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Elite Mathematics
Pearson Edexcel International GCSE

IGCSE LINEAR · 4MA1

4MA1/1H June 2022 Worked Solutions

June 2022 paper rebuilt with the worked solution after each question.

24	2020–2026	Single-paper solutions
paper questions	52 past papers	checked by Dr Eslam



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PAST PAPER

4MA1/1H June 2022

June 2022

24	100	2 h
questions	marks	exam time

Each question is followed by its worked solution and final answer.

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)

WORKED SOLUTION

Question 1 · 4MA1/1H June 2022

1 The sequence is

The sequence is

$$1,\ 5,\ 9,\ 13,\ 17$$

2 Find the nth term

The common difference is 4, so the nth term is

$$4n - 3$$

3 Find the nth term

For the second sequence, the nth term is $3n + 5$.

4 The th term is

The $(2m)$th term is

$$3(2m) + 5 = 6m + 5$$

FINAL ANSWER

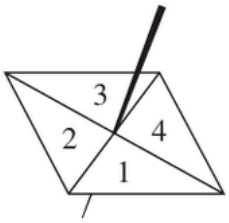
$4n - 3$, and $6m + 5$.

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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)

WORKED SOLUTION

Question 2 · 4MA1/1H June 2022

1 **Probabilities of landing on 2 and on 4**

The probabilities add to 1, and $P(2) = P(4)$:

$$1 - (0.26 + 0.18) = 0.56, \qquad P(4) = 0.56 \div 2 = 0.28$$

2 **Number of spins**

An estimate of 45 for the number 3 means

$$0.18 \times n = 45 \Rightarrow n = 250$$

3 **Estimate for landing on 4**

$$250 \times 0.28 = 70$$

FINAL ANSWER

70

4MA1/1H JUNE 2022

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)

WORKED SOLUTION

Question 3 · 4MA1/1H June 2022

1 Find the LCM

For the HCF of 56 and 84:

$$56 = 2^3 \times 7$$

$$84 = 2^2 \times 3 \times 7$$

2 Take the smaller powers

Take the smaller powers:

$$\text{HCF} = 2^2 \times 7 = 28$$

3 Find the LCM

For the LCM of 60 and 72:

$$60 = 2^2 \times 3 \times 5$$

$$72 = 2^3 \times 3^2$$

4 Take the larger powers

Take the larger powers:

$$\text{LCM} = 2^3 \times 3^2 \times 5 = 360$$

FINAL ANSWER

(a) 28, (b) 360

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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.

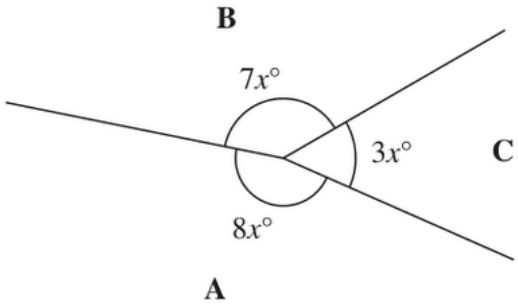


Diagram **NOT** accurately drawn

Polygon **B** has n sides.

Work out the value of n.

$n =$ .....

(Total for Question 4 is 4 marks)

WORKED SOLUTION

Question 4 · 4MA1/1H June 2022

1 **The angles around the point**

The angles around the point add to $360°$:

$$7x + 3x + 8x = 360$$

$$18x = 360$$

$$x = 20$$

2 **The interior angle of polygon**

The interior angle of polygon B is

$$7x = 7 \times 20 = 140°$$

3 **Find the gradient**

So the exterior angle is

$$180° - 140° = 40°$$

4 **Find the gradient**

For a regular polygon,

$$n = \frac{360}{40} = 9$$

✓ **FINAL ANSWER**

$n = 9$.

4MA1/1H JUNE 2022

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)

WORKED SOLUTION

Question 5 · 4MA1/1H June 2022

1 **(a)**

(a)

$$(n-6)(n+4)=n^2-2n-24$$

2 **(b)**

(b)

$$2x-3=\frac{3x-5}{4}$$

$$8x-12=3x-5$$

$$5x=7$$

✓ **FINAL ANSWER**

(a) $n^2-2n-24$, (b) $x=\frac{7}{5}$

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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)

WORKED SOLUTION

Question 6 · 4MA1/1H June 2022

1 **Use compound interest**

For part (a), the value in 2021 was 4% more than in 2020.

$$\text{2020 value} = \frac{634400}{1.04} = 610000$$

2 **Use compound interest**

In 2020, $600000 < x < 700000$, so the service charge band was B.

3 **Use compound interest**

In 2021, 634400 is also between 600000 and 700000, so the band was still B.

4 **Use compound interest**

For part (b), a depreciation of 15% has multiplier 0.85.

5 **Use compound interest**

After 2 years, the multiplier is

$$0.85^2 = 0.7225$$

6 **Use compound interest**

So the value left is 72.25%, meaning the total depreciation is

$$100\% - 72.25\% = 27.75\%$$

✓ **FINAL ANSWER**

(a) No, it stayed in band B. (b) 27.75%

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Question 7

4 marks | Standard & Compound Units

7 A cylinder is placed on the ground.

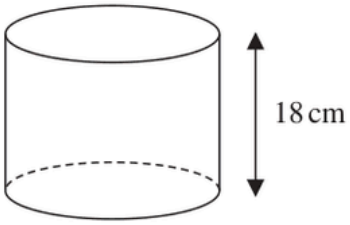


Diagram **NOT** accurately drawn

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)

WORKED SOLUTION

Question 7 · 4MA1/1H June 2022

1 Calculate area

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

$$1.4 = \frac{72}{\text{area}}$$

$$\text{area} = \frac{72}{1.4} = 51.428\ldots \text{ cm}^2$$

2 The base area of the

The base area of the cylinder is $51.428\ldots$ cm^2.

3 **Volume is**

Volume is

$$51.428\ldots \times 18 = 925.714\ldots$$

✓ **FINAL ANSWER**

$926\ \text{cm}^3$ to 3 significant figures.

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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)

WORKED SOLUTION

Question 8 · 4MA1/1H June 2022

1 Convert standard form

$$0.000089 = 8.9 \times 10^{-5}$$

$$8.34 \times 10^4 = 83400$$

FINAL ANSWER

(a) 8.9×10^{-5}, (b) 83400

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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)

WORKED SOLUTION

Question 9 · 4MA1/1H June 2022

1 **Use index laws**

$$8 \times (4t)^0 = 8 \times 1 = 8$$

2 **Use index laws**

For part (b),

$$x^6 \div x^{-5} = x^{6-(-5)} = x^{11}$$

3 **Use index laws**

So

$$p = 11$$

4 **Use index laws**

For part (c),

$$(2k^2m^4)^3 = 2^3k^{2\times3}m^{4\times3}$$

$$= 8k^6m^{12}$$

FINAL ANSWER

(a) 8, (b) $p = 11$, (c) $8k^6m^{12}$.

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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)

WORKED SOLUTION

Question 10 · 4MA1/1H June 2022

1 The centres are

The centres are

$$C_1 = (-1, 3), \qquad C_2 = (7, 18)$$

2 The distance between the centres

The distance between the centres is

$$\sqrt{(7-(-1))^2 + (18-3)^2}$$

$$= \sqrt{8^2 + 15^2} = \sqrt{289} = 17$$

3 Calculate value

The radii are 3 cm and 15 cm.

$$3 + 15 = 18$$

4 **Use Coordinate geometry tag correct**

Since the distance between the centres is 17 cm, which is less than the sum of the radii, the circles intersect.

✓ **FINAL ANSWER**

$17\ \text{cm}$, and the circles intersect because $17 < 18$.

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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)

WORKED SOLUTION

Question 11 · 4MA1/1H June 2022

1 **(a)**

(a)

$$9x^2 - 4y^2 = (3x)^2 - (2y)^2 = (3x - 2y)(3x + 2y)$$

2 **(b)**

(b)

$$\frac{7}{8} - \frac{x+3}{4x} = \frac{7x}{8x} - \frac{2(x+3)}{8x}$$

$$= \frac{7x - 2x - 6}{8x} = \frac{5x - 6}{8x}$$

FINAL ANSWER

(a) $(3x - 2y)(3x + 2y)$, (b) $\frac{5x-6}{8x}$

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Question 12

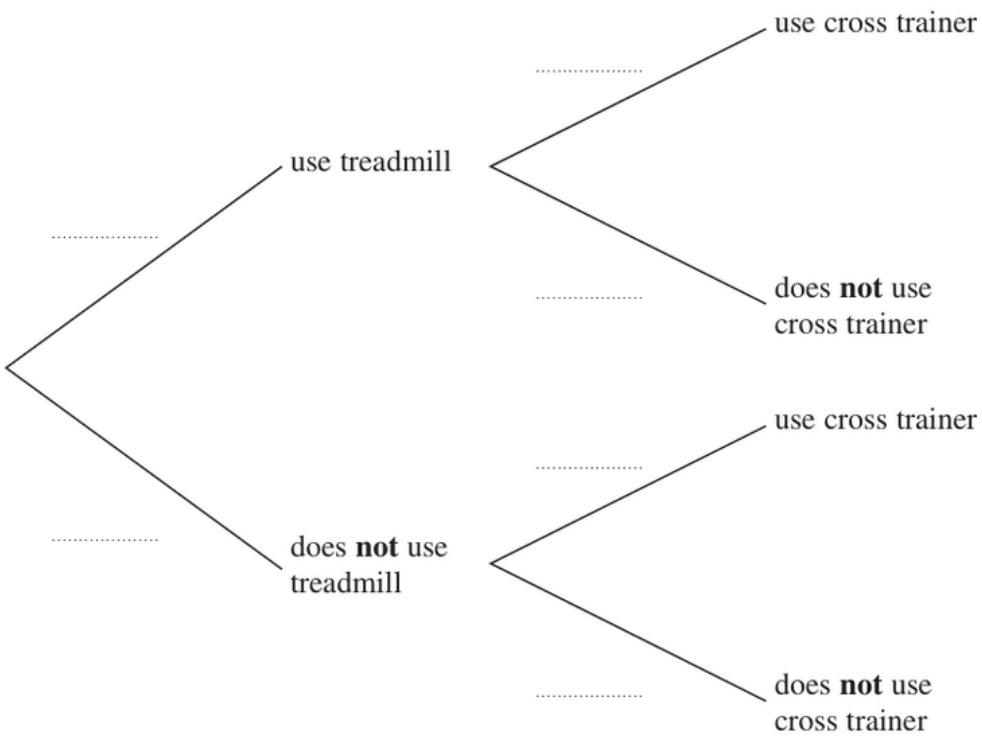
4 marks | Tree Diagrams & Conditional Probability

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)

WORKED SOLUTION

Question 12 · 4MA1/1H June 2022

1 **(a) Complete the tree**

Treadmill: use 0.8, not use 0.2.

After using the treadmill: cross trainer 0.3, not 0.7.

After not using the treadmill: cross trainer 0.6, not 0.4.

2 (b) Treadmill and cross trainer

$$0.8 \times 0.3 = 0.24$$

FINAL ANSWER

(a) $0.8, 0.2$; $0.3, 0.7$; $0.6, 0.4$ (b) 0.24

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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)

WORKED SOLUTION

Question 13 · 4MA1/1H June 2022

1 **Payment 1 is**

Payment 1 is

$$\frac{3}{8}$$

2 **Payment 2 is**

Payment 2 is

$$45\% = \frac{45}{100} = \frac{9}{20}$$

3 **Together**

Together:

$$\frac{3}{8} + \frac{9}{20} = \frac{15}{40} + \frac{18}{40} = \frac{33}{40}$$

4 **Calculate percentage**

So Payment 3 is

$$1 - \frac{33}{40} = \frac{7}{40}$$

5 **Calculate percentage**

Payment 3 is $406, so

$$\frac{7}{40} \times \text{total} = 406$$

$$\text{total} = 406 \times \frac{40}{7} = 2320$$

6 **Payment 2 is**

Payment 2 is

$$45\% \times 2320 = 1044$$

✓ **FINAL ANSWER**

$1044

4MA1/1H JUNE 2022

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)

WORKED SOLUTION

Question 14 · 4MA1/1H June 2022

1 **Evaluate fraction**

$$f(x) = \frac{2x}{x-6}$$

2 **(a)**

(a)

$$f(10) = \frac{2(10)}{10-6} = \frac{20}{4} = 5$$

3 **(b) Let**

(b) Let

$$y = \frac{2x}{x-6}$$

$$y(x-6) = 2x$$

$$yx - 6y = 2x$$

$$x(y-2) = 6y$$

$$x = \frac{6y}{y-2}$$

---

4 **Evaluate fraction**

So

$$f^{-1}(x) = \frac{6x}{x-2}$$

✓ **FINAL ANSWER**

$f(10) = 5$, and $f^{-1}(x) = \frac{6x}{x-2}$.

4MA1/1H JUNE 2022

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)

WORKED SOLUTION

Question 15 · 4MA1/1H June 2022

1 Ways to score a total of 0

Three draws ($0+0+0$), or one win and two losses ($10-5-5=0$) in any order.

2 Three draws

$$0.5^3 = 0.125$$

3 One win and two losses (3 orders)

$$3 \times 0.3 \times 0.2 \times 0.2 = 0.036$$

4 Add the cases

$$0.125 + 0.036 = 0.161$$

✓ **FINAL ANSWER**

0.161

4MA1/1H JUNE 2022

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)

WORKED SOLUTION

Question 16 · 4MA1/1H June 2022

1 **Proof**

Rationalise the denominator:

$$\frac{12}{\sqrt{2}-1} = \frac{12(\sqrt{2}+1)}{(\sqrt{2}-1)(\sqrt{2}+1)}$$

$$= 12(\sqrt{2}+1) = 12\sqrt{2}+12$$

Also,

$$(\sqrt{2})^5 = (\sqrt{2})^4\sqrt{2} = 4\sqrt{2}$$

So the left side is

$$12\sqrt{2}+12-4\sqrt{2} = 8\sqrt{2}+12$$

And

$$2\sqrt{32}+12 = 2(4\sqrt{2})+12 = 8\sqrt{2}+12$$

So both sides are equal.

FINAL ANSWER

Shown.

4MA1/1H JUNE 2022

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)

WORKED SOLUTION

Question 17 · 4MA1/1H June 2022

1 Differentiate

$$s = 4t^2 + \frac{125}{t}$$

2 Velocity is

Velocity is

$$v = \frac{ds}{dt} = 8t - \frac{125}{t^2}$$

3 Differentiate

When $v = 0$,

$$8t - \frac{125}{t^2} = 0$$

$$8t^3 = 125$$

$$t^3 = 15.625$$

$$t = 2.5$$

4 **Differentiate**

Now find s:

$$s = 4(2.5)^2 + \frac{125}{2.5}$$

$$s = 25 + 50 = 75$$

✓ **FINAL ANSWER**

$75\ \text{m}$.

4MA1/1H JUNE 2022

Question 18

5 marks | Sine & Cosine Rules

18 Here is triangle ABC

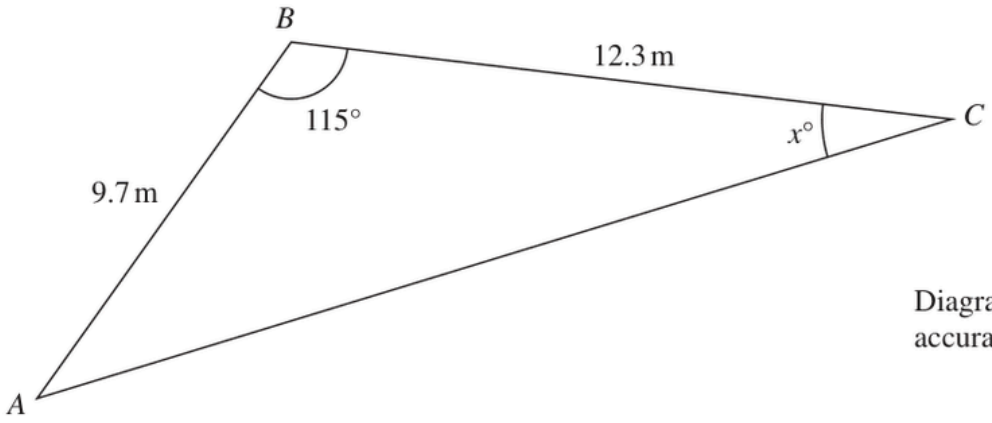


Diagram **NOT** accurately drawn

Work out the value of x
Give your answer correct to 3 significant figures.

$x =$ .....

(Total for Question 18 is 5 marks)

WORKED SOLUTION

Question 18 · 4MA1/1H June 2022

1 Use trigonometry

First use the cosine rule to find AC:

$$AC^2 = 9.7^2 + 12.3^2 - 2(9.7)(12.3)\cos 115°$$

$$AC = 18.607\ldots$$

2 Use trigonometry

Now use the sine rule:

$$\frac{\sin x}{9.7} = \frac{\sin 115°}{18.607\ldots}$$

$$\sin x = \frac{9.7 \sin 115°}{18.607\ldots}$$

$$x = 28.194\ldots°$$

FINAL ANSWER

$28.2°$.

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Question 19

5 marks | Circles, Arcs & Sectors

19

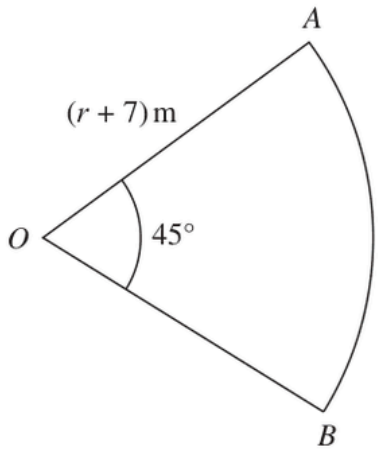


Diagram **NOT** accurately drawn

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)

WORKED SOLUTION

Question 19 · 4MA1/1H June 2022

1 **Area of sector**

Area of sector S:

$$\frac{45}{360}\pi(r+7)^2 = \frac{1}{8}\pi(r+7)^2$$

2 **Area of circle**

Area of circle C:

$$\pi(r-2)^2$$

---

3 **The sector area is twice**

The sector area is twice the circle area:

$$\frac{1}{8}\pi(r+7)^2 = 2\pi(r-2)^2$$

$$(r+7)^2 = 16(r-2)^2$$

---

4 **Solve inequality**

Since $r > 2$,

$$r+7 = 4(r-2)$$

$$r+7 = 4r-8$$

$$r = 5$$

✓ **FINAL ANSWER**

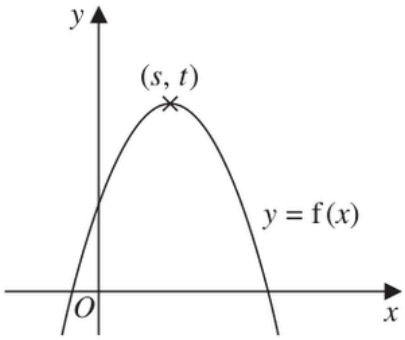
$r = 5$.

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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)

WORKED SOLUTION

Question 20 · 4MA1/1H June 2022

1 The maximum point of is

The maximum point of $y = f(x)$ is (s, t).

2 Calculate value

For

$$y = f(x - 2)$$

3 the graph moves 2 units

the graph moves 2 units right:

$$(s, t) \to (s + 2, t)$$

4 **Calculate value**

For

$$y = 3f(x)$$

5 **the coordinate is multiplied by**

the y-coordinate is multiplied by 3:

$$(s, t) \to (s, 3t)$$

✓ **FINAL ANSWER**

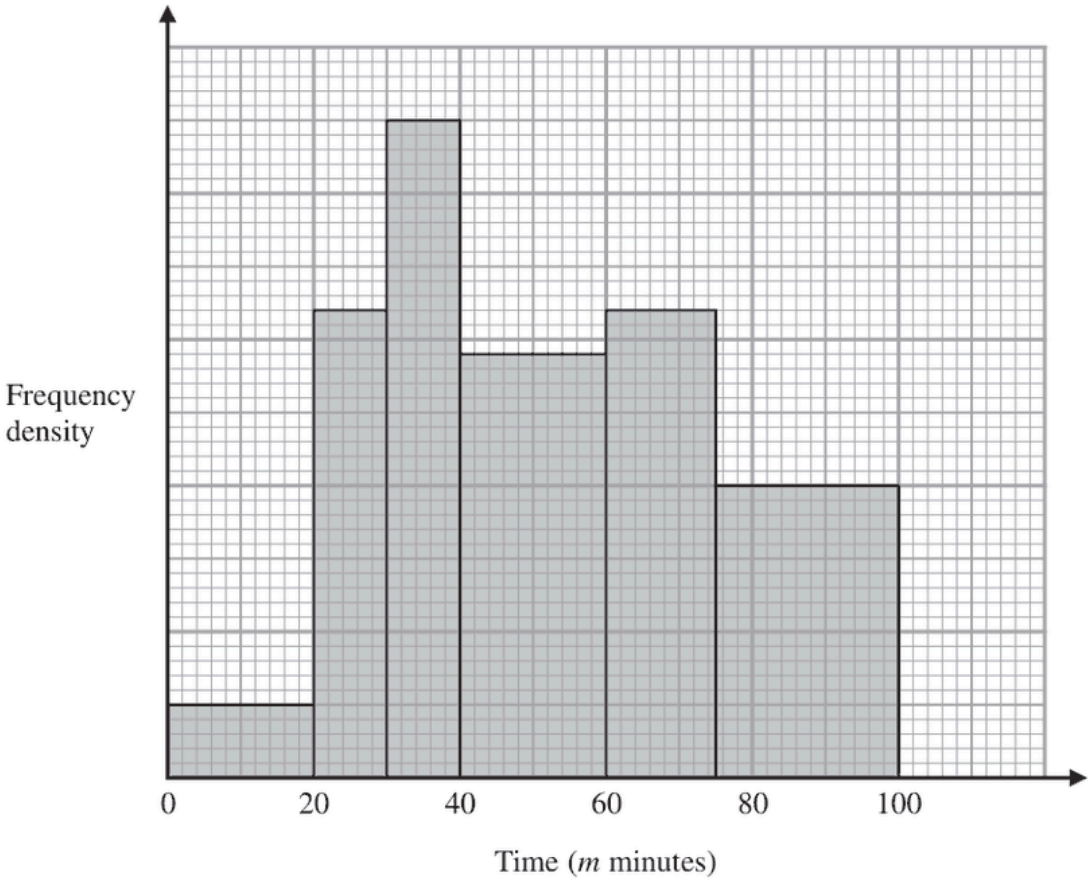
$(s + 2, t)$ and $(s, 3t)$

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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)

WORKED SOLUTION

Question 21 · 4MA1/1H June 2022

1 **Use histogram**

For a histogram,

$$\text{frequency} = \text{class width} \times \text{frequency density}$$

2 **Use frequency table**

For $m \leq 20$, the frequency is 10 and the class width is 20, so

$$\text{frequency density} = \frac{10}{20} = 0.5$$

---

3 **Use histogram**

Using this scale from the histogram:

$$40 < m \leq 60 \quad \text{has frequency density } 2.9$$

$$60 < m \leq 75 \quad \text{has frequency density } 3.2$$

$$75 < m \leq 100 \quad \text{has frequency density } 2.0$$

---

4 **Use part of each relevant**

For $50 < m \leq 80$, use part of each relevant bar:

$$(10)(2.9) + (15)(3.2) + (5)(2.0)$$

$$= 29 + 48 + 10$$

$$= 87$$

✓ **FINAL ANSWER**

87 children

4MA1/1H JUNE 2022

Question 22

5 marks | Volume & Surface Area

22 A solid is made from a cone and a hemisphere.

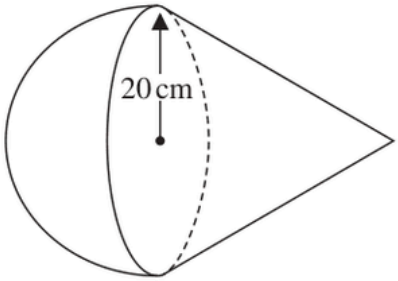


Diagram **NOT** accurately drawn

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)

WORKED SOLUTION

Question 22 · 4MA1/1H June 2022

1 The cone has radius cm

The cone has radius 20 cm.

2 Calculate surface area

The curved surface area of the cone is

$$\pi rl$$

3 Calculate value

So

$$\pi(20)l = 580\pi$$

$$l = 29$$

4 **Use Pythagoras to find the**

Use Pythagoras to find the height of the cone:

$$h^2 + 20^2 = 29^2$$

$$h^2 = 841 - 400 = 441$$

$$h = 21$$

---

5 **Volume of the cone**

Volume of the cone:

$$\frac{1}{3}\pi r^2 h = \frac{1}{3}\pi(20)^2(21) = 2800\pi$$

---

6 **Volume of the hemisphere**

Volume of the hemisphere:

$$\frac{2}{3}\pi r^3 = \frac{2}{3}\pi(20)^3 = \frac{16000}{3}\pi$$

---

7 **Total volume**

Total volume:

$$2800\pi + \frac{16000}{3}\pi = \frac{24400}{3}\pi$$

---

8 **Calculate volume**

The volume is $k\pi$, so

$$k = \frac{24400}{3}$$

✓ **FINAL ANSWER**

$$\boxed{\frac{24400}{3}}$$

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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)

WORKED SOLUTION

Question 23 · 4MA1/1H June 2022

1 The interior angles form an

The interior angles form an arithmetic sequence:

$$177,\ 175,\ 173,\ 171,\ 169, \ldots$$

2 Calculate value

So

$$a = 177, \quad d = -2$$

3 Use trigonometry

For an n-sided polygon, the sum of the interior angles is

$$180(n-2)$$

4 **The sum of the arithmetic**

The sum of the arithmetic sequence is

$$\frac{n}{2}(2(177)+(n-1)(-2))$$

$$=\frac{n}{2}(354-2n+2)$$

$$=\frac{n}{2}(356-2n)$$

$$=n(178-n)$$

---

5 **Set this equal to the**

Set this equal to the polygon angle sum:

$$n(178-n)=180(n-2)$$

$$178n-n^2=180n-360$$

$$n^2+2n-360=0$$

---

6 **Factorise**

Factorise:

$$(n+20)(n-18)=0$$

---

7 **Solve inequality**

Since $n>5$,

$$n=18$$

✓ **FINAL ANSWER**

$n=18$

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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)

WORKED SOLUTION

Question 24 · 4MA1/1H June 2022

1 Evaluate fraction

$$q + 12x - qx^2 = -q\left(x^2 - \frac{12}{q}x\right) + q$$

2 Complete the square

Complete the square:

$$x^2 - \frac{12}{q}x = \left(x - \frac{6}{q}\right)^2 - \frac{36}{q^2}$$

3 Evaluate fraction

So

$$q + 12x - qx^2 = -q\left[\left(x - \frac{6}{q}\right)^2 - \frac{36}{q^2}\right] + q$$

$$= q + \frac{36}{q} - q\left(x - \frac{6}{q}\right)^2$$

4 Compare coefficients

Compare with

$$a - b(x - c)^2$$

FINAL ANSWER

$$a = q + \frac{36}{q},\ b = q,\ c = \frac{6}{q}$$