Elite Mathematics
Pearson Edexcel International GCSE

IGCSE LINEAR · 4MA1

4MA1/2H January 2020 Worked Solutions

January 2020 paper rebuilt with the worked solution after each question.

26	2020–2026	Single-paper solutions
paper questions	52 past papers	checked by Dr Eslam



Dr Eslam Ahmed
Assistant Lecturer, Faculty of Engineering, Cairo University
eliteigcse.com · free for every student

PAST PAPER

4MA1/2H January 2020

January 2020

26	100	2 h
questions	marks	exam time

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

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)

WORKED SOLUTION

Question 1 · 4MA1/2H January 2020

1 **(a)**

(a)

$$\frac{x^9}{x^2} = x^{9-2} = x^7$$

2 **(b)**

(b)

$$\frac{7^8 \times 7^4}{7^3} = 7^{8+4-3} = 7^9$$

✓ **FINAL ANSWER**

(a) x^7, (b) 7^9.

4MA1/2H JANUARY 2020

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)

WORKED SOLUTION

Question 2 · 4MA1/2H January 2020

1 Calculate value

$$1\text{ m} = 100\text{ cm}$$

2 Calculate value

So

$$1\text{ m}^3 = 100^3\text{ cm}^3 = 1,000,000\text{ cm}^3$$

$$32.4\text{ m}^3 = 32.4 \times 1,000,000$$

$$= 32,400,000\text{ cm}^3$$

FINAL ANSWER

$32,400,000\text{ cm}^3$.

4MA1/2H JANUARY 2020

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)

WORKED SOLUTION

Question 3 · 4MA1/2H January 2020

1 Convert to improper fractions

Convert to improper fractions:

$$4\frac{2}{3} = \frac{14}{3}$$

$$3\frac{4}{5} = \frac{19}{5}$$

2 Use a common denominator

Use a common denominator:

$$\frac{14}{3} + \frac{19}{5} = \frac{70}{15} + \frac{57}{15}$$

$$= \frac{127}{15} = 8\frac{7}{15}$$

FINAL ANSWER

$8\frac{7}{15}$

4MA1/2H JANUARY 2020

Question 4

4 marks | Angles in Polygons & Parallel Lines

4 The diagram shows a triangle.

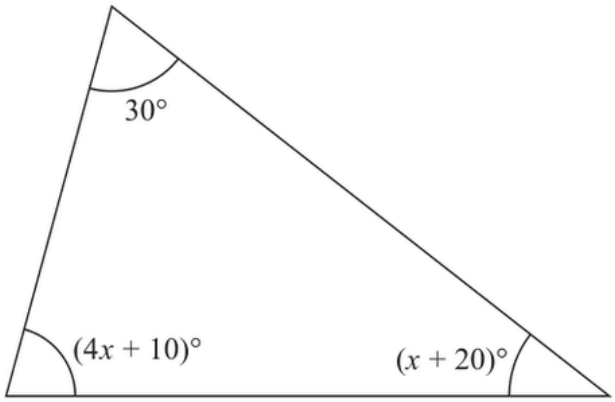


Diagram **NOT** accurately drawn

Work out the value of x.

$x =$ .....

(Total for Question 4 is 4 marks)

WORKED SOLUTION

Question 4 · 4MA1/2H January 2020

1 Angles in a triangle add

Angles in a triangle add to $180°$:

$$30 + (4x + 10) + (x + 20) = 180$$

$$5x + 60 = 180$$

$$5x = 120$$

$$x = 24$$

FINAL ANSWER

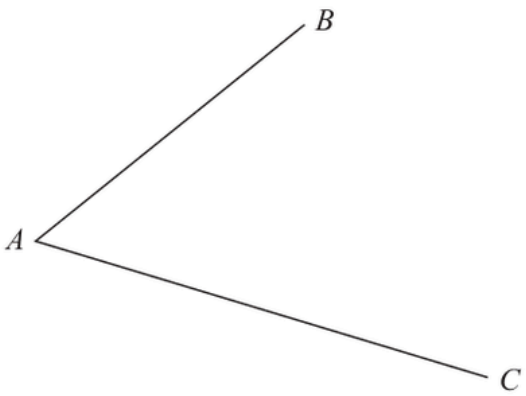
$x = 24$.

4MA1/2H JANUARY 2020

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)

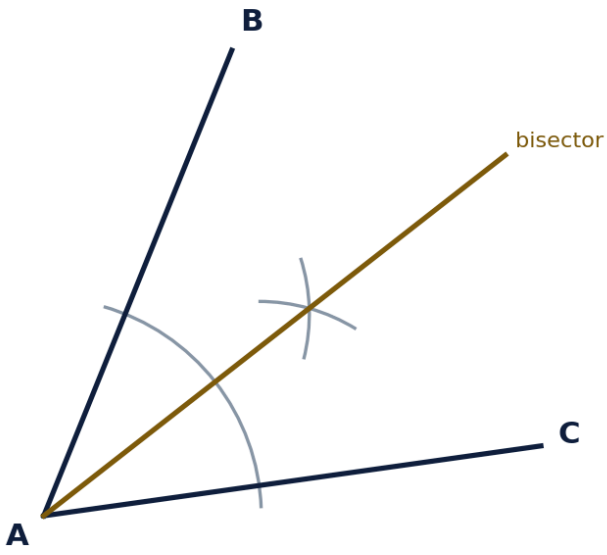
WORKED SOLUTION

Question 5 · 4MA1/2H January 2020

1 **Construction answer**

To construct the bisector of angle BAC:

1. Put the compass point at A and draw an arc that cuts AB and AC.
2. From the two points where the arc cuts the arms, draw equal arcs inside the angle.
3. Draw a straight line from A through the intersection of those two arcs.



FINAL ANSWER

The ray from A through the arc intersection is the angle bisector of BAC.

4MA1/2H JANUARY 2020

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)

WORKED SOLUTION

Question 6 · 4MA1/2H January 2020

1 Use the fact that probabilities add to 1

Let $P(\text{red}) = r$, so $P(\text{green}) = 2r$.

$$r + 0.24 + 2r + 0.31 = 1 \Rightarrow 3r = 0.45 \Rightarrow r = 0.15$$

2 Expected number of red beads

$$180 \times 0.15 = 27$$

FINAL ANSWER

27

4MA1/2H JANUARY 2020

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)

WORKED SOLUTION

Question 7 · 4MA1/2H January 2020

1 **(a)**

(a)

$$2x + 7 > 4$$

$$2x > -3$$

$$x > -\frac{3}{2}$$

2 **(b)**

(b)

$$x^2 - 3x - 40 = 0$$

3 **Factorise**

Factorise:

$$(x - 8)(x + 5) = 0$$

4 **Solve quadratic equation**

So

$$x = 8 \quad \text{or} \quad x = -5$$

FINAL ANSWER

$x > -\frac{3}{2}$, and $x = 8$ or $x = -5$.

4MA1/2H JANUARY 2020

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)

WORKED SOLUTION

Question 8 · 4MA1/2H January 2020

1 **Convert standard form**

From 2016 to 2017, the increase is

$$545 - 500 = 45$$

$$\frac{45}{500} \times 100 = 9\%$$

2 **Convert standard form**

From 2017 to 2018, the increase is

$$592 - 545 = 47$$

$$\frac{47}{545} \times 100 \approx 8.62\%$$

3 **Calculate percentage**

So Brigitte is not correct because the second percentage increase is smaller.

4 **Calculate percentage**

For Henri, 952 is 85% of the original price because there is a 15% discount.

$$\text{original price} = 952 \div 0.85 = 1120$$

5 **The discount is**

The discount is

$$1120 - 952 = 168$$

✓ **FINAL ANSWER**

Brigitte is not correct; the discount is 168 euros.

4MA1/2H JANUARY 2020

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)

WORKED SOLUTION

Question 9 · 4MA1/2H January 2020

1 Calculate volume

$$\text{mass} = \text{density} \times \text{volume}$$

$$\text{mass} = 19.3 \times 150$$

$$\text{mass} = 2895$$

FINAL ANSWER

2895 g.

4MA1/2H JANUARY 2020

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)

WORKED SOLUTION

Question 10 · 4MA1/2H January 2020

1 **Convert m/s to km/h multiply**

To convert m/s to km/h, multiply by $\mathbf{3.6}$.

$$50 \times 3.6 = 180$$

FINAL ANSWER

$180\ \mathrm{km/h}$.

4MA1/2H JANUARY 2020

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.

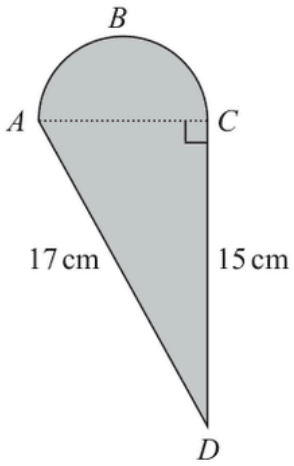


Diagram **NOT** accurately drawn

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)

WORKED SOLUTION

Question 11 · 4MA1/2H January 2020

1 Use trigonometry

Triangle ACD is right-angled, with

$$AD = 17 \text{ cm}, \qquad CD = 15 \text{ cm}$$

2 Use Pythagoras to find

Use Pythagoras to find AC:

$$AC^2 = 17^2 - 15^2 = 289 - 225 = 64$$

$$AC = 8 \text{ cm}$$

3 **Calculate area**

So the semicircle has radius

$$r = 4 \text{ cm}$$

4 **The arc length of the**

The arc length of the semicircle is

$$\pi r = 4\pi$$

5 **The perimeter of the shaded**

The perimeter of the shaded shape is

$$AD + CD + \text{semicircle arc} = 17 + 15 + 4\pi = 44.566\ldots$$

✓ **FINAL ANSWER**

44.6 cm.

4MA1/2H JANUARY 2020

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)

WORKED SOLUTION

Question 12 · 4MA1/2H January 2020

1 Convert standard form

Dane Oil costs 2500000 Krone for

$$4.2 \times 10^5 = 420000$$

2 litres

litres.

$$\text{Dane cost per litre} = \frac{2500000}{420000} = 5.952\ldots$$

3 Convert standard form

So Dane Oil costs about 5.95 Krone per litre.

4 Arctic Oil costs dollars. Convert

Arctic Oil costs 770000 dollars. Convert this to Krone:

$$770000 \times 6.57 = 5058900$$

5 **Arctic Oil gives**

Arctic Oil gives

$$8.6 \times 10^5 = 860000$$

6 **litres**

litres.

$$\text{Arctic cost per litre} = \frac{5058900}{860000} = 5.882\ldots$$

7 **Arctic Oil has the lower**

Arctic Oil has the lower cost per litre.

✓ **FINAL ANSWER**

Arctic Oil

4MA1/2H JANUARY 2020

Question 13

4 marks | Circle Theorems

13

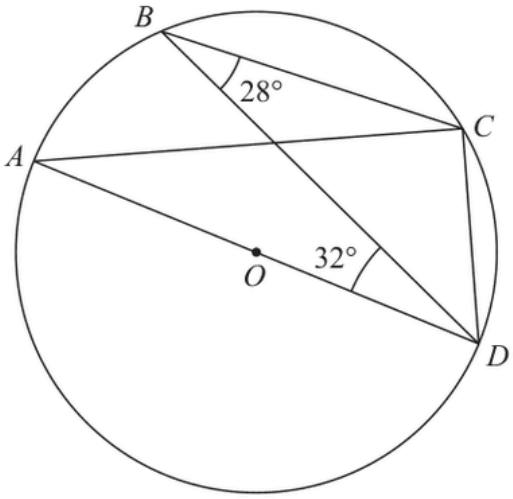


Diagram **NOT** accurately drawn

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)

WORKED SOLUTION

Question 13 · 4MA1/2H January 2020

1 Use trigonometry

Since AD is a diameter,

$$\angle ABD = 90°$$

2 Given

Given

$$\angle CBD = 28°$$

3 **Use trigonometry**

So

$$\angle ABC = 90° - 28° = 62°$$

---

4 **Opposite angles in a cyclic**

Opposite angles in a cyclic quadrilateral add to $180°$:

$$\angle ADC = 180° - 62° = 118°$$

---

5 **Use trigonometry**

At D,

$$\angle ADC = \angle BDA + \angle BDC$$

$$118° = 32° + \angle BDC$$

$$\angle BDC = 86°$$

✓ **FINAL ANSWER**

$86°$.

4MA1/2H JANUARY 2020

Question 14

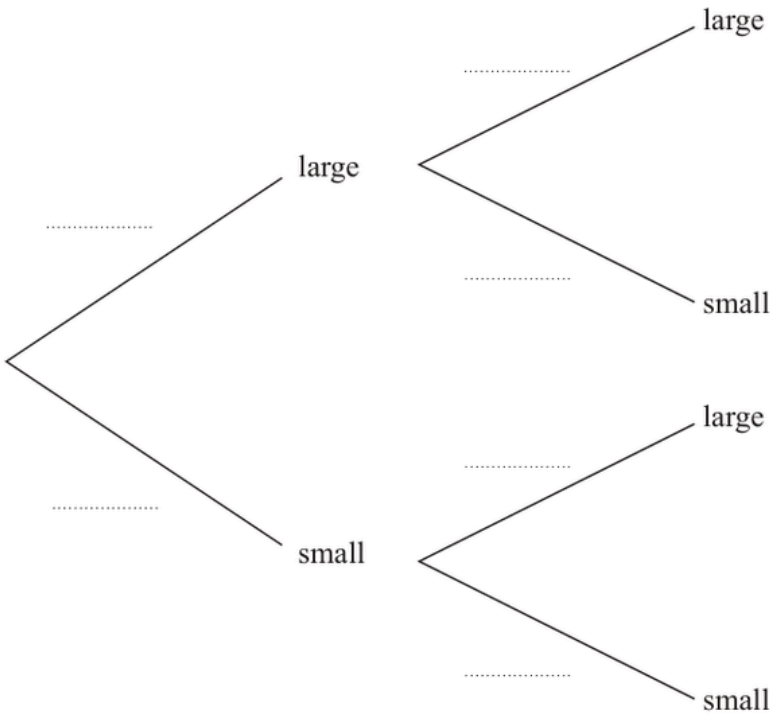
4 marks | Tree Diagrams & Conditional Probability

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)

WORKED SOLUTION

Question 14 · 4MA1/2H January 2020

1 **(a) First glass**

$$P(\text{large}) = \frac{13}{20}, \qquad P(\text{small}) = \frac{7}{20}$$

2 **(a) Second glass (one fewer glass left)**

After a large glass: large $\frac{12}{19}$, small $\frac{7}{19}$.
After a small glass: large $\frac{13}{19}$, small $\frac{6}{19}$.

---

3 **(b) Two small glasses**

$$\frac{7}{20} \times \frac{6}{19} = \frac{42}{380} = \frac{21}{190}$$

✓ **FINAL ANSWER**

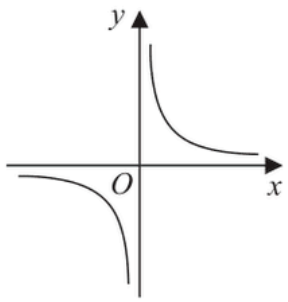
(a) $\frac{13}{20}, \frac{7}{20}$; $\frac{12}{19}, \frac{7}{19}$; $\frac{13}{19}, \frac{6}{19}$ (b) $\frac{21}{190}$

Question 15

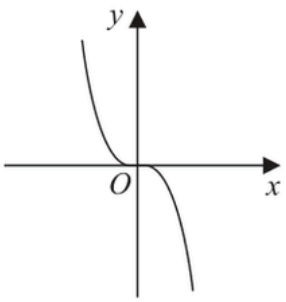
3 marks | Graphs of Functions

15 Here are six graphs.

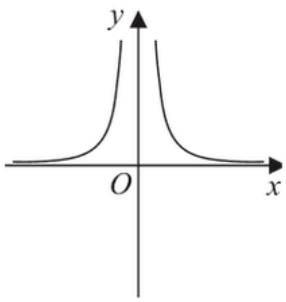
Graph A



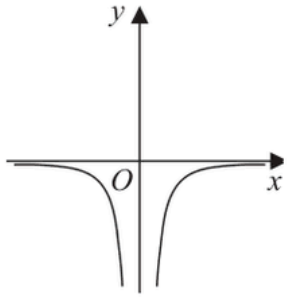
Graph B



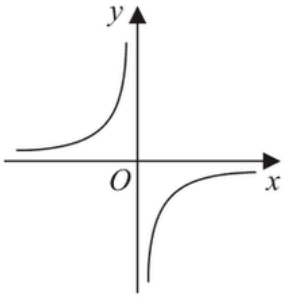
Graph C



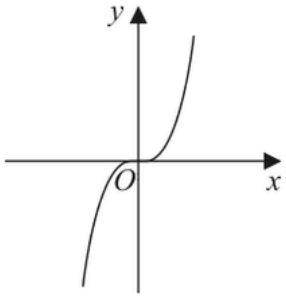
Graph D



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)

1 **Solve equation**

For

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

the graph is negative on both sides of the y-axis and is symmetrical in the y-axis.

2 **This is Graph D**

This is Graph D.

3 **Solve equation**

For

$$y = -\frac{1}{2}x^3$$

the graph is a decreasing cubic through the origin.

4 **This is Graph B**

This is Graph B.

5 **Solve equation**

For

$$y = \frac{5}{x}$$

the graph is a positive reciprocal graph in quadrants 1 and 3.

6 **This is Graph A**

This is Graph A.

✓ **FINAL ANSWER**

D, B, A.

4MA1/2H JANUARY 2020

Question 16

4 marks | Rearranging Formulae

16 Make x the subject of $y = \sqrt{\frac{x+1}{x-4}}$

(Total for Question 16 is 4 marks)

WORKED SOLUTION

Question 16 · 4MA1/2H January 2020

1 Rearrange formula

$$y = \sqrt{\frac{x+1}{x-4}}$$

2 Square both sides

Square both sides:

$$y^2 = \frac{x+1}{x-4}$$

$$y^2(x-4) = x+1$$

$$y^2x - 4y^2 = x+1$$

$$x(y^2-1) = 4y^2+1$$

FINAL ANSWER

$$x = \frac{4y^2+1}{y^2-1}$$

4MA1/2H JANUARY 2020

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)

WORKED SOLUTION

Question 17 · 4MA1/2H January 2020

1 Let the two consecutive square

Let the two consecutive square numbers be n^2 and $(n+1)^2$.

$$(n+1)^2 - n^2 = n^2 + 2n + 1 - n^2 = 2n + 1$$

2 is one more than an

$2n + 1$ is one more than an even number, so it is always odd.

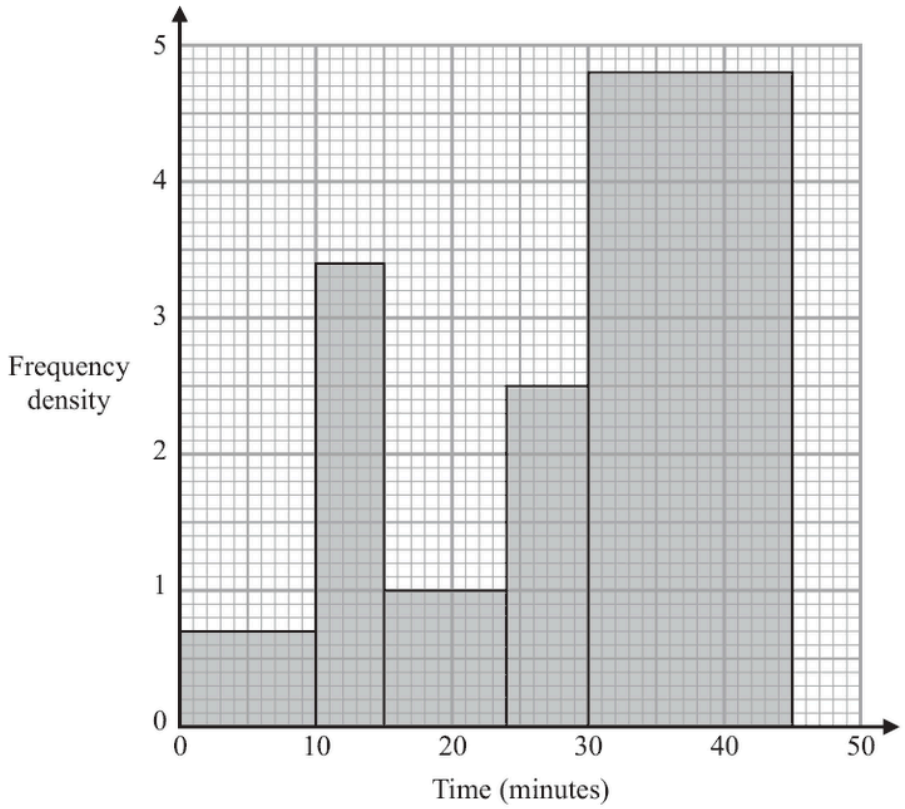
FINAL ANSWER

The difference is always odd.

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)

1 Total frequency

Total frequency:

$$10(0.7)+5(3.4)+9(1)+6(2.5)+15(4.8)=120$$

2 Between 17 and 35 minutes

Between 17 and 35 minutes:

$$7(1)+6(2.5)+5(4.8)=46$$

$$\text{proportion}=\frac{46}{120}=\frac{23}{60}$$

3 Given the customer spent more

Given the customer spent more than 30 minutes, they are in the 30 to 45 minute class.

4 More than 36 minutes is

More than 36 minutes is 9 minutes out of the 15-minute class:

$$\frac{9}{15}=\frac{3}{5}$$

FINAL ANSWER

$\frac{23}{60}$, then $\frac{3}{5}$.

4MA1/2H JANUARY 2020

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)

WORKED SOLUTION

Question 19 · 4MA1/2H January 2020

1 **(a)**

(a)

$$y = 7 - 4x$$

2 **A parallel line has the**

A parallel line has the same gradient, -4. One possible answer is

$$y = -4x$$

3 **(b) The gradient of line**

(b) The gradient of line L through $(-3, 1)$ and $(2, -2)$ is

$$\frac{-2-1}{2-(-3)} = -\frac{3}{5}$$

4 **A perpendicular line has gradient**

A perpendicular line has gradient $\frac{5}{3}$.

5 **Evaluate fraction**

Through $(-6, 4)$:

$$y - 4 = \frac{5}{3}(x + 6)$$

6 Multiply by 3

Multiply by 3:

$$3y - 12 = 5x + 30$$

$$5x - 3y + 42 = 0$$

FINAL ANSWER

For example $y = -4x$, and $5x - 3y + 42 = 0$.

4MA1/2H JANUARY 2020

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)

WORKED SOLUTION

Question 20 · 4MA1/2H January 2020

1 Simplify surd

$$\text{width} = \frac{18}{\sqrt{7}+1}$$

2 Rationalise the denominator

Rationalise the denominator:

$$\frac{18}{\sqrt{7}+1} \times \frac{\sqrt{7}-1}{\sqrt{7}-1} = \frac{18(\sqrt{7}-1)}{7-1}$$

$$= \frac{18(\sqrt{7}-1)}{6} = 3(\sqrt{7}-1)$$

$$= 3\sqrt{7}-3$$

FINAL ANSWER

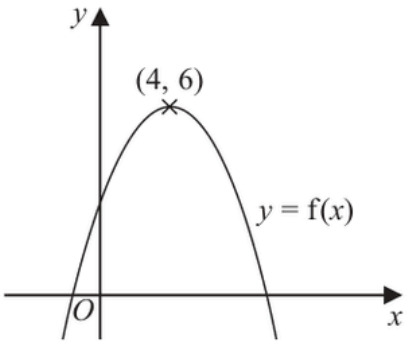
$3\sqrt{7}-3$ cm

4MA1/2H JANUARY 2020

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)

WORKED SOLUTION

Question 21 · 4MA1/2H January 2020

1 **The maximum point of is**

The maximum point of $y = f(x)$ is $(4, 6)$.

2 **Calculate value**

For

$$y = f(x + 4)$$

3 **the graph moves 4 units**

the graph moves 4 units left:

$$(4, 6) \to (0, 6)$$

4 **Calculate value**

For

$$y = f(2x)$$

5 **the coordinate is divided by**

the x-coordinate is divided by 2:

$$(4, 6) \to (2, 6)$$

6 **Calculate value**

For part (b),

$$y = x^2 + 3x + 4$$

7 **The translation vector is**

The translation vector is

$$\begin{pmatrix} 4 \\ 6 \end{pmatrix}$$

8 **Read the graph**

So the graph moves 4 units right and 6 units up.

9 **Add 6**

Replace x by $x - 4$, then add 6:

$$y = (x - 4)^2 + 3(x - 4) + 4 + 6$$

$$y = (x - 4)^2 + 3(x - 4) + 10$$

✓ **FINAL ANSWER**

$(0, 6)$, $(2, 6)$, and $y = (x - 4)^2 + 3(x - 4) + 10$

4MA1/2H JANUARY 2020

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)

WORKED SOLUTION

Question 22 · 4MA1/2H January 2020

1 **The line is**

The line is

$$y = x + 2$$

2 **Substitute this into the circle**

Substitute this into the circle equation:

$$x^2 + y^2 - 2y = 24$$

$$x^2 + (x+2)^2 - 2(x+2) = 24$$

$$x^2 + x^2 + 4x + 4 - 2x - 4 = 24$$

$$2x^2 + 2x - 24 = 0$$

$$x^2 + x - 12 = 0$$

$$(x+4)(x-3) = 0$$

3 **Calculate value**

So

$$x = -4 \quad \text{or} \quad x = 3$$

---

4 **Calculate value**

Using $y = x + 2$:

$$x = -4 \Rightarrow y = -2$$

$$x = 3 \Rightarrow y = 5$$

✓ **FINAL ANSWER**

$(-4, -2)$ and $(3, 5)$

4MA1/2H JANUARY 2020

Question 23

3 marks | Vectors

23

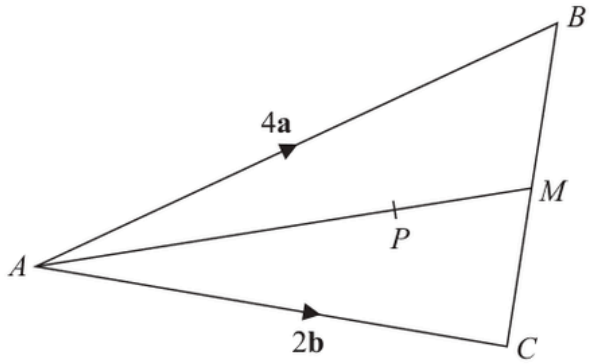


Diagram **NOT** accurately drawn

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)

WORKED SOLUTION

Question 23 · 4MA1/2H January 2020

1 **Split the ratio**

Since M is the midpoint of BC,

$$\overrightarrow{AM} = \frac{\overrightarrow{AB} + \overrightarrow{AC}}{2}$$

$$\overrightarrow{AM} = \frac{4a + 2b}{2} = 2a + b$$

2 **Given**

Given

$$\overrightarrow{AP} = \frac{3}{2}a + \frac{3}{4}b$$

3 **Factorise**

Factorise:

$$\overrightarrow{AP} = \frac{3}{4}(2a + b) = \frac{3}{4}\overrightarrow{AM}$$

4 **Split the ratio**

So AP is $\frac{3}{4}$ of AM, leaving PM as $\frac{1}{4}$ of AM.

✓ **FINAL ANSWER**

$AP : PM = 3 : 1$

4MA1/2H JANUARY 2020

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)

WORKED SOLUTION

Question 24 · 4MA1/2H January 2020

1 Use trigonometry

$$\left(\frac{4}{2x-5}-\frac{3}{2x-3}\right)\div\frac{9x-4x^3}{6x^2-17x+5}$$

2 Use trigonometry

First simplify the bracket:

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

$$=\frac{8x-12-6x+15}{(2x-5)(2x-3)}$$

$$=\frac{2x+3}{(2x-5)(2x-3)}$$

3 Use trigonometry

Now factor the second fraction:

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

$$6x^2-17x+5=(2x-5)(3x-1)$$

4 **Dividing by a fraction means**

Dividing by a fraction means multiplying by its reciprocal:

$$\frac{2x+3}{(2x-5)(2x-3)} \times \frac{(2x-5)(3x-1)}{-x(2x-3)(2x+3)}$$

5 **Cancel common factors**

Cancel common factors:

$$= -\frac{3x-1}{x(2x-3)^2}$$

$$= \frac{1-3x}{x(2x-3)^2}$$

✓ **FINAL ANSWER**

$$\boxed{\frac{1-3x}{x(2x-3)^2}}$$

4MA1/2H JANUARY 2020

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)

WORKED SOLUTION

Question 25 · 4MA1/2H January 2020

1 Mario saves from 2021 up

Mario saves from 2021 up to and including 2070.

2 Number of years

Number of years:

$$2070 - 2021 + 1 = 50$$

3 This is an arithmetic sequence

This is an arithmetic sequence.

4 Use trigonometry

First term:

$$50$$

5 Common difference

Common difference:

$$k$$

6 Last term

Last term:

$$50 + 49k$$

7 **Use the arithmetic series formula**

Use the arithmetic series formula:

$$S_n = \frac{n}{2}(a + l)$$

$$33125 = \frac{50}{2}(50 + (50 + 49k))$$

$$33125 = 25(100 + 49k)$$

$$1325 = 100 + 49k$$

$$49k = 1225$$

$$k = 25$$

✓ **FINAL ANSWER**

$\boxed{k = 25}$

Question 26

6 marks | Volume & Surface Area

26 Here is a sector, AOB, of a circle with centre O and angle $AOB = x°$

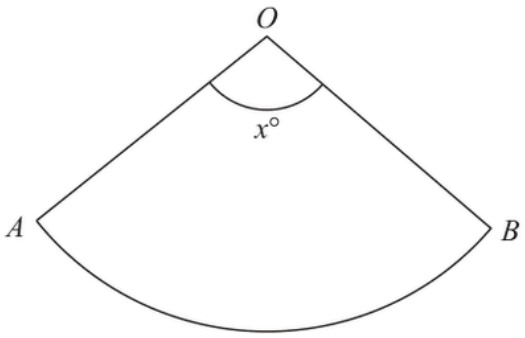


Diagram **NOT** accurately drawn

The sector can form the curved surface of a cone by joining OA to OB.

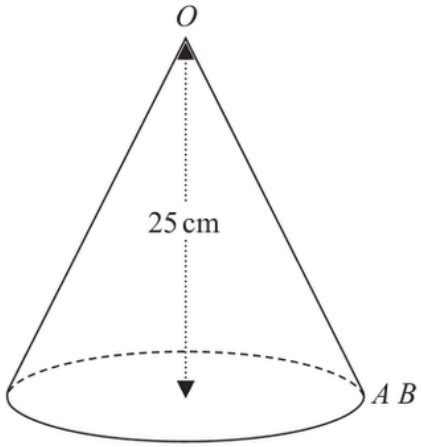


Diagram **NOT** accurately drawn

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)

1 **Let the radius of the**

Let the radius of the base of the cone be r, and let the slant height be l.

2 **The volume of the cone**

The volume of the cone is

$$\frac{1}{3}\pi r^2 h = 1600$$

3 **Calculate area**

The height is 25 cm, so

$$\frac{1}{3}\pi r^2 (25) = 1600$$

$$r^2 = \frac{4800}{25\pi}$$

$$r = 7.8176\ldots$$

4 **The slant height is found**

The slant height is found using Pythagoras:

$$l^2 = r^2 + 25^2$$

$$l = 26.1938\ldots$$

5 **Calculate area**

When the sector is joined to form the cone, the arc length of the sector becomes the circumference of the cone base.

$$\frac{x}{360} \times 2\pi l = 2\pi r$$

6 **Cancel**

Cancel 2π:

$$\frac{x}{360}l = r$$

$$x = \frac{360r}{l}$$

$$x = \frac{360(7.8176\ldots)}{26.1938\ldots} = 107.4433\ldots$$

✓ **FINAL ANSWER**

$\boxed{107°}$