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Elite Mathematics
Pearson Edexcel International GCSE

IGCSE LINEAR · 4MA1

4MA1/1H November 2025 Worked Solutions

November 2025 paper rebuilt with the worked solution after each question.

28	2020–2026	Single-paper solutions
paper questions	52 past papers	checked by Dr Eslam



Dr Eslam Ahmed
Assistant Lecturer, Faculty of Engineering, Cairo University
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PAST PAPER

4MA1/1H November 2025

November 2025

28	100	2 h
questions	marks	exam time

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

4MA1/1H NOVEMBER 2025

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)

WORKED SOLUTION

Question 1 · 4MA1/1H November 2025

1 **Use midpoints**

Use midpoints $2.5, 7.5, 12.5, 17.5, 22.5$.

$$2.5(8) + 7.5(7) + 12.5(3) + 17.5(10) + 22.5(2) = 330$$

$$\text{estimated mean} = \frac{330}{30} = 11$$

✓ **FINAL ANSWER**

11 km.

4MA1/1H NOVEMBER 2025

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)

WORKED SOLUTION

Question 2 · 4MA1/1H November 2025

1 Round each number to one

Round each number to one significant figure:

$$2.11 \approx 2, \quad 58.9 \approx 60, \quad 8.859 \approx 9$$

$$\frac{2.11^2 \times 58.9}{\sqrt{8.859}} \approx \frac{2^2 \times 60}{\sqrt{9}}$$

$$= \frac{4 \times 60}{3} = 80$$

FINAL ANSWER

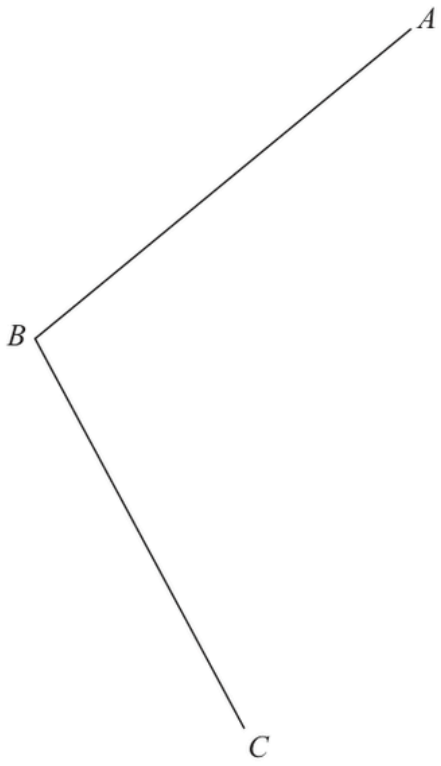
80

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Question 3

2 marks | Constructions & Loci

3 Using ruler and compasses only, construct the bisector of angle ABC
Show all your construction lines.

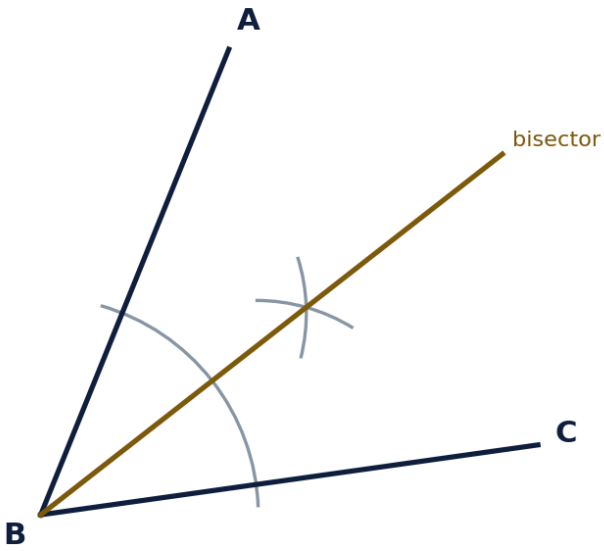


(Total for Question 3 is 2 marks)

1 Construction answer

To construct the bisector of angle ABC:

1. Use centre B to draw an arc crossing BA and BC.
2. Use the same compass width from the two crossing points to make two arcs inside the angle.
3. Join B to the point where these two arcs meet.



FINAL ANSWER

That line is the required angle bisector.

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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)

WORKED SOLUTION

Question 4 · 4MA1/1H November 2025

1 **The range is**

The range is 15:

$$17 - e = 15$$

$$e = 2$$

2 **Calculate statistic**

The mean is 9, so the total is

$$6 \times 9 = 54$$

$$2 + f + 7 + g + 12 + 17 = 54$$

$$f + g = 16$$

3 **The median is**

The median is 8.5:

$$\frac{7+g}{2} = 8.5$$

$$g = 10$$

$$f = 16 - 10 = 6$$

✓ **FINAL ANSWER**

$e = 2,\ f = 6,\ g = 10$.

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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)

WORKED SOLUTION

Question 5 · 4MA1/1H November 2025

1 Evaluate fraction

$$\frac{3}{7} + \frac{1}{3}$$

2 Use denominator 21

Use denominator 21:

$$\frac{3}{7} = \frac{9}{21}, \qquad \frac{1}{3} = \frac{7}{21}$$

$$\frac{9}{21} + \frac{7}{21} = \frac{16}{21}$$

FINAL ANSWER

$\frac{16}{21}$.

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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)

WORKED SOLUTION

Question 6 · 4MA1/1H November 2025

1 The ratio is

The ratio is

$$\text{Eli} : \text{Peta} = 2 : 3$$

2 Split the ratio

There are 5 parts, so one part is

$$275 \div 5 = 55$$

3 Eli gets

Eli gets

$$2 \times 55 = 110$$

4 Peta gets

Peta gets

$$3 \times 55 = 165$$

5 Eli gives

Eli gives

$$\frac{3}{11} \times 110 = 30$$

6 **Peta gives**

Peta gives

$$0.32 \times 165 = 52.8$$

7 **Total given to charity**

Total given to charity:

$$30 + 52.8 = 82.8$$

✓ **FINAL ANSWER**

82.8.

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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)

WORKED SOLUTION

Question 7 · 4MA1/1H November 2025

1 Find lower bound

The weight 475 g correct to the nearest g has lower bound

$$475 - 0.5 = 474.5$$

2 Find upper bound

The height 120 cm correct to the nearest 10 cm has upper bound

$$120 + 5 = 125$$

FINAL ANSWER

(a) 474.5 g, (b) 125 cm

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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)

WORKED SOLUTION

Question 8 · 4MA1/1H November 2025

1 Use index laws

$$\frac{8^{-2} \times 8^{9}}{8^{10}} = 8^{-2+9-10} = 8^{-3}$$

FINAL ANSWER

$n = -3$

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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)

WORKED SOLUTION

Question 9 · 4MA1/1H November 2025

1 Tuesday s score was more

Tuesday's score was 12% more than Monday's score, so Tuesday was 112% of Monday.

$$1.12 \times \text{Monday} = 140$$

$$\text{Monday} = \frac{140}{1.12} = 125$$

FINAL ANSWER

125 points

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)

(a)

(a) $(6m)^0 = 1$.

(b)

(b)

$$5y + 20 < 7y + 1$$

$$19 < 2y$$

$$y > \frac{19}{2}$$

(c)

(c)

$$15w^2x^5 + 25w^3x^2 = 5w^2x^2(3x^3 + 5w)$$

(d)

(d)

$$\frac{36a^5c^7}{12a^2c^3} = 3a^3c^4$$

FINAL ANSWER

1, $y > \frac{19}{2}$, $5w^2x^2(3x^3 + 5w)$, $3a^3c^4$

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Question 11

4 marks | Right-Angled Triangles - Pythagoras & Trigonometry

11 ABC is a right-angled triangle.

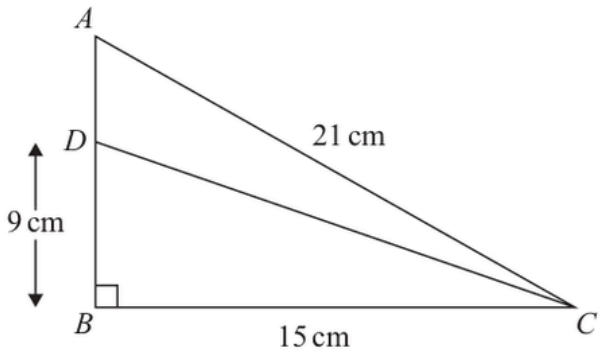


Diagram **NOT** accurately drawn

$AC = 21\,\text{cm}$ $BC = 15\,\text{cm}$ 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)

WORKED SOLUTION

Question 11 · 4MA1/1H November 2025

1 **Use trigonometry**

First find AB:

$$AB^2 = 21^2 - 15^2 = 216$$

$$AB = 14.696\ldots$$

$$AD = AB - DB = 14.696\ldots - 9 = 5.696\ldots$$

2 **Angle**

Angle ACB:

$$\cos ACB = \frac{15}{21}$$

$$ACB = 44.415\ldots^\circ$$

---

3 **Angle**

Angle DCB:

$$\tan DCB = \frac{9}{15}$$

$$DCB = 30.963\ldots^\circ$$

$$ACD = 44.415\ldots - 30.963\ldots = 13.451\ldots^\circ$$

✓ **FINAL ANSWER**

13.5°.

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Question 12

4 marks | Angles in Polygons & Parallel Lines

12

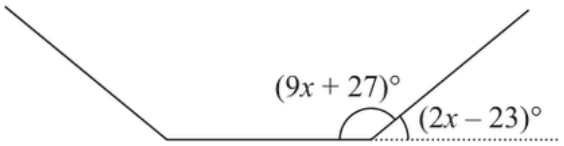


Diagram **NOT** accurately drawn

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)

WORKED SOLUTION

Question 12 · 4MA1/1H November 2025

1 The interior angle and exterior

The interior angle and exterior angle of a regular polygon add to $180°$:

$$(9x + 27) + (2x - 23) = 180$$

$$11x + 4 = 180$$

$$x = 16$$

2 The exterior angle is

The exterior angle is

$$2x - 23 = 2(16) - 23 = 9°$$

3 Find the gradient

For a regular polygon,

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

FINAL ANSWER

$n = 40$.

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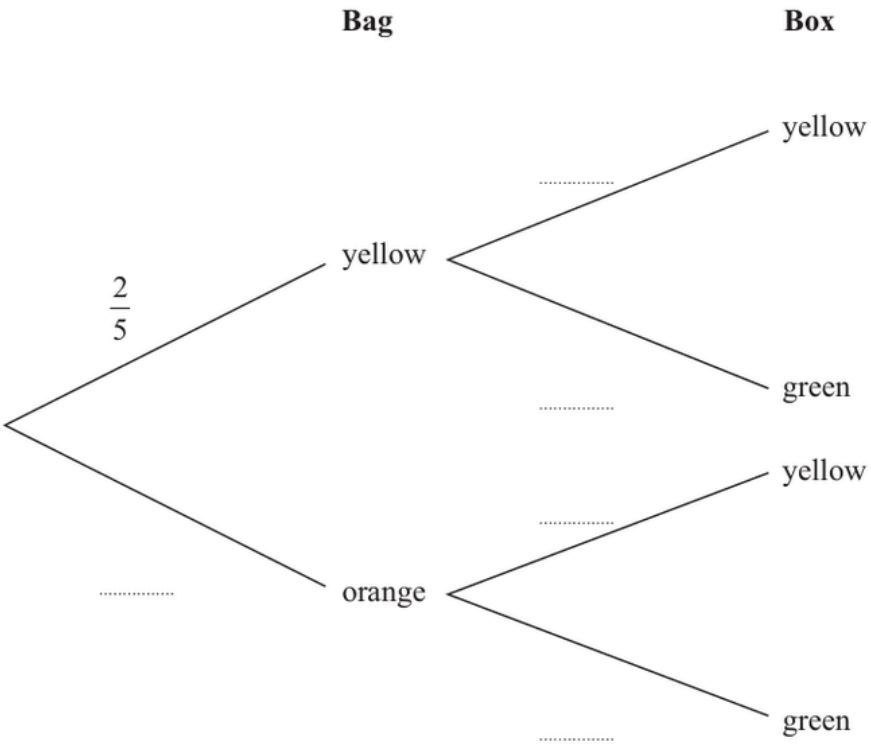
Question 13

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)

WORKED SOLUTION

Question 13 · 4MA1/1H November 2025

1 **(a) Complete the tree**

Bag: orange $\frac{3}{5}$.

Box (on both branches): yellow $\frac{3}{8}$, green $\frac{5}{8}$.

2 **(b) Use the complement**

The only way to get the same colour is yellow from both, so

$$P(\text{different}) = 1 - \frac{2}{5} \times \frac{3}{8} = 1 - \frac{6}{40} = \frac{17}{20}$$

✓ **FINAL ANSWER**

(a) $\frac{3}{5}$; $\frac{3}{8}, \frac{5}{8}$ on both branches (b) $\frac{17}{20}$

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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)

WORKED SOLUTION

Question 14 · 4MA1/1H November 2025

1 **(a)**

(a)

$$7x(3x+2)(2x-5) = 7x(6x^2 - 11x - 10)$$

$$= 42x^3 - 77x^2 - 70x$$

2 **(b)**

(b)

$$\frac{9}{2y} + \frac{5}{7} = 5$$

$$\frac{9}{2y} = \frac{30}{7}$$

$$63 = 60y$$

FINAL ANSWER

(a) $42x^3 - 77x^2 - 70x$, (b) $y = \frac{21}{20}$

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Question 15

2 marks | Circles, Arcs & Sectors

15 AOB is a sector of a circle with centre O and radius 12 cm

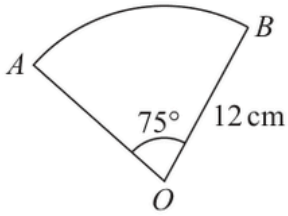


Diagram **NOT** accurately drawn

Work out the area of the sector.
Give your answer correct to 3 significant figures.

..... cm^2

(Total for Question 15 is 2 marks)

WORKED SOLUTION

Question 15 · 4MA1/1H November 2025

1 Calculate area

$$\text{area} = \frac{75}{360} \times \pi(12)^2$$

$$= 94.247\ldots$$

FINAL ANSWER

$94.2\ \text{cm}^2$.

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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)

WORKED SOLUTION

Question 16 · 4MA1/1H November 2025

1 Use Statistics Toolkit correct

The data are already in order:

$$1,\ 1,\ 3,\ 4,\ 6,\ 7,\ 8,\ 9,\ 10,\ 12,\ 15,\ 25,\ 30,\ 37,\ 50$$

2 There are 15 values

There are 15 values.

$$Q_1 = 4, \qquad Q_3 = 25$$

$$\text{IQR} = 25 - 4 = 21$$

FINAL ANSWER

21.

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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)

WORKED SOLUTION

Question 17 · 4MA1/1H November 2025

1 **Simplify surd**

$$\frac{2\sqrt{7}+2}{\sqrt{7}-3}\times\frac{\sqrt{7}+3}{\sqrt{7}+3}=\frac{(2\sqrt{7}+2)(\sqrt{7}+3)}{7-9}$$

$$=\frac{14+6\sqrt{7}+2\sqrt{7}+6}{-2}$$

$$=\frac{20+8\sqrt{7}}{-2}=-10-4\sqrt{7}$$

2 **Simplify surd**

Since $4\sqrt{7}=\sqrt{112}$,

$$-10-4\sqrt{7}=-10-\sqrt{112}$$

FINAL ANSWER

$-10-\sqrt{112}$, so $a=-10$ and $b=112$.

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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)

WORKED SOLUTION

Question 18 · 4MA1/1H November 2025

1 Rearrange formula

$$p = \sqrt{\frac{y+w}{3y-t}}$$

$$p^2 = \frac{y+w}{3y-t}$$

$$p^2(3y-t) = y+w$$

$$3p^2y - p^2t = y+w$$

$$y(3p^2-1) = w+p^2t$$

FINAL ANSWER

$y = \frac{w+p^2t}{3p^2-1}$

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Question 19

3 marks | Sine & Cosine Rules

19 The diagram shows triangle ABC

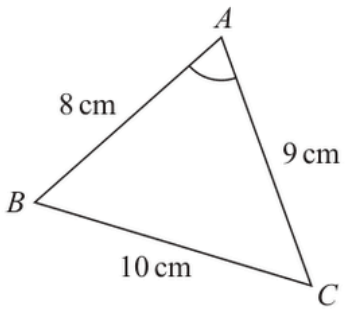


Diagram **NOT** accurately drawn

$AB = 8\,\text{cm}$ $BC = 10\,\text{cm}$ $CA = 9\,\text{cm}$

Work out the size of angle BAC
Give your answer correct to one decimal place.

.....°

(Total for Question 19 is 3 marks)

WORKED SOLUTION

Question 19 · 4MA1/1H November 2025

1 Use cosine rule

Use the cosine rule for angle BAC:

$$\cos A = \frac{8^2 + 9^2 - 10^2}{2(8)(9)}$$

$$\cos A = \frac{45}{144}$$

$$A = 71.790\ldots^\circ$$

FINAL ANSWER

71.8°.

4MA1/1H NOVEMBER 2025

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)

WORKED SOLUTION

Question 20 · 4MA1/1H November 2025

1 Line has equation

Line L has equation

$$y = 4x + 7$$

2 Find the gradient

So its gradient is

$$4$$

3 Find the gradient

Line M is perpendicular to L, so its gradient is

$$-\frac{1}{4}$$

4 Evaluate fraction

Line M passes through $(8, 1)$.

$$y - 1 = -\frac{1}{4}(x - 8)$$

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

$$y = -\frac{1}{4}x + 3$$

FINAL ANSWER

$$y = -\frac{1}{4}x + 3$$

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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)

WORKED SOLUTION

Question 21 · 4MA1/1H November 2025

1 Solve inequality

$$5x^2 - 20x + 23 = 5(x^2 - 4x) + 23$$

$$= 5\left((x - 2)^2 - 4\right) + 23$$

$$= 5(x - 2)^2 - 20 + 23$$

$$= 5(x - 2)^2 + 3$$

FINAL ANSWER

$5(x - 2)^2 + 3$

4MA1/1H NOVEMBER 2025

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)

WORKED SOLUTION

Question 22 · 4MA1/1H November 2025

1 There are 2 pink buttons

There are 2 pink buttons.

2 At least one pink button

At least one pink button is still in the box unless both pink buttons are taken.

3 Use the complement

So use the complement.

4 The probability that both pink

The probability that both pink buttons are taken is

$$\frac{\binom{2}{2}\binom{13}{1}}{\binom{15}{3}}$$

$$= \frac{13}{455}$$

$$= \frac{1}{35}$$

5 **Evaluate fraction**

Therefore,

$$P(\text{at least one pink is still in the box}) = 1 - \frac{1}{35}$$

$$= \frac{34}{35}$$

✓ **FINAL ANSWER**

$\frac{34}{35}$

4MA1/1H NOVEMBER 2025

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)

WORKED SOLUTION

Question 23 · 4MA1/1H November 2025

1 Split the ratio

$$a = \frac{2x+5}{1-x}, \quad x = \frac{5-2y}{3y}$$

2 Split the ratio

Substitute for x.

3 Numerator

Numerator:

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

$$= \frac{10-4y+15y}{3y} = \frac{10+11y}{3y}$$

4 Denominator

Denominator:

$$1-x = 1-\frac{5-2y}{3y}$$

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

5 **Split the ratio**

Therefore

$$a = \frac{\frac{10+11y}{3y}}{\frac{5(y-1)}{3y}} = \frac{10+11y}{5(y-1)}$$

✓ **FINAL ANSWER**

$$\frac{10+11y}{5(y-1)}$$

4MA1/1H NOVEMBER 2025

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)

WORKED SOLUTION

Question 24 · 4MA1/1H November 2025

1 The turning point of is

The turning point of $y = f(x)$ is $(4, 3)$.

2 Calculate value

For

$$y = f(x + 5)$$

3 the graph moves 5 units

the graph moves 5 units left:

$$(4, 3) \rightarrow (-1, 3)$$

4 **Calculate value**

For

$$y = f(x) + 7$$

5 **the graph moves 7 units**

the graph moves 7 units up:

$$(4, 3) \to (4, 10)$$

6 **Calculate value**

For

$$y = f(2x)$$

7 **the coordinate is divided by**

the x-coordinate is divided by 2:

$$(4, 3) \to (2, 3)$$

✓ **FINAL ANSWER**

$(-1, 3)$, $(4, 10)$, and $(2, 3)$

4MA1/1H NOVEMBER 2025

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)

WORKED SOLUTION

Question 25 · 4MA1/1H November 2025

1 Solve inequality

$$2x^2 + x - 28 > 0$$

2 Factorise

Factorise:

$$2x^2 + x - 28 = (2x - 7)(x + 4)$$

3 The critical values are

The critical values are

$$x = \frac{7}{2} \quad \text{and} \quad x = -4$$

4 The quadratic is greater than

The quadratic is greater than 0 outside the roots.

FINAL ANSWER

$x < -4$ or $x > \frac{7}{2}$

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Question 26

5 marks | 3D Pythagoras & Trigonometry

26 Here is a prism $ABCDEFGH$ with a horizontal, rectangular base $ABGF$

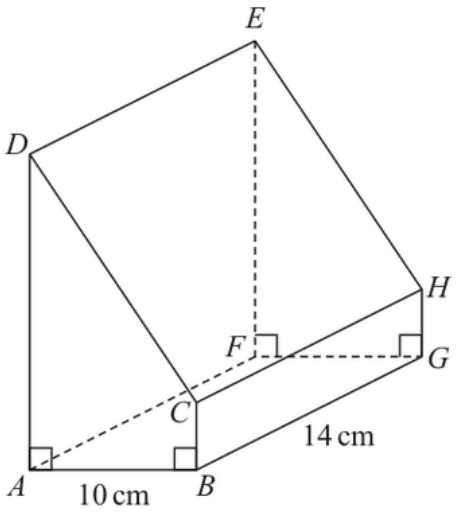


Diagram **NOT** accurately drawn

$AB = 10\,\text{cm}$ $BG = 14\,\text{cm}$

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)

WORKED SOLUTION

Question 26 · 4MA1/1H November 2025

1 **The horizontal base is a**

The horizontal base $ABGF$ is a rectangle.

$$AB = 10, \qquad BG = 14$$

2 **Use trigonometry**

So the horizontal distance from B to F is

$$BF = \sqrt{10^2 + 14^2} = \sqrt{296}$$

3 **Use trigonometry**

The angle of elevation of E from B is $50°$.

4 **Use trigonometry**

Since E is vertically above F,

$$\tan 50° = \frac{FE}{BF}$$

$$FE = \sqrt{296} \tan 50°$$

5 **The prism has the same**

The prism has the same cross section throughout, so

$$AD = FE = \sqrt{296} \tan 50°$$

6 **Use trigonometry**

Also

$$BC = \frac{1}{5} AD$$

7 **Area of the trapezium cross**

Area of the trapezium cross section $ABCD$:

$$\frac{1}{2}(AD + BC) \times AB$$

$$= \frac{1}{2}\left(AD + \frac{1}{5}AD\right) \times 10$$

$$= 6AD$$

8 **Volume of the prism**

Volume of the prism:

$$6AD \times 14 = 84AD$$

$$= 84\sqrt{296}\tan 50°$$

$$= 1722.311\ldots$$

9 **Correct to 3 significant figures**

Correct to 3 significant figures:

$$1720$$

✓ **FINAL ANSWER**

$$\boxed{1720\ \text{cm}^3}$$

4MA1/1H NOVEMBER 2025

Question 27

6 marks | Vectors

27

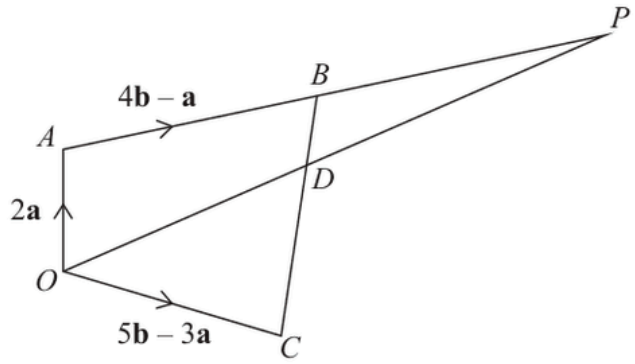


Diagram **NOT** accurately drawn

$OABC$ 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)

WORKED SOLUTION

Question 27 · 4MA1/1H November 2025

1 Read the graph

$$\vec{OA} = \mathbf{2a}, \qquad \vec{AB} = \mathbf{4b - a}, \qquad \vec{OC} = \mathbf{5b - 3a}$$

2 **Read the graph**

First find $\vec{OB}$:

$$\vec{OB} = \vec{OA} + \vec{AB}$$

$$\vec{OB} = 2\mathbf{a} + 4\mathbf{b} - \mathbf{a}$$

$$\vec{OB} = \mathbf{a} + 4\mathbf{b}$$

---

3 **Read the graph**

For part (a),

$$\vec{BC} = \vec{OC} - \vec{OB}$$

$$\vec{BC} = (5\mathbf{b} - 3\mathbf{a}) - (\mathbf{a} + 4\mathbf{b})$$

$$\vec{BC} = \mathbf{b} - 4\mathbf{a}$$

---

4 **Read the graph**

For part (b), $BD : DC = 1 : 3$, so

$$\vec{OD} = \vec{OB} + \frac{1}{4}\vec{BC}$$

$$\vec{OD} = \mathbf{a} + 4\mathbf{b} + \frac{1}{4}(\mathbf{b} - 4\mathbf{a})$$

$$\vec{OD} = \frac{17}{4}\mathbf{b}$$

---

5 **Read the graph**

Since A, B, P are collinear, let

$$\vec{OP} = \vec{OA} + s\vec{AB}$$

$$\vec{OP} = 2\mathbf{a} + s(4\mathbf{b} - \mathbf{a})$$

$$\vec{OP} = (2 - s)\mathbf{a} + 4s\mathbf{b}$$

---

6 **Read the graph**

But O, D, P are collinear, and $\vec{OD}$ has only a $\mathbf{b}$ component.

---

7 **Read the graph**

So

$$2 - s = 0$$

$$s = 2$$

---

8 **Read the graph**

Then

$$\vec{OP} = 8\mathbf{b}$$

---

9 **Given**

Given

$$\vec{OP} = n\vec{OD}$$

$$8\mathbf{b} = n\left(\frac{17}{4}\mathbf{b}\right)$$

$$n = \frac{32}{17}$$

✓ **FINAL ANSWER**

$$\vec{BC} = \mathbf{b} - 4\mathbf{a}, \quad n = \frac{32}{17}$$

4MA1/1H NOVEMBER 2025

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)

WORKED SOLUTION

Question 28 · 4MA1/1H November 2025

1 The line is

The line is

$$y = 3x + e$$

2 Point lies on the line

Point $A = (0.2, 2.6)$ lies on the line.

$$2.6 = 3(0.2) + e$$

$$2.6 = 0.6 + e$$

$$e = 2$$

3 Calculate value

So

$$y = 3x + 2$$

4 **The curve is**

The curve is

$$x^2 + y^2 = d - 11x$$

5 **Use point**

Use point $A = (0.2, 2.6)$:

$$0.2^2 + 2.6^2 = d - 11(0.2)$$

$$0.04 + 6.76 = d - 2.2$$

$$d = 9$$

6 **Substitute into the curve**

Now substitute $y = 3x + 2$ into the curve:

$$x^2 + (3x + 2)^2 = 9 - 11x$$

$$x^2 + 9x^2 + 12x + 4 = 9 - 11x$$

$$10x^2 + 23x - 5 = 0$$

7 **One root is**

One root is $0.2 = \frac{1}{5}$.

8 **The product of the roots**

The product of the roots is

$$\frac{-5}{10} = -\frac{1}{2}$$

9 **Evaluate fraction**

So the other root is

$$\frac{-\frac{1}{2}}{\frac{1}{5}} = -\frac{5}{2}$$

10 **Evaluate fraction**

Then

$$y = 3\left(-\frac{5}{2}\right) + 2$$

$$y = -\frac{11}{2}$$

✓ **FINAL ANSWER**

$$B = \left(-\frac{5}{2}, -\frac{11}{2}\right)$$