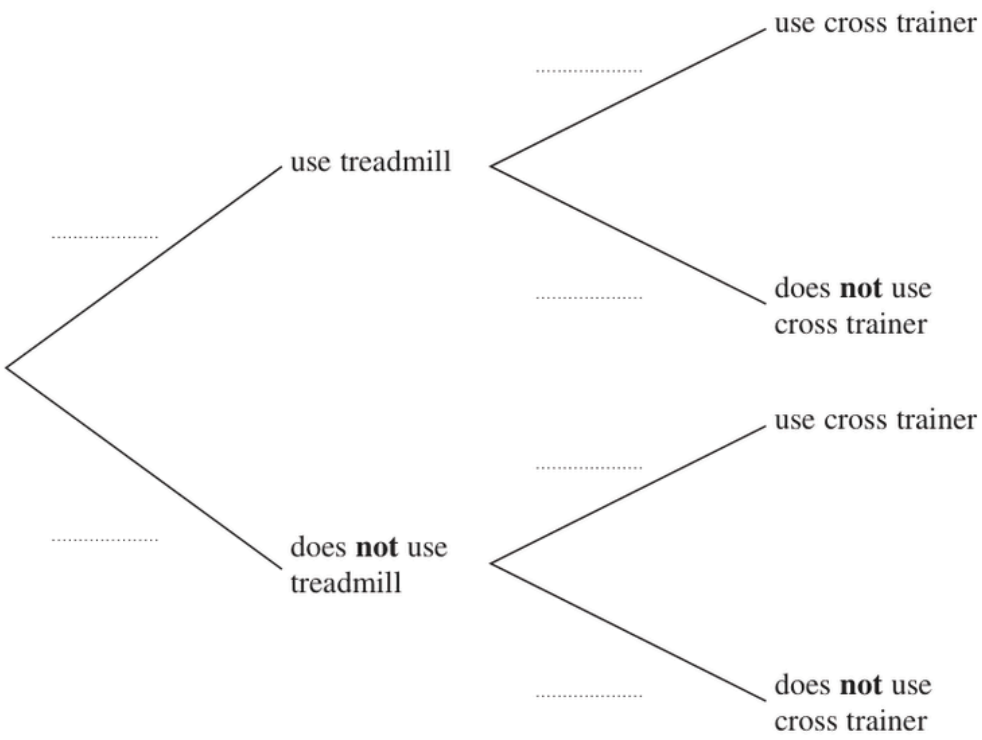
4 marks | Tree Diagrams & Conditional Probability

12 Rudolf goes to the gym.

The probability that he will use the treadmill is 0.8

When he uses the treadmill, the probability that he will use the cross trainer is 0.3
When he does **not** use the treadmill, the probability that he will use the cross trainer is 0.6

(a) Complete the probability tree diagram for this information.



(2)

(b) Work out the probability that Rudolf uses both the treadmill and the cross trainer.

.....

(2)

(Total for Question 12 is 4 marks)

Question 14

3 marks | Tree Diagrams & Conditional Probability

14 Ciara throws **four** fair six-sided dice.

The faces of each dice are labelled with the numbers 1, 2, 3, 4, 5, 6

Work out the probability that at least one of the dice lands on an even number.

(Total for Question 14 is 3 marks)

Question 12

5 marks | Tree Diagrams & Conditional Probability

12 Moeen has a biased 6-sided dice.

The table gives information about the probability that, when the dice is thrown, it will land on each number.

Number	1	2	3	4	5	6
Probability	x	0.15	0.5	y	0.13	0.03

(a) Show that $x + y = 0.19$

(2)

Given that $3x - y = 0.09$

and $x + y = 0.19$

(b) work out the value of x and the value of y
Show clear algebraic working.

$x =$ .....

$y =$ .....

(3)

(Total for Question 12 is 5 marks)

Question 13

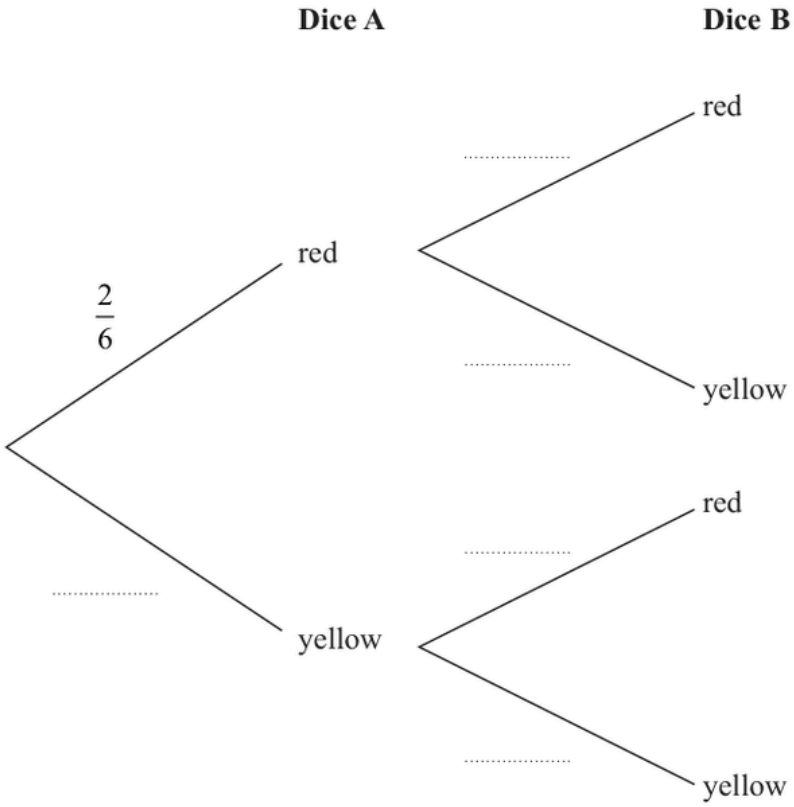
4 marks | Tree Diagrams & Conditional Probability

13 Narin has two fair 6-sided dice.

Dice **A** has 2 red faces and 4 yellow faces.
Dice **B** has 1 red face and 5 yellow faces.

Narin is going to throw each dice once.

(a) Complete the probability tree diagram.



(2)

(b) Work out the probability that both dice land on yellow.

.....

(2)

(Total for Question 13 is 4 marks)

Question 13

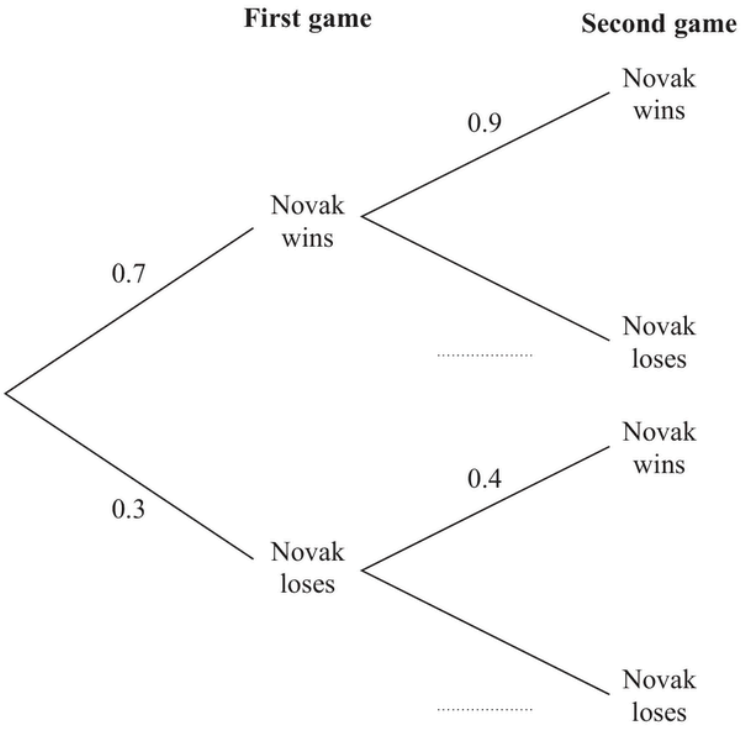
3 marks | Tree Diagrams & Conditional Probability

13 Novak is going to play two games of tennis.

The probability that he wins the first game is 0.7

If he wins the first game, the probability that he wins the second game is 0.9
If he loses the first game, the probability that he wins the second game is 0.4

(a) Complete the probability tree diagram.



(1)

(b) Work out the probability that Novak wins both games of tennis.

.....

(2)

(Total for Question 13 is 3 marks)

Question 20

3 marks | Tree Diagrams & Conditional Probability

20 There are 12 counters in a bag.

3 of the counters are red
9 of the counters are green

Ameya, Jack and Ella each take at random one counter from the bag.

Work out the probability that at least one red counter is still in the bag.

(Total for Question 20 is 3 marks)

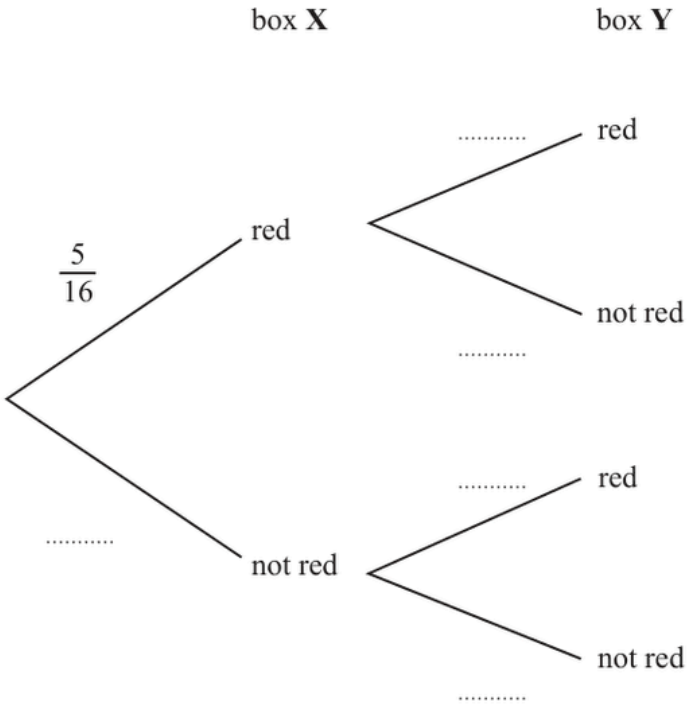
Question 11

5 marks | Tree Diagrams & Conditional Probability

11 Sid has 2 boxes of crayons, box **X** and box **Y**

5 of the 16 crayons in box **X** are red.
7 of the 20 crayons in box **Y** are red.
Sid takes at random one crayon from box **X** and one crayon from box **Y**

(a) Complete the probability tree diagram.



(2)

(b) Work out the probability that Sid takes two crayons that are red or two crayons that are not red.

.....

(3)

(Total for Question 11 is 5 marks)

Question 13

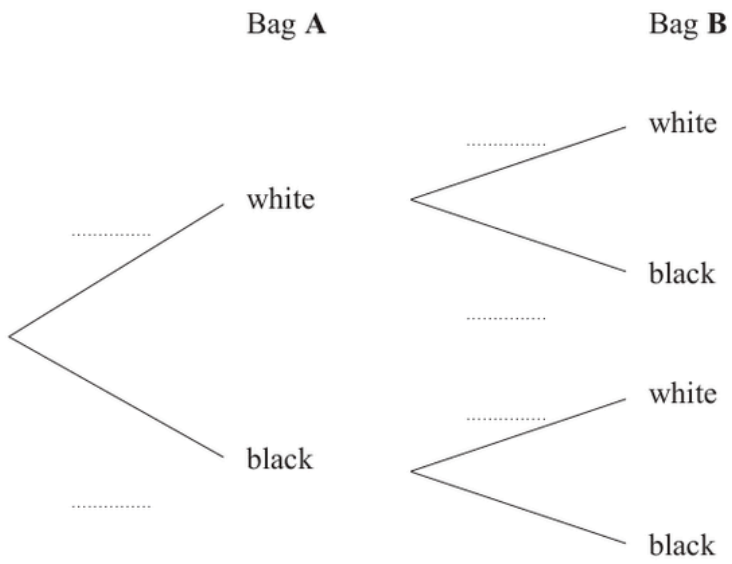
5 marks | Tree Diagrams & Conditional Probability

13 Harman has two bags of beads.

In bag **A**, there are 3 white beads and 7 black beads.
In bag **B**, there are 5 white beads and 4 black beads.

Harman takes at random a bead from bag **A** and a bead from bag **B**

(a) Complete the probability tree diagram.



(2)

(b) Work out the probability that Harman takes two beads of the same colour.

.....

(3)

(Total for Question 13 is 5 marks)

Question 16

4 marks | Tree Diagrams & Conditional Probability

16 There are 20 sweets in a box.

15 of the sweets are red
5 of the sweets are yellow

Fred takes at random 3 sweets from the box.

Work out the probability that Fred takes at least one sweet of each colour from the box.

(Total for Question 16 is 4 marks)

Question 13

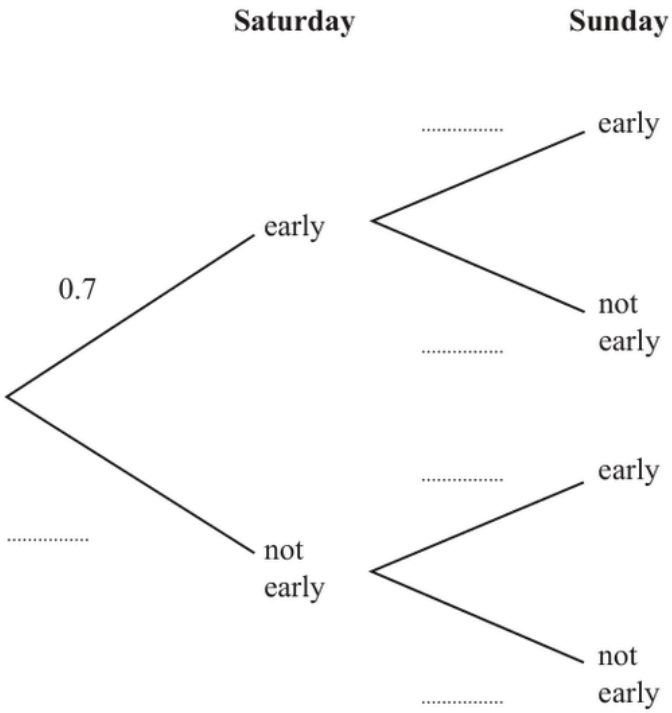
4 marks | Tree Diagrams & Conditional Probability

13 The probability that Thomas gets to work early on Saturday is 0.7

If Thomas gets to work early on Saturday, the probability that he will get to work early on Sunday is 0.9

If Thomas does **not** get to work early on Saturday, the probability that he will get to work early on Sunday is 0.6

(a) Use this information to complete the probability tree diagram.



(2)

(b) Work out the probability that Thomas gets to work early on both Saturday and Sunday.

.....

(2)

(Total for Question 13 is 4 marks)

Question 11

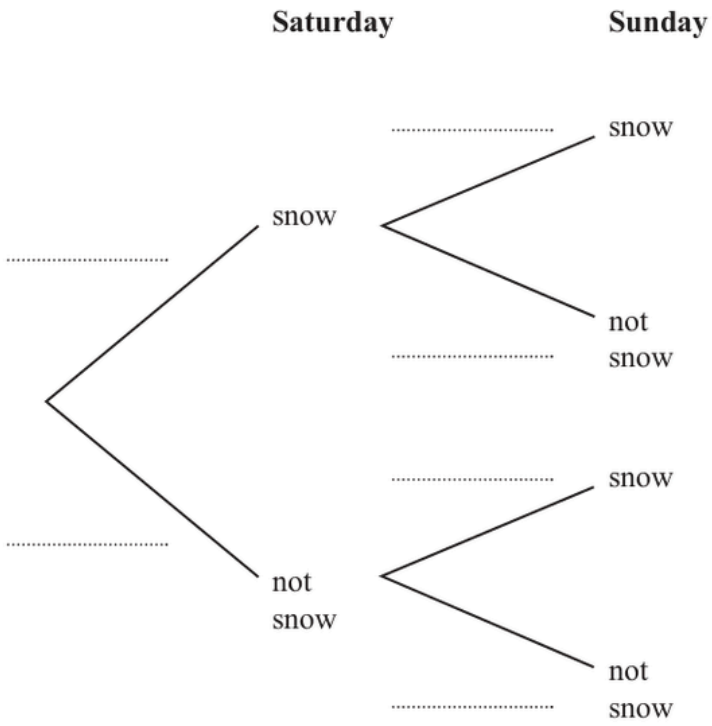
4 marks | Tree Diagrams & Conditional Probability

11 The probability that it will snow on Saturday is 0.2

If it snows on Saturday, the probability that it will snow on Sunday is 0.35

If it does not snow on Saturday, the probability that it will snow on Sunday is 0.4

(a) Use this information to complete the probability tree diagram.



(2)

(b) Work out the probability that it will snow on both Saturday and Sunday.

.....

(2)

(Total for Question 11 is 4 marks)

Question 12

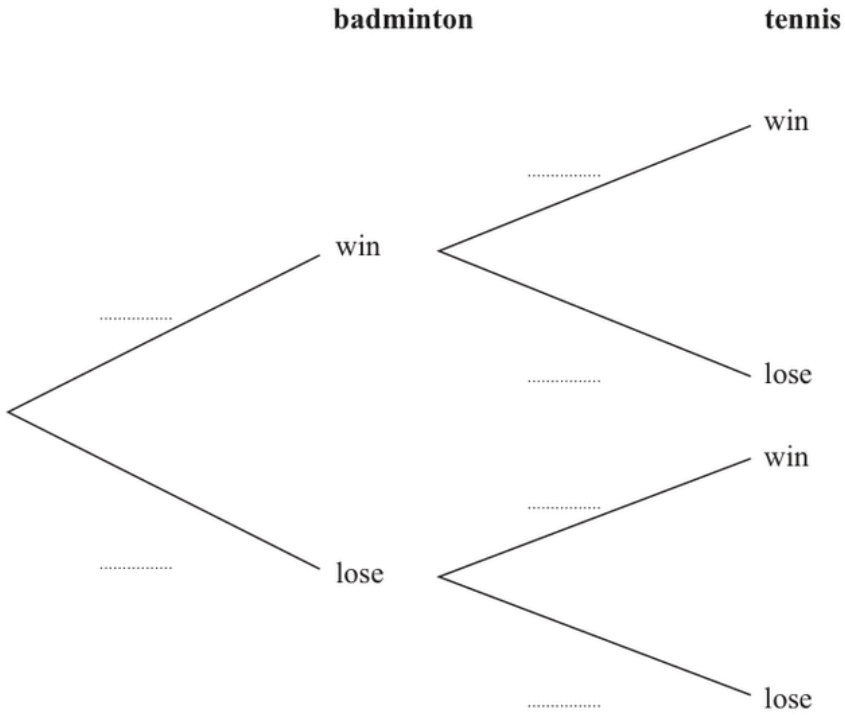
4 marks | Tree Diagrams & Conditional Probability

12 Ricardo is going to play one game of badminton and one game of tennis.

He can either win or lose each game.

The probability that he will win the game of badminton is 0.7
The probability that he will win the game of tennis is 0.4

(a) Complete the probability tree diagram.



(2)

(b) Work out the probability that Ricardo loses both games.

.....

(2)

(Total for Question 12 is 4 marks)

Question 14

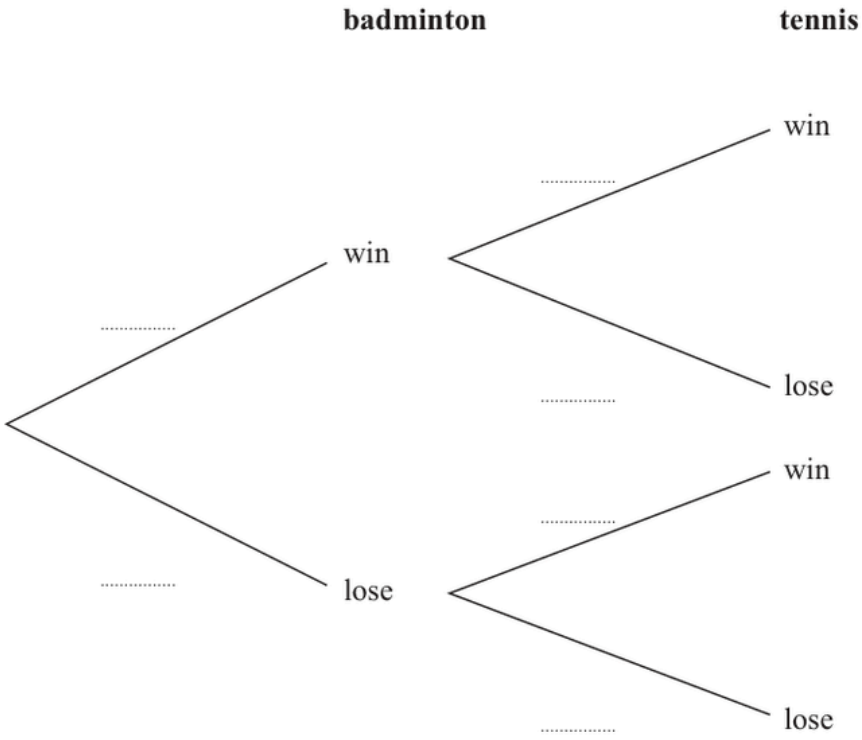
4 marks | Tree Diagrams & Conditional Probability

14 Ricardo is going to play one game of badminton and one game of tennis.

He can either win or lose each game.

The probability that he will win the game of badminton is 0.7
The probability that he will win the game of tennis is 0.4

(a) Complete the probability tree diagram.



(2)

(b) Work out the probability that Ricardo loses both games.

.....

(2)

(Total for Question 14 is 4 marks)

Question 14

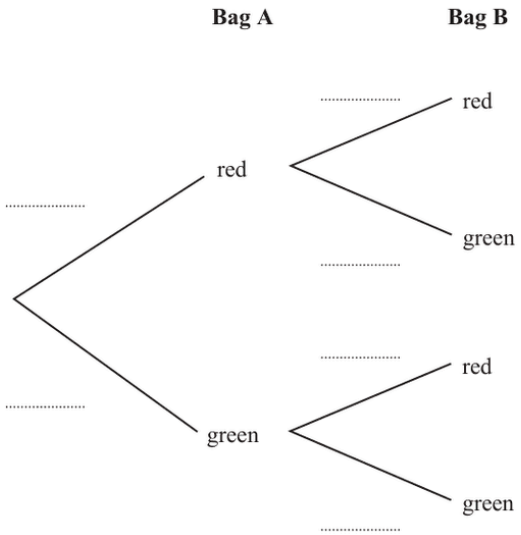
7 marks | Tree Diagrams & Conditional Probability

14 Sara has two bags, **A** and **B**

In bag **A**, there are only 5 red beads and 4 green beads.
In bag **B**, there are only 7 red beads and 3 green beads.

Sara takes at random a bead from bag **A**
She then takes at random a bead from bag **B**

(a) Use this information to complete the probability tree diagram.



(2)

(b) Work out the probability that Sara takes two red beads.

.....

(2)

Sara puts the beads back into their original bags.

Sara also has a box of beads.
In the box, there are only red beads and green beads.

When a bead is taken at random from the box, the probability that it is

a green bead is $\frac{2}{11}$

Sara takes at random a bead from bag **A**
She then takes at random a bead from bag **B**
She then takes at random a bead from the box.

(c) Work out the probability that Sara takes more red beads than green beads.

.....

(3)

(Total for Question 14 is 7 marks)

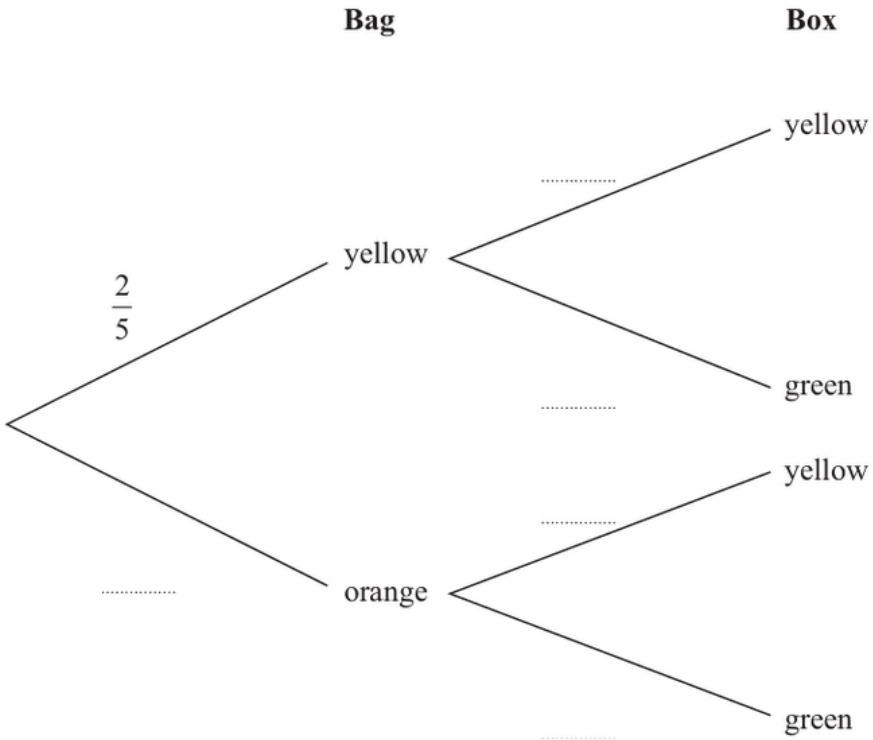
Question 12

5 marks | Tree Diagrams & Conditional Probability

12 In a bag, there are only 2 yellow beads and 3 orange beads.
In a box, there are only 3 yellow beads and 5 green beads.

Chi takes at random a bead from the bag and a bead from the box.

(a) Complete the probability tree diagram.



(2)

(b) Work out the probability that Chi takes two beads of different colours.

.....

(3)

(Total for Question 12 is 5 marks)

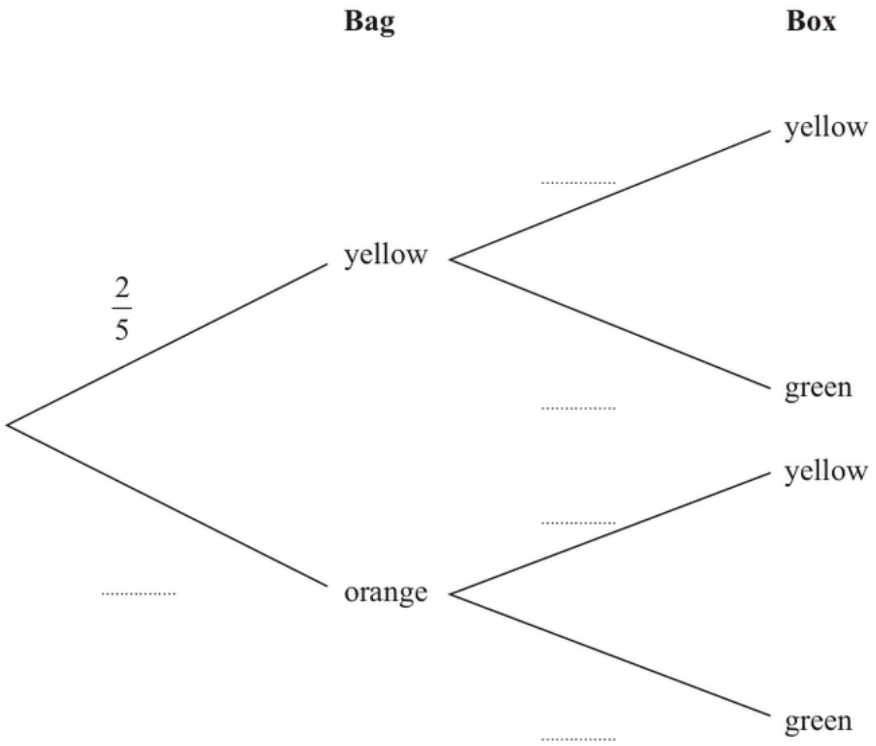
Question 13

5 marks | Tree Diagrams & Conditional Probability

13 In a bag, there are only 2 yellow beads and 3 orange beads.
In a box, there are only 3 yellow beads and 5 green beads.

Chi takes at random a bead from the bag and a bead from the box.

(a) Complete the probability tree diagram.



(2)

(b) Work out the probability that Chi takes two beads of different colours.

.....

(3)

(Total for Question 13 is 5 marks)

Question 22

3 marks | Tree Diagrams & Conditional Probability

22 There are 15 buttons in a box.

3 of the buttons are red
2 of the buttons are pink
10 of the buttons are blue

Pete takes at random three buttons from the box.

Work out the probability that there is still at least one pink button in the box.

(Total for Question 22 is 3 marks)

Question 23

3 marks | Tree Diagrams & Conditional Probability

23 There are 15 buttons in a box.

3 of the buttons are red
2 of the buttons are pink
10 of the buttons are blue

Pete takes at random three buttons from the box.

Work out the probability that there is still at least one pink button in the box.

(Total for Question 23 is 3 marks)

Question 13

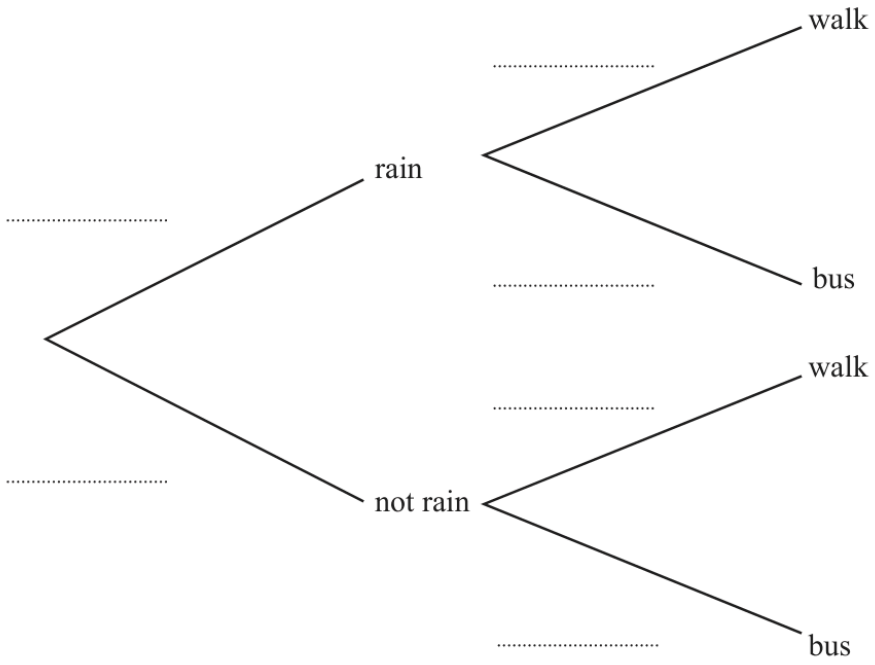
4 marks | Tree Diagrams & Conditional Probability

13 On any school day, Paulo either walks to school or travels by bus to school.

The probability that it rains on any school day is 0.15

If it rains on a school day, the probability that Paulo walks to school is 0.2
If it does not rain on a school day, the probability that Paulo walks to school is 0.75

(a) Complete the probability tree diagram for this information.



(2)

(b) Work out the probability that on a school day, it rains and Paulo walks to school.

.....

(2)

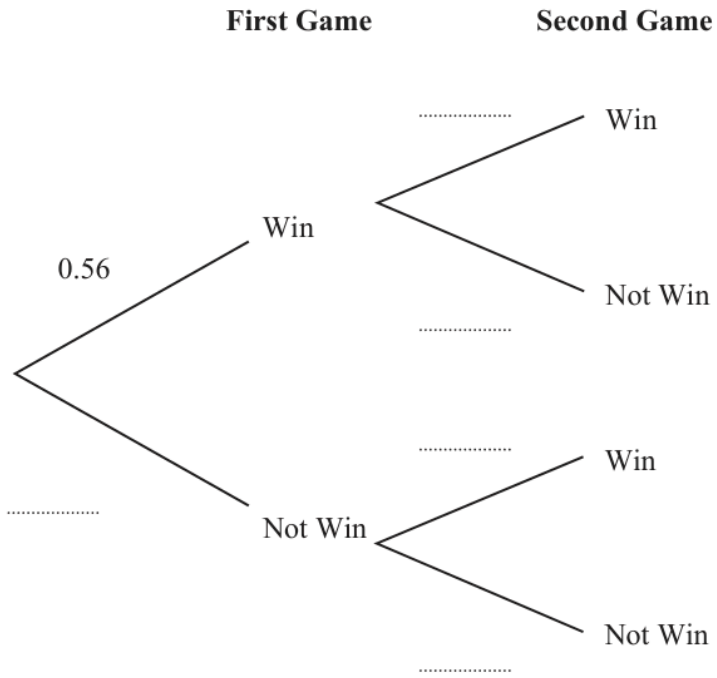
(Total for Question 13 is 4 marks)

Question 13

4 marks | Tree Diagrams & Conditional Probability

13 A team plays two games of football.
For each game, the probability that the team wins is 0.56

(a) Complete the probability tree diagram.



(2)

(b) Work out the probability that the team wins both games.

.....

(2)

(Total for Question 13 is 4 marks)

Question 14

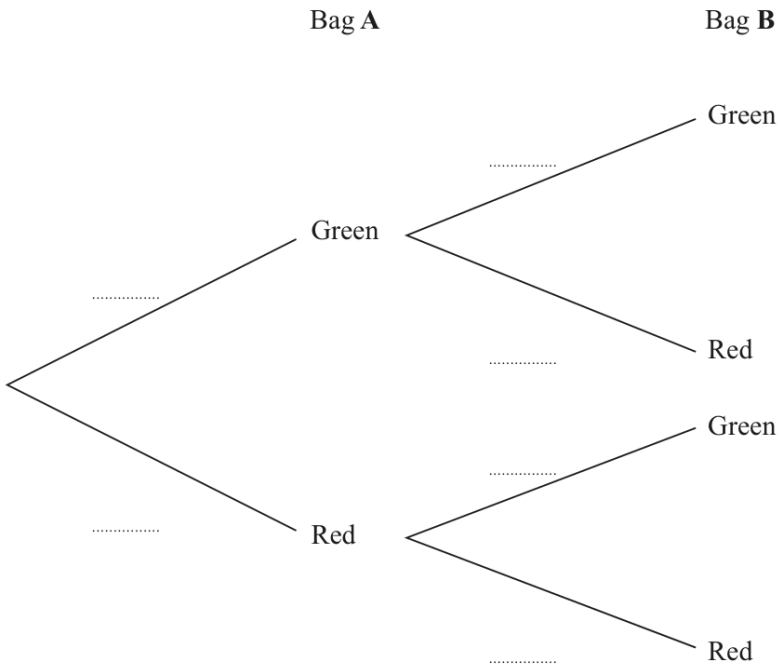
8 marks | Tree Diagrams & Conditional Probability

14 Pras has 2 bags of counters, bag **A** and bag **B**

In bag **A**, there are 4 green counters and 3 red counters.
In bag **B**, there are 5 green counters and 1 red counter.

Pras is going to take at random a counter from bag **A** and a counter from bag **B**

(a) Complete the probability tree diagram.



(2)

(b) Work out the probability that Pras will take two green counters.

.....

(2)

Pras also has a third bag of counters, bag **C**
In bag **C**, there are only green counters and red counters.
All the original counters are back in bag **A** and bag **B**

Pras is going to take at random a counter from bag **A**, a counter from bag **B** and a counter from bag **C**

The probability that Pras will take three red counters is $\frac{3}{70}$

(c) Work out the probability that Pras will take 1 green counter and 2 red counters.

.....

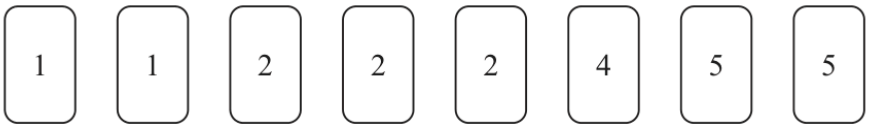
(4)

(Total for Question 14 is 8 marks)

Question 18

3 marks | Tree Diagrams & Conditional Probability

18 Here are 8 cards.
There is a number on each card.



Gordon puts the 8 cards in a bag.
He takes at random a card from the bag and does not replace it.
Gordon then takes at random a second card from the bag.

Calculate the probability that the number on the second card is 3 more than the number on the first card.

.....

(Total for Question 18 is 3 marks)

Question 22

5 marks | Tree Diagrams & Conditional Probability

22 A bag contains x marbles.
12 of the marbles are pink and the rest are yellow.

Greta takes at random 2 marbles from the bag.

The probability that Greta takes a pink marble and a yellow marble is $\frac{18}{47}$

Work out the value of x
Show clear algebraic working.

$x =$ .....

(Total for Question 22 is 5 marks)

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Question 23

5 marks | Tree Diagrams & Conditional Probability

23 A bag contains x marbles.
12 of the marbles are pink and the rest are yellow.

Greta takes at random 2 marbles from the bag.

The probability that Greta takes a pink marble and a yellow marble is $\frac{18}{47}$

Work out the value of x
Show clear algebraic working.

$x =$ .....

(Total for Question 23 is 5 marks)

Dr Eslam Ahmed · eliteigcse.com

TOPIC

Set Notation & Venn Diagrams

Every past-paper question on this topic, 2020 to 2026.

Question 14

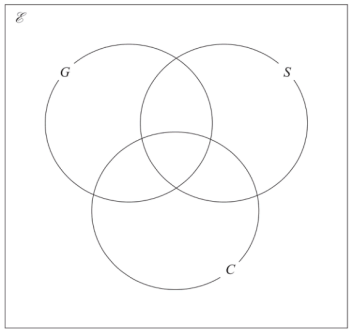
8 marks | Set Notation & Venn Diagrams

14 100 farmers are asked if they have goats (G), sheep (S) or chickens (C) on their farms.

Of these farmers

31 have sheep
53 have chickens
6 have goats, sheep and chickens
11 have sheep and goats
17 have sheep and chickens
18 have goats and chickens
20 do not have any goats, sheep or chickens

(a) Using this information, complete the Venn diagram to show the number of farmers in each appropriate subset.



(3)

(b) Find

(i) $n(G)$

.....

(1)

(ii) $n([G \cup S]')$

.....

(1)

(iii) $n(G' \cap C)$

.....

(1)

One of the farmers who has chickens is chosen at random.

(c) Find the probability that this farmer also has goats.

.....

(2)

(Total for Question 14 is 8 marks)

Question 4

3 marks | Set Notation & Venn Diagrams

4 $B = \{b, l, u, e\}$

$G = \{g, r, e, y\}$

$W = \{w, h, i, t, e\}$

(a) List all the members of the set

(i) $B \cup G$

(ii) $W \cap G'$

.....

(2)

Serena writes down the statement $B \cap G \cap W = \varnothing$

(b) Is Serena's statement correct?
You must give a reason for your answer.

.....

(1)

(Total for Question 4 is 3 marks)

Question 17

6 marks | Set Notation & Venn Diagrams

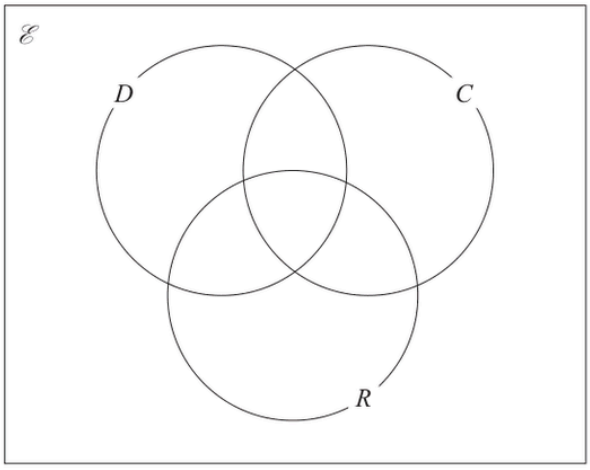
17 Some students in a school were asked the following question.

"Do you have a dog (D), a cat (C) or a rabbit (R)?"

Of these students

28 have a dog
18 have a cat
20 have a rabbit
8 have both a cat and a rabbit
9 have both a dog and a rabbit
x have both a dog and a cat
6 have a dog, a cat and a rabbit
5 have not got a dog or a cat or a rabbit

(a) Using this information, complete the Venn diagram to show the number of students in each appropriate subset.
Give the numbers in terms of x where necessary.



(3)

Given that a total of 50 students answered the question,

(b) work out the value of x.

$x =$ .....

(2)

(c) Find $n(C' \cap D')$

.....

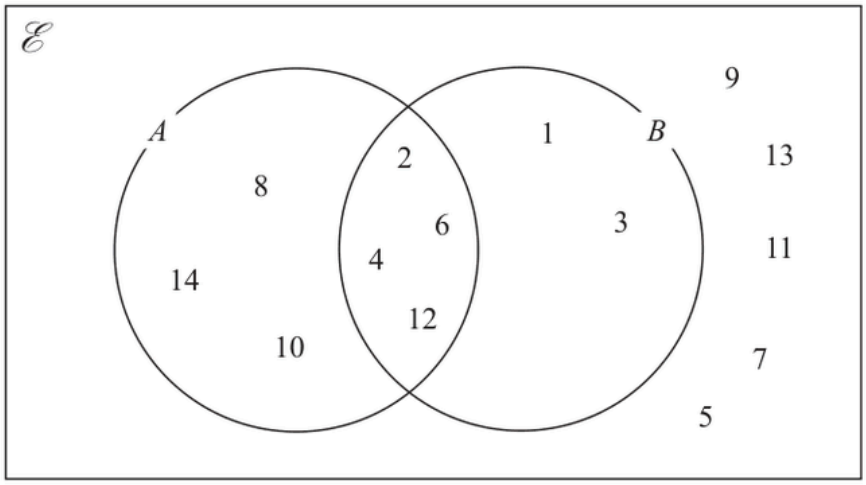
(1)

(Total for Question 17 is 6 marks)

Question 1

4 marks | Set Notation & Venn Diagrams

1 The numbers from 1 to 14 are shown in the Venn diagram.



(a) List the members of the set $A \cap B$

.....

(1)

(b) List the members of the set B'

.....

(1)

A number is picked at random from the numbers in the Venn diagram.

(c) Find the probability that this number is in set A but is **not** in set B.

.....

(2)

(Total for Question 1 is 4 marks)

Question 3

3 marks | Set Notation & Venn Diagrams

3 $\mathscr{E} = \{21, 22, 23, 24, 25, 26, 27, 28, 29, 30\}$
$A = \{22, 24, 26, 28, 30\}$
$B = \{21, 24, 27, 30\}$

(a) List the members of the set

(i) $A \cap B$

(ii) A'

.....

(2)

$C = \{23, 25, 29\}$

(b) Using set notation, find an expression for C in terms of A and B.

.....

(1)

(Total for Question 3 is 3 marks)

Question 4

2 marks | Set Notation & Venn Diagrams

4 $\mathscr{E} = \{20, 21, 22, 23, 24, 25, 26, 27, 28, 29\}$

$A = \{\text{odd numbers}\}$
$B = \{\text{multiples of 3}\}$

List the members of the set

(i) $A \cap B$

.....

(1)

(ii) $A \cup B$

.....

(1)

(Total for Question 4 is 2 marks)

Question 16

6 marks | Set Notation & Venn Diagrams

16 Some students were asked the following question.

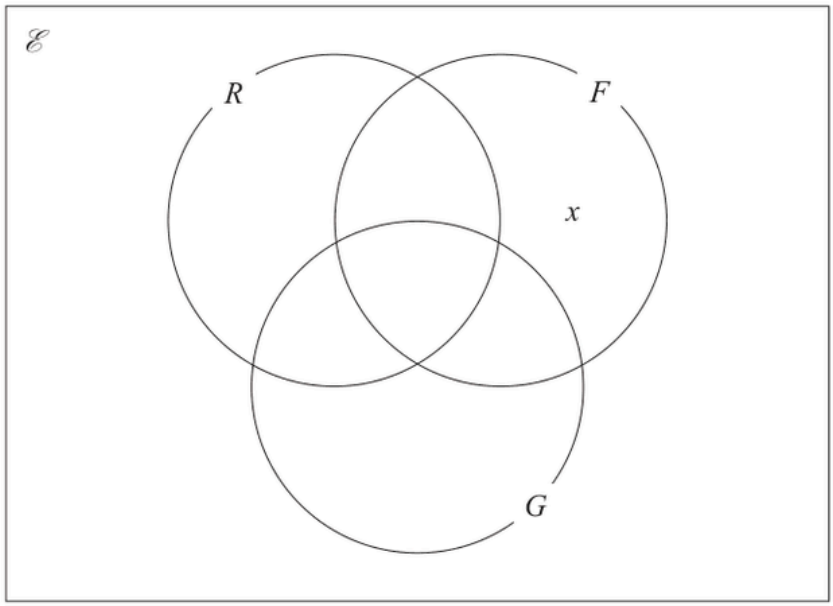
"Which of the subjects Russian (R), French (F) and German (G) do you study?"

Of these students

4 study all three of Russian, French and German
10 study Russian and French
13 study French and German
6 study Russian and German
24 study German
11 study none of the three subjects
the number who study Russian only is twice the number who study French only.

Let x be the number of students who study French only.

(a) Show all this information on the Venn diagram, giving the number of students in each appropriate subset, in terms of x where necessary.



(3)

Given that the number of students who were asked the question was 80

(b) work out the number of these students that study Russian.

.....

(3)

(Total for Question 16 is 6 marks)

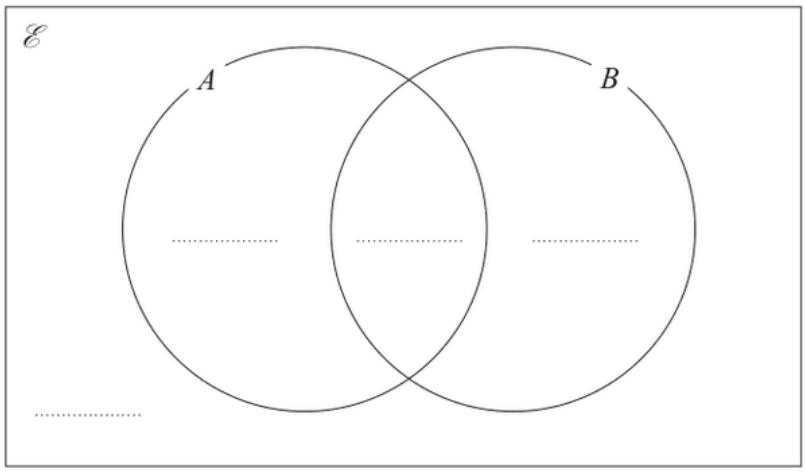
Question 16

5 marks | Set Notation & Venn Diagrams

16 Two events A and B are such that $n(A) = 62$ $n(B) = 30$ and $n(A \cup B) = 68$

Given that $n(\mathscr{E}) = 80$

(a) complete the Venn diagram to show the number of elements in each region.



(2)

An element is chosen at random from $\mathscr{E}$.

(b) Using the Venn diagram, find the probability that this element is in

(i) $A \cap B$

.....

(1)

(ii) $A \cup B'$

.....

(2)

(Total for Question 16 is 5 marks)

Question 4

3 marks | Set Notation & Venn Diagrams

4 $\mathscr{E}$ = {letters of the alphabet}
B = {b, r, a, z, i, l}
I = {i, r, e, l, a, n, d}

(a) List the members of the set

(i) $B \cup I$

(ii) $B \cap I'$

.....

(2)

K = {k, e, n, y, a}

Cody writes down the statement $B \cap K = \varnothing$
Cody's statement is wrong.

(b) Explain why.

.....

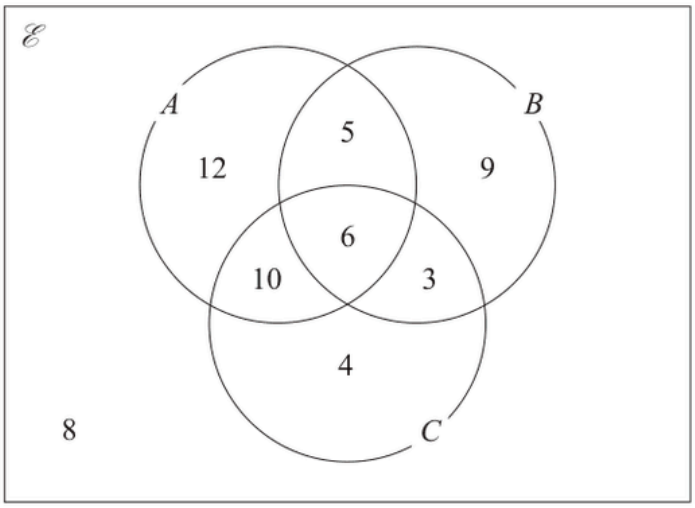
(1)

(Total for Question 4 is 3 marks)

Question 19

3 marks | Set Notation & Venn Diagrams

19 The Venn diagram shows a universal set, $\mathscr{E}$ and sets A, B and C.



12, 5, 9, 10, 6, 3, 4 and 8 represent the **numbers** of elements.

Find

(i) $n(A \cup B)$

.....

(1)

(ii) $n(A' \cap B')$

.....

(1)

(iii) $n([A \cap B] \cup C)$

.....

(1)

(Total for Question 19 is 3 marks)

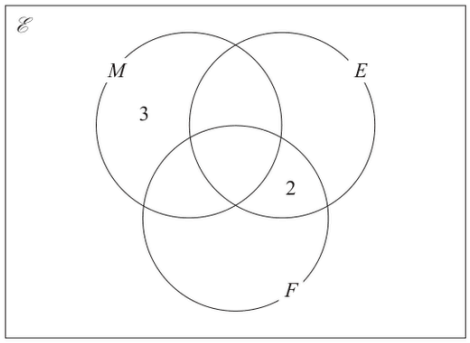
Question 16

5 marks | Set Notation & Venn Diagrams

16 There are 32 students in a class.
In one term these 32 students each took a test in Maths (M), in English (E) and in French (F).

25 students passed the test in Maths.
20 students passed the test in English.
14 students passed the test in French.
18 students passed the tests in Maths and English.
11 students passed the tests in Maths and French.
4 students failed all three tests.
x students passed all three tests.

The incomplete Venn diagram gives some more information about the results of the 32 students.

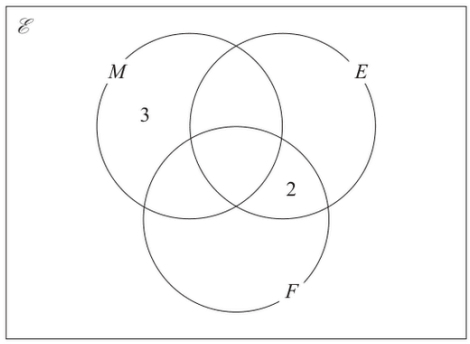


(a) Use all the given information about the results of students who passed the test in Maths to find the value of x.

$x =$ .....

(2)

(b) Use your value of x to complete the Venn diagram to show the number of students in each subset.



(2)

A student who passed the test in Maths is chosen at random.

(c) Find the probability that this student failed the test in French.

.....

(1)

(Total for Question 16 is 5 marks)

Question 7

3 marks | Set Notation & Venn Diagrams

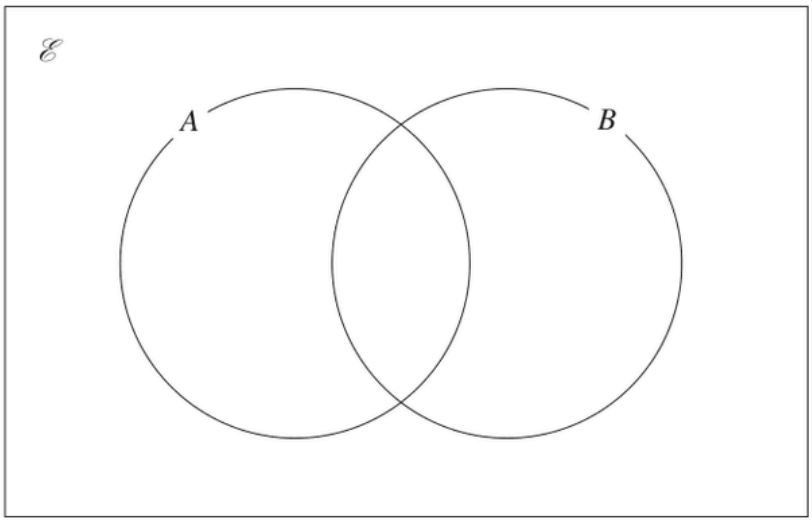
7 $\mathscr{E} = \{4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15\}$

$A \cap B = \{5, 10, 15\}$

$B' = \{7, 8, 9, 11, 12, 13, 14\}$

$A' = \{4, 6, 7, 8, 14\}$

Complete the Venn diagram for this information.

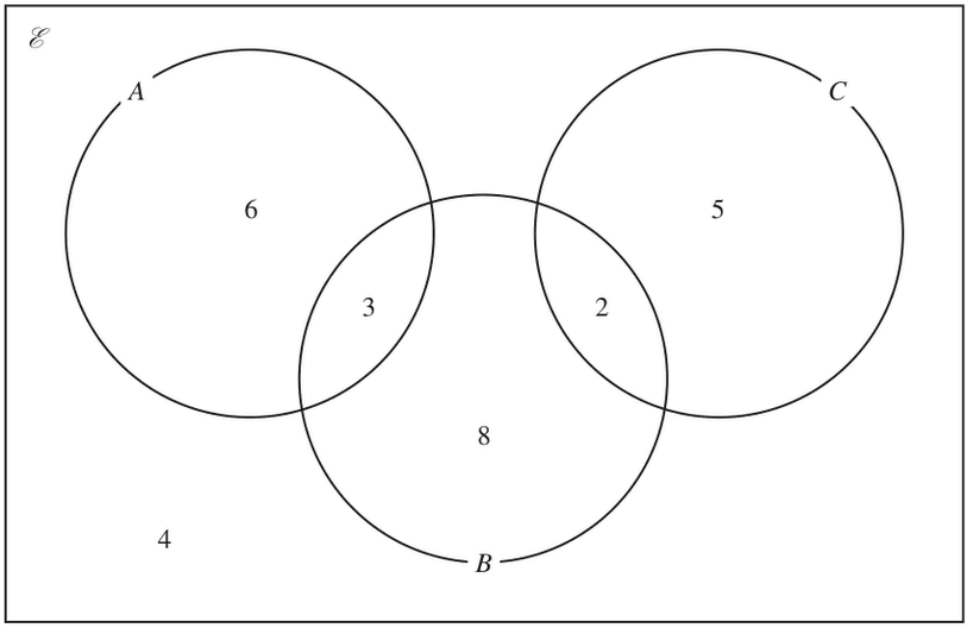


(Total for Question 7 is 3 marks)

Question 17

4 marks | Set Notation & Venn Diagrams

17 The Venn diagram shows a universal set $\mathscr{E}$ and three sets A, B and C.



6, 3, 8, 2, 5 and 4 represent the **numbers** of elements.

Find

(i) $n(A \cup B)$

.....

(1)

(ii) $n(A \cap C)$

.....

(1)

(iii) $n(B \cap C')$

.....

(1)

(iv) $n(A' \cup B' \cup C')$

.....

(1)

(Total for Question 17 is 4 marks)

Question 4

5 marks | Set Notation & Venn Diagrams

4 $\mathscr{E} = \{9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20\}$
$A = \{\text{multiples of } 3\}$
$B = \{\text{odd numbers}\}$

(a) List the members of the set

(i) $A \cap B$

.....

(1)

(ii) $A \cup B$

.....

(1)

(b) Is it true that $24 \in A$?

Tick one of the boxes below.

Yes	No
☐	☐

Give a reason for your answer.

.....

(1)

Set C has 4 members such that $C \cap B' = \{10, 18\}$

(c) List the members of one possible set C

.....

(2)

(Total for Question 4 is 5 marks)

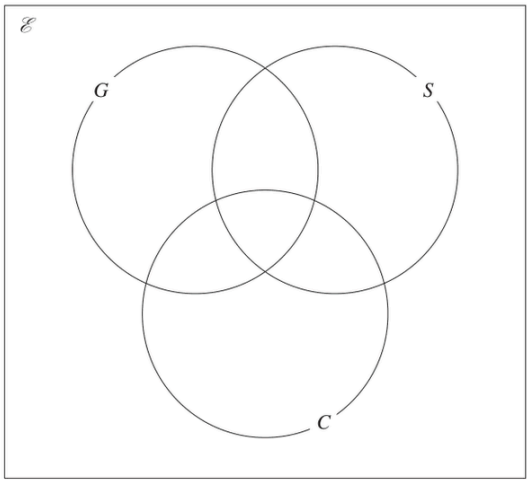
Question 16

8 marks | Set Notation & Venn Diagrams

16 100 farmers are asked if they have goats (G), sheep (S) or chickens (C) on their farms.

Of these farmers
- 31 have sheep
- 53 have chickens
- 6 have goats, sheep and chickens
- 11 have sheep and goats
- 17 have sheep and chickens
- 18 have goats and chickens
- 20 do not have any goats, sheep or chickens

(a) Using this information, complete the Venn diagram to show the number of farmers in each appropriate subset.



(3)

(b) Find

(i) n(G)

.....

(1)

(ii) n($[G \cup S]'$)

.....

(1)

(iii) n($G' \cap C$)

.....

(1)

One of the farmers who has chickens is chosen at random.

(c) Find the probability that this farmer also has goats.

.....

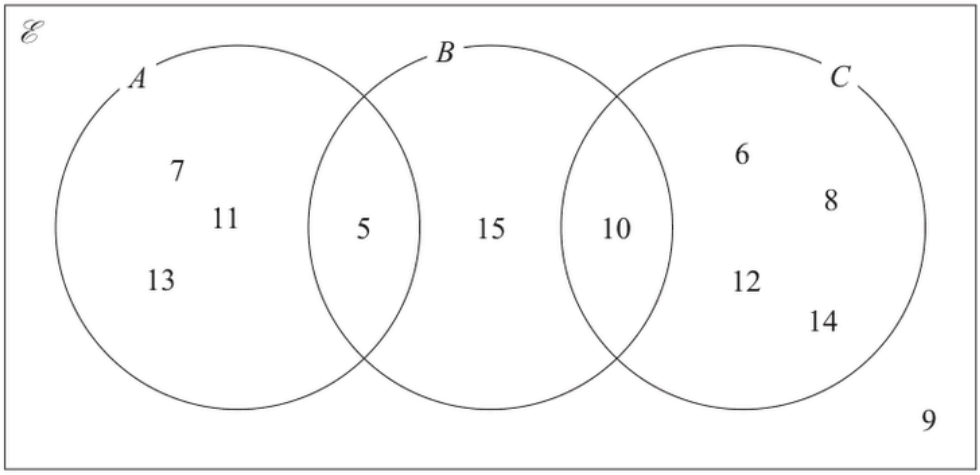
(2)

(Total for Question 16 is 8 marks)

Question 2

3 marks | Set Notation & Venn Diagrams

2 Here is a Venn diagram.



(a) Write down the numbers that are in the set

(i) A

.....

(1)

(ii) $B \cup C$

.....

(1)

Dominic writes down $9 \notin C$

(b) Explain why Dominic is correct.

.....

.....

(1)

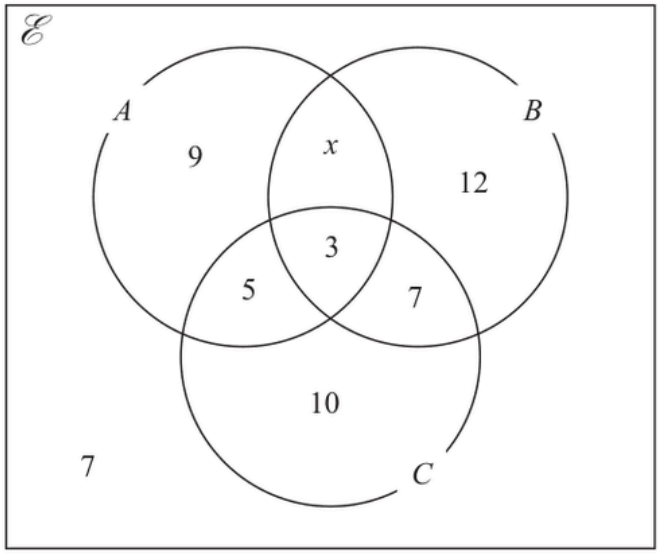
(Total for Question 2 is 3 marks)

Question 16

3 marks | Set Notation & Venn Diagrams

16 The Venn diagram shows a universal set $\mathscr{E}$ and sets A, B and C

The numbers and the letter x represent **numbers** of elements.



Given that $n(A \cup B) = 42$

(a) find the value of x

$x =$ .....

(1)

(b) Find $n(A')$

.....

(1)

(c) Find $n(B' \cap C)$

.....

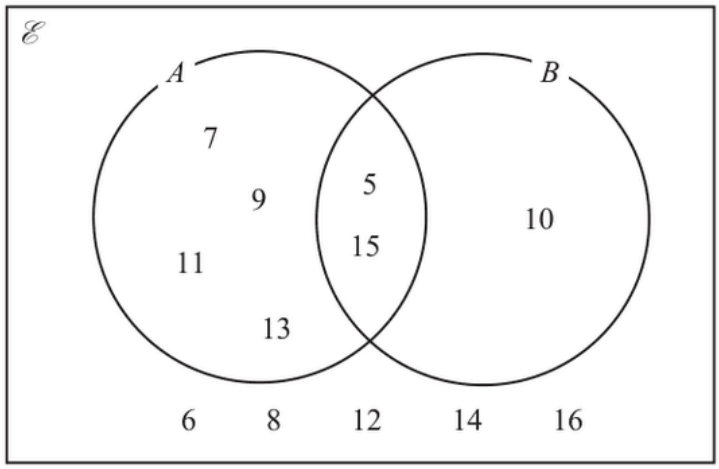
(1)

(Total for Question 16 is 3 marks)

Question 1

3 marks | Set Notation & Venn Diagrams

1 Here is a Venn diagram.



List the members of the set

(a) A

.....

(1)

(b) $A \cap B$

.....

(1)

(c) $(A \cup B)'$

.....

(1)

(Total for Question 1 is 3 marks)

Question 4

5 marks | Set Notation & Venn Diagrams

4 $\mathscr{E} = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$
$A = \{\text{factors of } 6\}$
$B = \{\text{prime numbers}\}$

(a) List the members of the set

(i) $A \cup B$

.....

(1)

(ii) A'

.....

(1)

Harpreet states that $A \cap B = \varnothing$

Harpreet is incorrect.

(b) Explain why.

.....

(1)

C is a set with 4 members such that

the set $A \cap C$ has 2 members
the set $B \cap C$ has 2 members

Set $A \cap C$ and set $B \cap C$ have no members in common.

(c) List the 4 members of set C

.....

(2)

(Total for Question 4 is 5 marks)

Question 7

5 marks | Set Notation & Venn Diagrams

7 $\mathscr{E} = \{23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34\}$
$A = \{\text{even numbers}\}$
$B = \{23, 29, 31\}$
$C = \{\text{multiples of } 3\}$

(a) List the members of the set

(i) $B \cup C$

.....

(1)

(ii) $A' \cap C$

.....

(1)

(b) Is it true that $B \cap C = \varnothing$?

Tick (✓) one of the boxes below.

Yes	No
☐	☐

Give a reason for your answer.

.....

(1)

The set D has 4 members and is such that $D \cap (A \cup C) = \varnothing$

(c) List the members of set D

.....

(2)

(Total for Question 7 is 5 marks)

Question 16

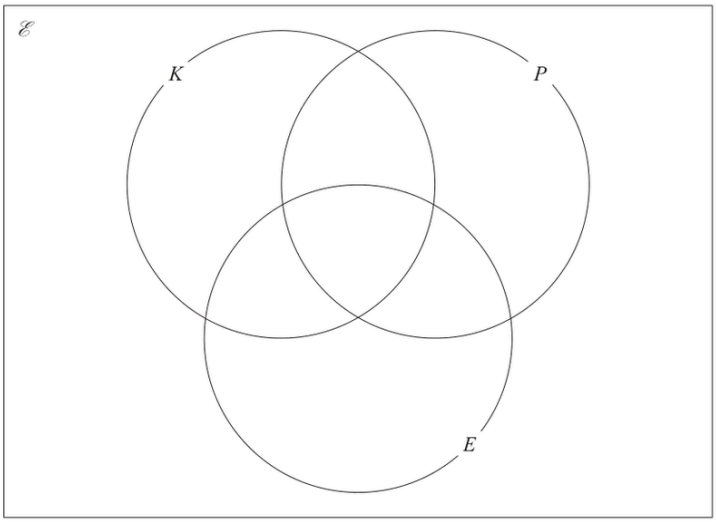
7 marks | Set Notation & Venn Diagrams

16 60 art students were asked if they would like to attend workshops for knitting (K), for photography (P) or for embroidery (E)

Of these students

9 chose knitting, photography and embroidery
17 chose knitting and photography
16 chose photography and embroidery
20 chose knitting and embroidery
28 chose photography
39 chose embroidery
2 chose none of the workshops

(a) Using this information, complete the Venn diagram to show the numbers of students in each subset.



(3)

One of the students is chosen at random.

Given that this student chose photography,

(b) find the probability that this student also chose knitting.

.....

(2)

(c) Find $n(P \cap K')$

.....

(1)

(d) Find $n([P \cup E] \cap K)$

.....

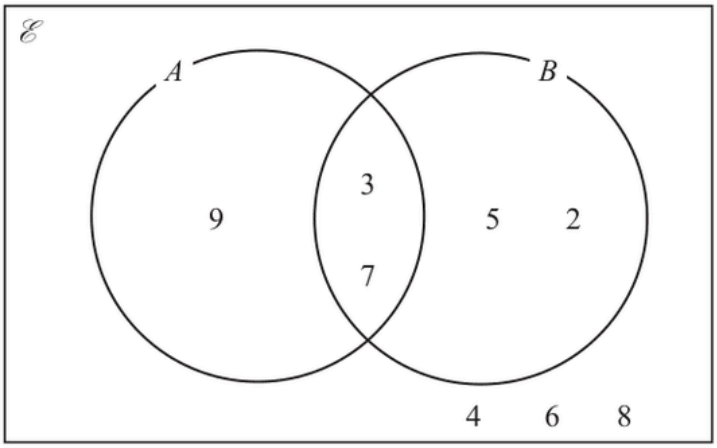
(1)

(Total for Question 16 is 7 marks)

Question 4

3 marks | Set Notation & Venn Diagrams

4 Here is a Venn diagram.



(a) List the members of the set B

.....

(1)

(b) List the members of the set $A \cap B$

.....

(1)

(c) List the members of the set A'

.....

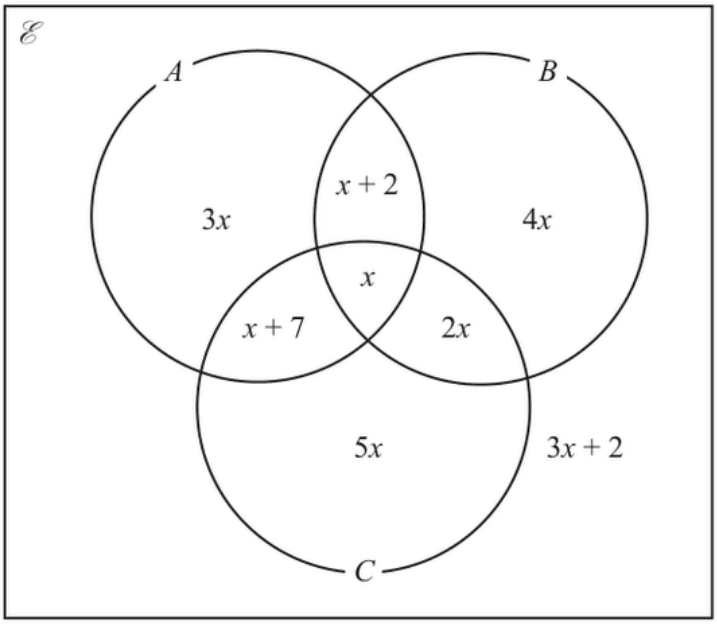
(1)

(Total for Question 4 is 3 marks)

Question 21

4 marks | Set Notation & Venn Diagrams

21 The Venn diagram shows information about the numbers of items in set A, set B and set C, where x is an integer.



Given that $n(A \cup B)' = 26$

find $n(A' \cap C)$

$n(A' \cap C) =$ .....

(Total for Question 21 is 4 marks)

Question 4

4 marks | Set Notation & Venn Diagrams

4 $\mathscr{E} = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12\}$

$A = \{2, 4, 6, 8, 10, 12\}$

$B = \{3, 6, 9, 12\}$

$C = \{1, 3, 5, 7, 9, 11\}$

(a) List the members of the set

(i) $A \cup B$

.....

(ii) B'

.....

(2)

$\mathscr{E} = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12\}$

$A = \{2, 4, 6, 8, 10, 12\}$

$B = \{3, 6, 9, 12\}$

$C = \{1, 3, 5, 7, 9, 11\}$

$\mathscr{E}$	$\cap$	$\cup$	$\varnothing$	$\in$	$\notin$

(b) Write a symbol from the box on each dotted line to make each of the following a true statement.

(i) $A \cap C =$ .....

(ii) 13 ..... $\mathscr{E}$

(2)

(Total for Question 4 is 4 marks)

Question 5

4 marks | Set Notation & Venn Diagrams

5 $\mathscr{E} = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12\}$

$A = \{2, 4, 6, 8, 10, 12\}$

$B = \{3, 6, 9, 12\}$

$C = \{1, 3, 5, 7, 9, 11\}$

(a) List the members of the set

(i) $A \cup B$

.....

(ii) B'

.....

(2)

$\mathscr{E} = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12\}$

$A = \{2, 4, 6, 8, 10, 12\}$

$B = \{3, 6, 9, 12\}$

$C = \{1, 3, 5, 7, 9, 11\}$

$\mathscr{E}$	$\cap$	$\cup$	$\varnothing$	$\in$	$\notin$

(b) Write a symbol from the box on each dotted line to make each of the following a true statement.

(i) $A \cap C =$ .....

(ii) 13 ..... $\mathscr{E}$

(2)

(Total for Question 5 is 4 marks)

Question 8

5 marks | Set Notation & Venn Diagrams

8 $\mathscr{E} = \{18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30\}$

$A = \{\text{even numbers}\}$

$B = \{\text{multiples of 3}\}$

$C = \{\text{multiples of 5}\}$

(a) List the members of the set $(A \cup B)'$

.....

(2)

Sophie writes down the statement $B \cap C = \emptyset$

(b) Explain why Sophie's statement is wrong.

.....

(1)

D is a set such that $A \cap D = \{18, 26\}$
The set D has exactly 5 members.

(c) List the members of one possible set D

.....

(2)

(Total for Question 8 is 5 marks)

Question 20

6 marks | Set Notation & Venn Diagrams

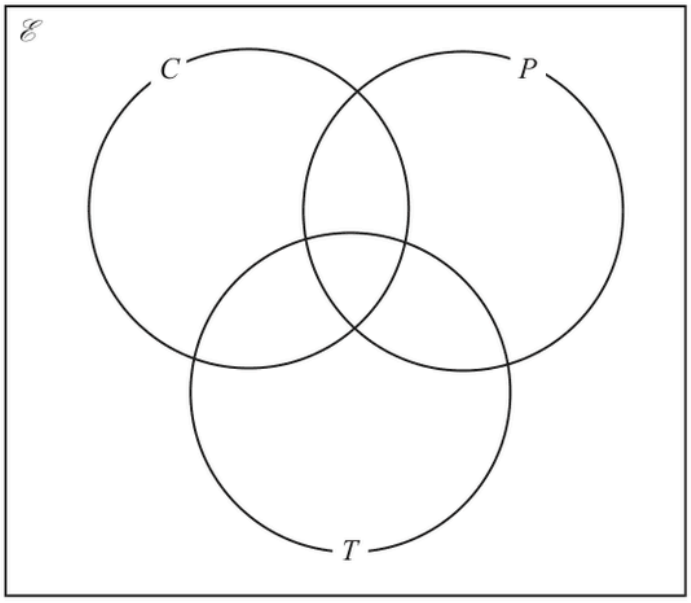
20 120 gardeners were asked if they grow carrots (C) or potatoes (P) or tomatoes (T)

Of these gardeners

43 grow carrots
12 grow carrots and potatoes and tomatoes
18 grow carrots and potatoes
27 grow carrots and tomatoes
32 grow potatoes and tomatoes
29 do not grow carrots or potatoes or tomatoes

The number of these gardeners who grow only potatoes is equal to the number of these gardeners who grow only tomatoes.

(a) Complete the Venn diagram to show this information.



(3)

(b) Find $n(T' \cap C)$

.....

(1)

One of the gardeners who grows carrots is chosen at random.

(c) Calculate the probability that this gardener also grows potatoes.

.....

(2)

(Total for Question 20 is 6 marks)

Question 4

4 marks | Set Notation & Venn Diagrams

4 $\mathscr{E} = \{8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18\}$

$A = \{\text{odd numbers}\}$

$B = \{\text{multiples of 3}\}$

$C = \{\text{prime numbers}\}$

(a) List the members of the set $A \cup C$

.....

(1)

(b) List the members of the set $(A \cap B)'$

.....

(1)

(c) Is it true that $15 \in (B \cap C)$?

Tick (✓) the correct box.

Yes	No
☐	☐

Give a reason for your answer.

.....

(1)

D is a set such that $D \cup C = A$

D has 2 members.

(d) List the members of D

.....

(1)

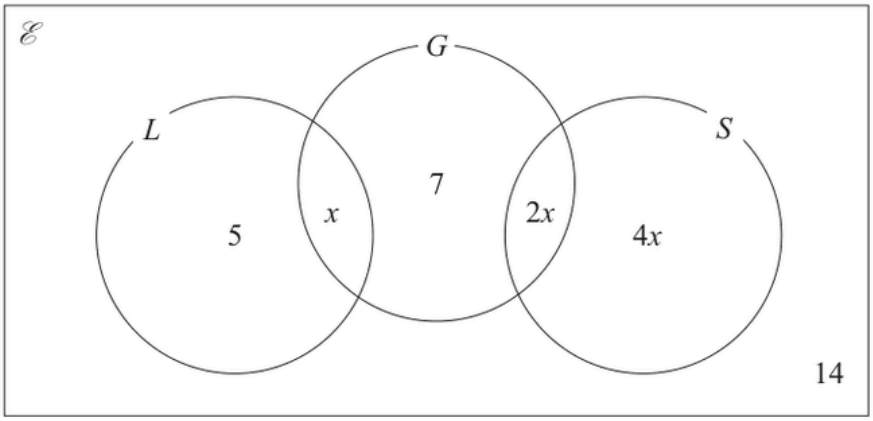
(Total for Question 4 is 4 marks)

Question 18

3 marks | Set Notation & Venn Diagrams

18 Bianca asked 40 students which of the languages Latin (L), Greek (G) and Sanskrit (S) they study.

The Venn diagram gives some information about her results.
It shows the number of students in each subset.



One of these students is selected at random.
Work out the probability that this student studies Latin or Sanskrit.

(Total for Question 18 is 3 marks)

Question 3

3 marks | Set Notation & Venn Diagrams

3 $\mathscr{E} = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19\}$

$A = \{\text{factors of } 20\}$

$B = \{\text{multiples of } 5\}$

(a) List the members of the set

(i) $A \cup B$

.....

(1)

(ii) $A \cap B'$

.....

(1)

$C = \{\text{prime numbers}\}$

Ana writes down the statement $A \cap C = \varnothing$
Ana's statement is wrong.

(b) Explain why.

.....

.....

(1)

(Total for Question 3 is 3 marks)

Question 3

1 marks | Set Notation & Venn Diagrams

3 $\mathscr{E}$ = {integers from 1 to 12}
A = {factors of 12}

List the members of the set A'

.....

(Total for Question 3 is 1 mark)

Question 5

4 marks | Set Notation & Venn Diagrams

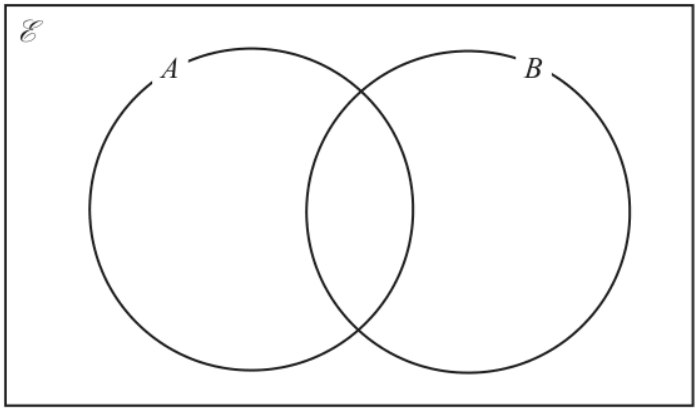
5 $\mathscr{E} = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12\}$

$A = \{2, 3, 5, 7, 11\}$

$A \cap B = \{2, 5\}$

$B' = \{3, 4, 6, 7, 9, 11\}$

(a) Complete the Venn diagram for this information.



(3)

A number is chosen at random from the universal set $\mathscr{E}$

(b) Write down the probability that this number is in the set $(A \cup B)'$

.....

(1)

(Total for Question 5 is 4 marks)

Question 12

2 marks | Set Notation & Venn Diagrams

12 $\mathscr{E} = \{\text{integers } x \text{ such that } 20 \leqslant x \leqslant 32\}$

$A = \{x \text{ such that } x < 27\}$

$B = \{x \text{ such that } 25 \leqslant x \leqslant 30\}$

(a) List the members of the set $A \cap B$

.....

(1)

(b) List the members of the set $(A \cup B)'$

.....

(1)

(Total for Question 12 is 2 marks)

Question 21

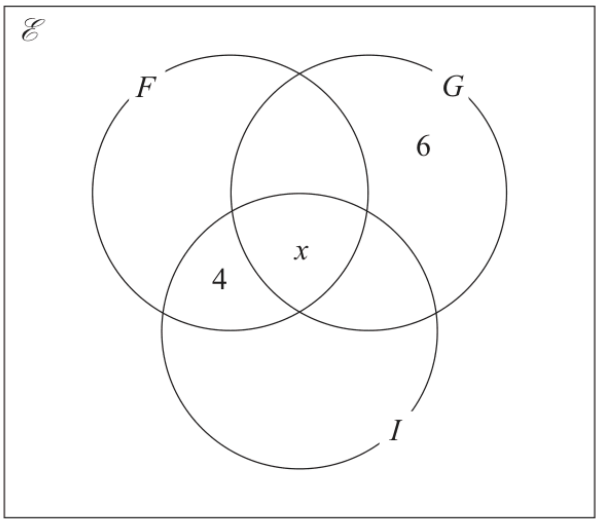
5 marks | Set Notation & Venn Diagrams

21 60 students were asked if they study French (F), German (G) or Italian (I)

Of these students

32 students study French
24 students study German
27 students study Italian
16 students study French and German
15 students study German and Italian

The incomplete Venn diagram gives some more information about the languages the 60 students study.



(a) Work out the value of x

$x =$ .....

(3)

(b) Work out how many of the 60 students study none of French or German or Italian.

.....

(2)

(Total for Question 21 is 5 marks)