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Elite Mathematics
Pearson Edexcel International GCSE

IGCSE LINEAR · 4MA1

4WM2/01 November 2025 Worked Solutions

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

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



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PAST PAPER

4WM2/01 November 2025

November 2025

26	100	2 h
questions	marks	exam time

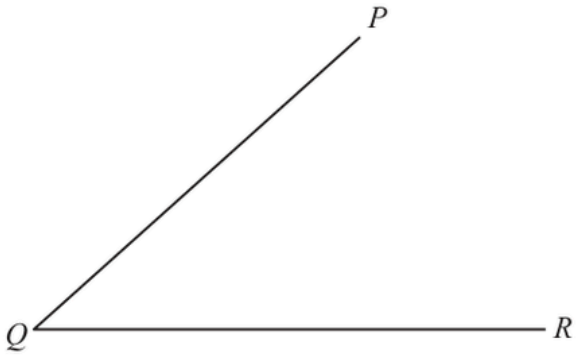
Each question is followed by its worked solution and final answer.

4WM2/01 NOVEMBER 2025

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)

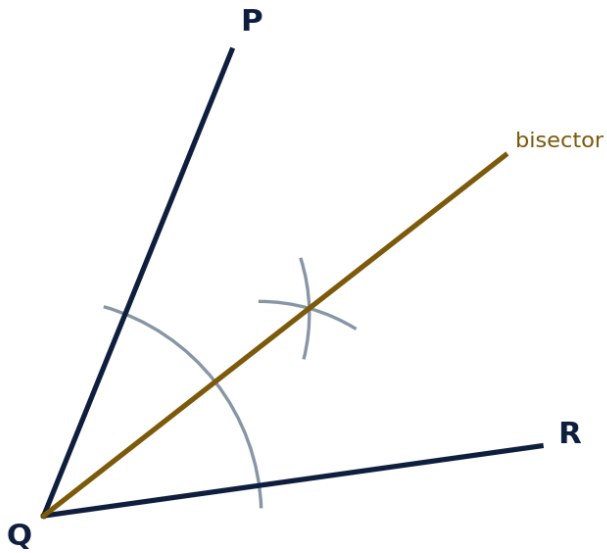
1 Construct angle bisector

Step 1: Place the point of the compass at the vertex *Q*. Draw an arc that intersects both arms *Q**P*** **and *Q**R***. Let's call these intersection points *A* and *B*.

Step 2: Without changing the compass width, place the compass point on *A* and draw an arc inside the angle.

Step 3: Place the compass point on *B* and draw another arc to intersect the previous arc. Let this intersection be point *C*.

Step 4: Draw a straight line from *Q* through *C*. This is the angle bisector.



FINAL ANSWER

This is the angle bisector.

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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)

WORKED SOLUTION

Question 2 · 4WM2/01 November 2025

1 Find class midpoints

Step 1: Find the midpoints (*x*) for each class interval.

2 0 h 10 x 5

0 \< *h* ≤ 10 ⟹ *x* = 5

3 10 h 20 x 15

10 \< *h* ≤ 20 ⟹ *x* = 15

4 20 h 30 x 25

20 \< *h* ≤ 30 ⟹ *x* = 25

5 30 h 40 x 35

30 \< *h* ≤ 40 ⟹ *x* = 35

6 40 h 50 x 45

40 \< *h* ≤ 50 ⟹ *x* = 45

7 **Find the midpoint**

Step 2: Multiply frequency (*f*) by midpoint (*x*) to find *f*x*.

8 **Calculate statistic**

$$textMean = fracsumfxsumf = frac129060 = 21.5$$

✓ **FINAL ANSWER**

21.5 cm

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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)

WORKED SOLUTION

Question 3 · 4WM2/01 November 2025

1 Label the equations

Label the equations:

Misplaced &

2 Add (1) and (2) eliminate

Step 1: Add (1) and (2) to eliminate *y*.

Misplaced &

3 Solve equation

Step 2: Substitute *x* = 2.5 into equation (1) to find *y*.

Misplaced &

FINAL ANSWER

x = 2.5, *y* = − 1.5

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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)

WORKED SOLUTION

Question 4 · 4WM2/01 November 2025

1 Split the ratio

Total parts = 6 + 7 + 3 = 16 parts

2 Evaluate fraction

$$1 textpart = frac96016 = 60 texttrees$$

3 Calculate value

Cherry trees = 7 parts × 60 = 420 trees

4 Calculate percentage

Morello trees = 0.65 × 420 = 273

FINAL ANSWER

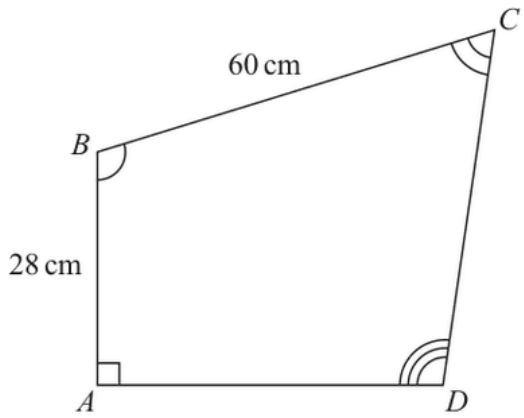
273 Always read carefully what the final question asks. A common mistake is stopping at the total number of cherry trees (420) instead of calculating the 65% morello portion.

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Question 5

3 marks | Similar Shapes

5 Here are three similar quadrilaterals.



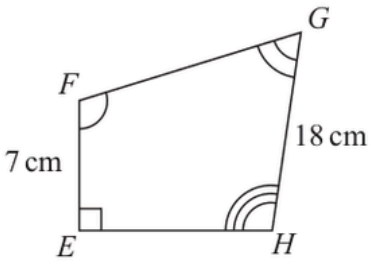
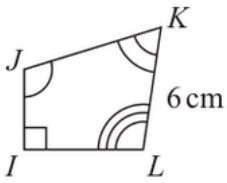


Diagram **NOT** accurately drawn



Work out the length of JK

..... cm

(Total for Question 5 is 3 marks)

WORKED SOLUTION

Question 5 · 4WM2/01 November 2025

1 Identify matching sides

Step 1: Identify corresponding sides from the similar shapes. Looking at the given angles/orientations:

2 Left side A B corresponds

Left side *A**B* corresponds to *E**F* and *I**J*.

3 Top side B C corresponds

Top side *B**C* corresponds to *F**G* and *J**K*.

4 Right side C D corresponds

Right side *C**D* corresponds to *G**H* and *K**L*.

5 **We are given C D**

We are given *C**D* = 60 (wait, diagram check: *B**C* is the top side labeled 60, *A**B* = 28. On middle shape *E**F* = 7, *G**H* = 18. On right shape *K**L* = 6, *J**K* is unknown). Let's use the explicit lengths:

Misplaced &

---

6 **Find scale factors**

Step 2: Find scale factors. Scale factor from *A**B**C**D* to *E**F**G**H* using the left sides:

$$textSF_1 = fracEFAB = frac728 = frac14$$

So, $FG = BCtimesfrac14 = 60timesfrac14 = 15textcm$.

---

7 **Scale factor from E F**

Scale factor from *E**F**G**H* to *I**J**K**L* using the right sides (*G**H* and *K**L*):

$$textSF_2 = fracKLGH = frac618 = frac13$$

---

8 **Calculate J K**

Step 3: Calculate *JK*. Side *J**K* corresponds to *F**G*.

$$JK = FGtimestextSF_2 = 15timesfrac13 = 5textcm$$

✓ **FINAL ANSWER**

5 cm

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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)

WORKED SOLUTION

Question 6 · 4WM2/01 November 2025

1 Calculate value

Increase = 87 − 75 = 12

2 Convert standard form

Extra open brace or missing close brace

3 Answer

16%

Step 1: Determine the depreciation multiplier. A 20% decrease means the multiplier is 1 − 0.20 = 0.80.

4 Solve inequality

Final Value = 960 × (0.80)³

Final Value = 960 × 0.512 = 491.52

FINAL ANSWER

491.52 Swiss francs

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Question 7

4 marks | Angles in Polygons & Parallel Lines

7 *ABCDE* is a regular pentagon and *APQE* is a rectangle.

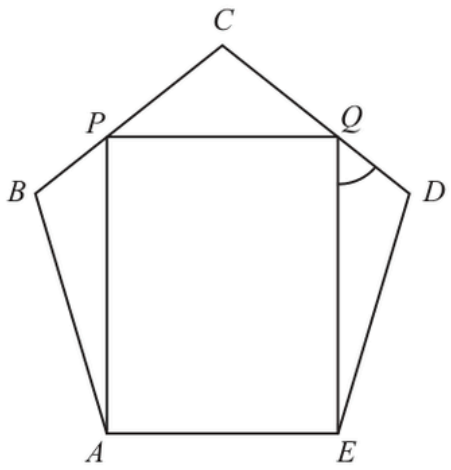


Diagram **NOT** accurately drawn

BPC and *DQC* are straight lines.

Work out the size of angle *EQD*
Show your working clearly.

.....°

(Total for Question 7 is 4 marks)

WORKED SOLUTION

Question 7 · 4WM2/01 November 2025

1 Use trigonometry

Missing open brace for superscript

So, ∠*A**E**D* = 108[∘].

Step 2: Find angles within the corner triangle △*DE**Q*.** Since *A**P**Q**E* is a rectangle, the angle ∠*A**E**Q* = 90[∘]. Therefore, the angle ∠*D*E**Q* is:

∠*D**E**Q* = ∠*A**E**D* − ∠*A**E**Q* = 108[∘] − 90[∘] = 18[∘]

Step 3: Analyze △*DE**Q*.** The problem states *D**Q*C* is a straight line, meaning *Q* lies on the side *D*C*. Therefore, △*D**E**Q* is formed by *D*, *E*, *Q*. In △*D**E**Q*, the angle at vertex *D* is the pentagon's interior angle ∠*C*D**E* = 108[∘].

Using angles in a triangle summing to 180[∘]:

∠*E**Q*D* = 180[∘] − (∠*D**E**Q*+∠*E**D*Q*) = 180[∘] − (18[∘]+108[∘]) = 180[∘] − 126[∘] = 54[∘]

FINAL ANSWER

54[∘]

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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)

WORKED SOLUTION

Question 8 · 4WM2/01 November 2025

1 Calculate normal price

Step 1: Calculate Normal Price for Shop A. A 25% discount means the sale price is 75% of the normal price.

0.75 × Normal_{*A*} = 240

$$\text{Normal}_A = \frac{240}{0.75} = 320\text{ euros}$$

2 Calculate normal price

Step 2: Calculate Normal Price for Shop B. A discount of $\frac{2}{9}$ means the sale price is $1 - \frac{2}{9} = \frac{7}{9}$ of the normal price.

$$\frac{7}{9} \times \text{Normal}_B = 245$$

$$\text{Normal}_B = 245 \times \frac{9}{7} = 35 \times 9 = 315\text{ euros}$$

3 Calculate value

Difference = 320 − 315 = 5 euros

FINAL ANSWER

5 euros

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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)

WORKED SOLUTION

Question 9 · 4WM2/01 November 2025

1 Move the decimal point 4

Move the decimal point 4 places to the right:

5.76 × 10⁴ = 57600

2 Answer

57600

3 Expand brackets

3 × 10⁵ = 300,000

8 × 10³ = 8,000

Numerator = 300,000 + 8,000 = 308,000 = 3.08 × 10⁵

4 Convert standard form

$$frac3.08times10^54times10^{-2} = left(frac3.084right)times10^{5-(-2)}$$

= 0.77 × 10⁷

Step 3: Convert to strict standard form (1 ≤ *A* \< 10).

0.77 × 10⁷ = 7.7 × 10⁶

FINAL ANSWER

7.7 × 10⁶

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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)

WORKED SOLUTION

Question 10 · 4WM2/01 November 2025

1 Calculate statistic

Total₅ = Mean × Number = 217 × 5 = 1085 grams

2 Solve inequality

Total₆ = 1085 + 175 = 1260 grams

3 Calculate statistic

$$textNewMean = frac12606 = 210textgrams$$

FINAL ANSWER

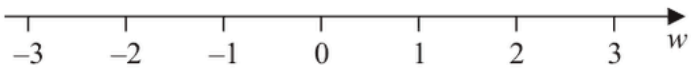
210

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Question 11

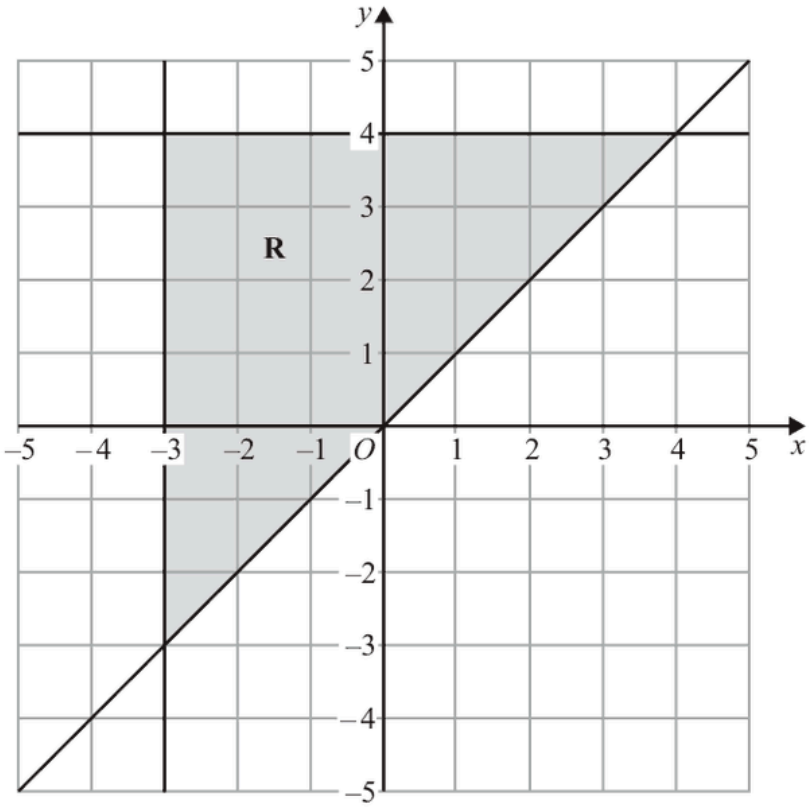
4 marks | Inequalities (Solving & Graphing)

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)

WORKED SOLUTION

Question 11 · 4WM2/01 November 2025

1 **Draw an open circle at**

Draw an open circle at 1 and an arrow pointing to the left.

2 **Identify vertical boundary**

Step 1: Identify the vertical boundary. The region is to the right of the vertical line at *x* = − 3. Inequality 1: *x* ≥ − 3

3 **Solve inequality**

Step 2: Identify the horizontal boundary. The region is below the horizontal line at *y* = 4. Inequality 2: *y* ≤ 4

4 **Calculate statistic**

Step 3: Identify the diagonal boundary. The line passes through (0,0), (1,1), (−1,−1), etc., meaning its equation is *y* = *x*. The shaded region is above this line. Inequality 3: *y* ≥ *x*

✓ **FINAL ANSWER**

x ≥ − 3, *y* ≤ 4, *y* ≥ *x* Always pick a test point inside the shaded region, like (0,2), to verify your inequalities. For *y* ≥ *x*, 2 ≥ 0 is true!

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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)

WORKED SOLUTION

Question 12 · 4WM2/01 November 2025

1 Calculate percentage

Decrease by 5% $\Rightarrow$ Multiplier = 1 − 0.05 = 0.95

Increase by 20% $\Rightarrow$ Multiplier = 1 + 0.20 = 1.20

Increase by 6.5% $\Rightarrow$ Multiplier = 1 + 0.065 = 1.065

2 Calculate value

Overall Multiplier = 0.95 × 1.20 × 1.065 = 1.2141

3 Calculate percentage

1.2141 − 1 = 0.2141 = 21.41%

✓ **FINAL ANSWER**

21.41%

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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)

WORKED SOLUTION

Question 13 · 4WM2/01 November 2025

1 Use index laws

(9×10⁸⁰)³ = 9³ × (10⁸⁰)³

2 Solve inequality

9³ = 729

(10⁸⁰)³ = 10^{80 × 3} = 10²⁴⁰

3 Convert standard form

729 × 10²⁴⁰ = 7.29 × 10² × 10²⁴⁰ = 7.29 × 10²⁴²

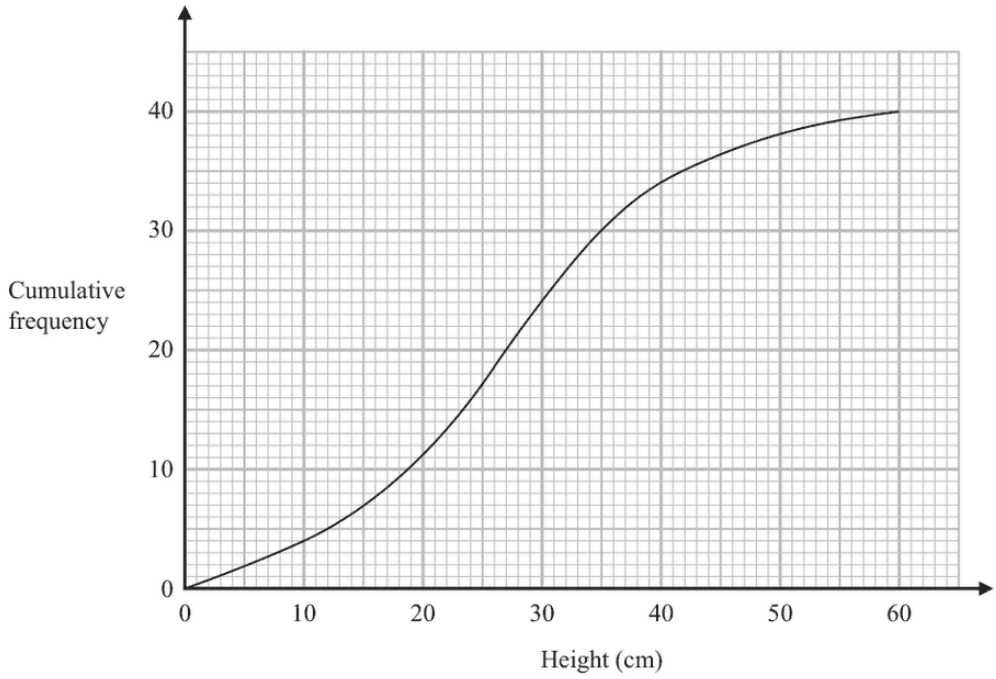
✓ **FINAL ANSWER**

7.29 × 10²⁴²

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)

1 **Part (a) Median Total plants**

Part (a) Median: Total plants = 40. The median position is at cumulative frequency = 40/2 = 20. Reading across from CF = 20 to the curve and down to the x-axis gives:

2 **Answer**

a 30 cm

3 **Part (b) Interquartile Range (IQR)**

Lower Quartile (Q1) is at CF = 10. Reading the graph ⟹ Height = 20 cm.

Upper Quartile (Q3) is at CF = 30. Reading the graph ⟹ Height = 40 cm.

IQR = *Q*3 − *Q*1 = 40 − 20 = 20 cm

4 **Answer**

b 20 cm

Part (c) Premium plants revenue: Premium plants have height \> 40 cm. From the graph, cumulative frequency at 40 cm is 30. This means 30 plants are ≤ 40 cm.

Number of premium plants = 40 − 30 = 10 plants

Total Money = 10 plants × 30 euros = 300 euros

✓ **FINAL ANSWER**

c 300 euros

Question 15

4 marks | Circle Theorems

15 A, B, C and D are points on a circle with centre O

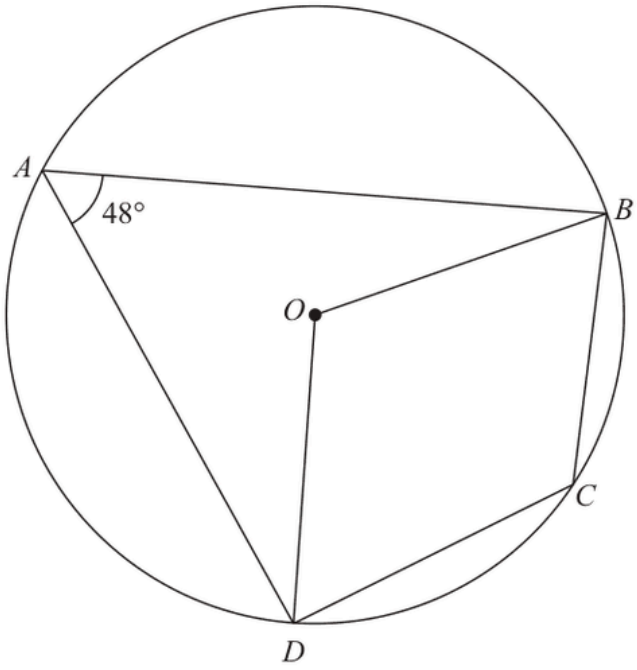


Diagram **NOT** accurately drawn

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)

1 **Part (a)(i) Angle D O**

Part (a)(i) Angle *DOB*:

∠*D**O**B* = 2 × 48[∘] = 96[∘]

2 **Answer**

(a)(i) 96[∘]

Part (a)(ii) Reason: The angle subtended by an arc at the centre is twice the angle subtended at the circumference.

Part (b)(i) Angle *BCD*:

∠*B**C**D* = 180[∘] − 48[∘] = 132[∘]

✓ **FINAL ANSWER**

(b)(i) 132[∘] **Part (b)(ii) Reason:** Opposite angles in a cyclic quadrilateral sum to 180[∘].

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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)

WORKED SOLUTION

Question 16 · 4WM2/01 November 2025

1 Calculate value

Data (sorted): 14, 15, 16, 18, 19, 20, 22, 25, 28, 40, 50.

Number of data points *n* = 11.

2 Find median

Step 1: Find the Median (Q2). The median is the $left(frac11 + 12right) = 6^{textth}$ value.

Median = 20

3 Find median

Step 2: Find Lower Quartile (Q1) and Upper Quartile (Q3). Q1 is the median of the lower 5 values (14, 15, **16**, 18, 19).

*Q*1 = 16

Q3 is the median of the upper 5 values (22, 25, **28**, 40, 50).

*Q*3 = 28

4 Calculate statistic

IQR = *Q*3 − *Q*1 = 28 − 16 = 12

✓ **FINAL ANSWER**

12 minutes

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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)

WORKED SOLUTION

Question 17 · 4WM2/01 November 2025

1 Solve equation

$$T = fracksqrtm$$

Step 2: Substitute the given values to find constant *k*.

$$15 = fracksqrt36$$

$$15 = frack6$$

k = 15 × 6 = 90

2 Rearrange formula

$$T = frac90sqrtm$$

FINAL ANSWER

$$T = frac90sqrtm$$

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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)

WORKED SOLUTION

Question 18 · 4WM2/01 November 2025

1 Multiply both sides denominator

$$p^2 = frac7w + ycw + k$$

Step 2: Multiply both sides by the denominator (*cw*+*k*).**

*p*²(*c**w*+*k*) = 7*w* + *y*

2 Expand brackets

*p*²*c**w* + *p*²*k* = 7*w* + *y*

Step 4: Collect all terms involving *w* on one side.

*p*²*c**w* − 7*w* = *y* − *p*²*k*

Step 5: Factor out *w*.

w(*p*²*c*−7) = *y* − *p*²*k*

Step 6: Divide to isolate *w*.

$$w = fracy - p^2kp^2c - 7$$

FINAL ANSWER

$$w = fracy - p^2kp^2c - 7$$

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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)

WORKED SOLUTION

Question 19 · 4WM2/01 November 2025

1 **Evaluate fraction**

$$r = frac242 = 12textcm$$

2 **Calculate area**

Surface Area = 4*π**r*²

= 4 × *π* × 12²

= 4 × *π* × 144

= 576*π* ≈ 1809.557... cm²

Step 3: Round to 3 significant figures. 1809.557 → 1810 (the 1, 8, and 1 are the first three sig figs).

✓ **FINAL ANSWER**

1810 cm²

4WM2/01 NOVEMBER 2025

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)

WORKED SOLUTION

Question 20 · 4WM2/01 November 2025

1 Substitute into equation

Step 1: Substitute *y* = (*x*+2) into the quadratic equation.

*x*² + (*x*+2)² = 3*x*(*x*+2) − 11

2 Expand brackets

*x*² + (*x*²+4*x*+4) = 3*x*² + 6*x* − 11

2*x*² + 4*x* + 4 = 3*x*² + 6*x* − 11

3 Solve equation

0 = 3*x*² − 2*x*² + 6*x* − 4*x* − 11 − 4

*x*² + 2*x* − 15 = 0

4 Solve quadratic equation

(*x*+5)(*x*−3) = 0

So, *x* = − 5 or *x* = 3.

Step 5: Find corresponding *y* values using *y* = *x* + 2.

If *x* = − 5 ⟹ *y* = − 5 + 2 = − 3

If *x* = 3 ⟹ *y* = 3 + 2 = 5

FINAL ANSWER

(−5,−3) and (3,5)

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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)

WORKED SOLUTION

Question 21 · 4WM2/01 November 2025

1 **(a) Find g (1)**

(a) Find *g*(−1):

g(−1) = 4(−1)² + 16(−1) − 9 = 4 − 16 − 9 = − 21

2 **Answer**

a − 21

(b) Find *fg*(*x*):

*f**g*(*x*) = *f*(*g*(*x*)) = 5(4*x*²+16*x*−9) − 3

= 20*x*² + 80*x* − 45 − 3 = 20*x*² + 80*x* − 48

---

3 **Answer**

b 20*x*² + 80*x* − 48

Let *y* = 4*x*² + 16*x* − 9. We must rearrange to make *x* the subject.

Step 1: Complete the square for the *x* terms.

y = 4(*x*²+4*x*) − 9

y = 4((*x*+2)²−4) − 9

y = 4(*x*+2)² − 16 − 9

y = 4(*x*+2)² − 25

Step 2: Rearrange for *x*.

y + 25 = 4(*x*+2)²

$$fracy + 254 = (x + 2)^2$$

$$x + 2 = pmsqrtfracy + 254$$

Since *x* ≥ − 2, *x* + 2 is positive, so we take the positive root.

$$x + 2 = fracsqrty + 252$$

$$x = fracsqrty + 252 - 2$$

Step 3: Swap *y* for *x* to write the inverse function.

✓ **FINAL ANSWER**

$g^{-1}(x) = fracsqrtx + 252 - 2$ When finding the inverse of a quadratic, always complete the square. The restricted domain (*x* ≥ − 2) tells you whether to take the positive or negative square root!

4WM2/01 NOVEMBER 2025

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)

WORKED SOLUTION

Question 22 · 4WM2/01 November 2025

1 **Find the gradient**

$$fracdydx = 3x^2 - 16$$

2 **Find the gradient**

3*x*² − 16 = 11

3*x*² = 27

*x*² = 9 ⟹ *x* = 3 or *x* = − 3

3 **Solve inequality**

For *x* = 3: *y* = (3)³ − 16(3) + 7 = 27 − 48 + 7 = − 14

4 **Solve inequality**

For *x* = − 3: *y* = (−3)³ − 16(−3) + 7 = − 27 + 48 + 7 = 28

5 **Use trigonometry**

Step 4: Find the y-intercept (*b*) for each tangent (*y* = 11*x* + *b*).

Using (3,−14):

− 14 = 11(3) + *b* ⟹ − 14 = 33 + *b* ⟹ *b* = − 47

Using (−3,28):

28 = 11(−3) + *b* ⟹ 28 = − 33 + *b* ⟹ *b* = 61

FINAL ANSWER

b = − 47 and 61

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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)

WORKED SOLUTION

Question 23 · 4WM2/01 November 2025

1 Calculate area

$$textASF = fractextAreaofQtextAreaofP = frac450200 = frac94 = 2.25$$

2 Simplify surd

$$textLSF = sqrttextASF = sqrtfrac94 = frac32 = 1.5$$

3 Calculate volume

$$textVSF = (textLSF)^3 = left(frac32right)^3 = frac278 = 3.375$$

4 Calculate volume

$$textVolumeofQ = textVolumeofPtimestextVSF = 672timesfrac278$$

= 84 × 27 = 2268

FINAL ANSWER

2268 cm³

Question 24

6 marks | Vectors

24 The diagram shows a quadrilateral $OABC$

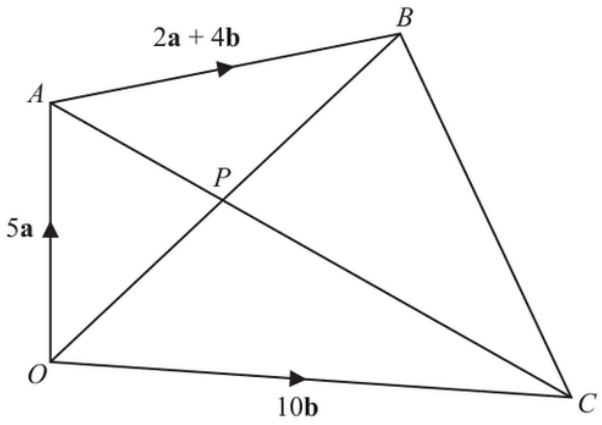


Diagram **NOT** accurately drawn

$\overrightarrow{OA} = 5\mathbf{a}$ $\overrightarrow{OC} = 10\mathbf{b}$ $\overrightarrow{AB} = 2\mathbf{a} + 4\mathbf{b}$

(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)

1

(a) Find $overrightarrow{AC}$

$$overrightarrow{AC} = overrightarrow{AO} + overrightarrow{OC} = -overrightarrow{OA} + overrightarrow{OC} = -5mathbf{a} + 10mathbf{b}$$

2

Answer

a − 5**a** + 10**b**

3

(b) Find $overrightarrow{OB}$

$$overrightarrow{OB} = overrightarrow{OA} + overrightarrow{AB} = 5mathbf{a} + (2mathbf{a} + 4mathbf{b}) = 7mathbf{a} + 4mathbf{b}$$

4

Answer

b 7**a** + 4**b**

Step 1: Set up vector equations for $overrightarrow{OP}$. Since *O**P**B* is a straight line, $overrightarrow{OP}$ is a scalar multiple of $overrightarrow{OB}$. Let this be *λ*.

$$overrightarrow{OP} = lambda(7mathbf{a} + 4mathbf{b}) = 7lambdamathbf{a} + 4lambdamathbf{b}$$

Since *P* lies on the straight line *A**C*, $overrightarrow{AP} = muoverrightarrow{AC}$ for some scalar *μ*.

$$overrightarrow{OP} = overrightarrow{OA} + overrightarrow{AP} = 5mathbf{a} + mu(-5mathbf{a} + 10mathbf{b})$$

$$overrightarrow{OP} = (5 - 5mu)mathbf{a} + 10mumathbf{b}$$

Step 2: Equate the coefficients of a **and** b**.**

7*λ* = 5 − 5*μ* — (1)

$$4lambda = 10mu implies mu = frac{4}{10}lambda = 0.4lambda quad text{---(2)}$$

Step 3: Solve for *λ*. Substitute (2) into (1):

7*λ* = 5 − 5(0.4*λ*)

7*λ* = 5 − 2*λ*

$$9lambda = 5 implies lambda = frac{5}{9}$$

5

Evaluate fraction

$$overrightarrow{OP} = frac{5}{9}(7mathbf{a} + 4mathbf{b}) = frac{35}{9}mathbf{a} + frac{20}{9}mathbf{b}$$

✓ **FINAL ANSWER**

$$frac{35}{9}mathbf{a} + frac{20}{9}mathbf{b}$$

Question 25

3 marks | Graphs of Functions

25 A curve has equation $y = f(x)$

There is one minimum point on this curve.

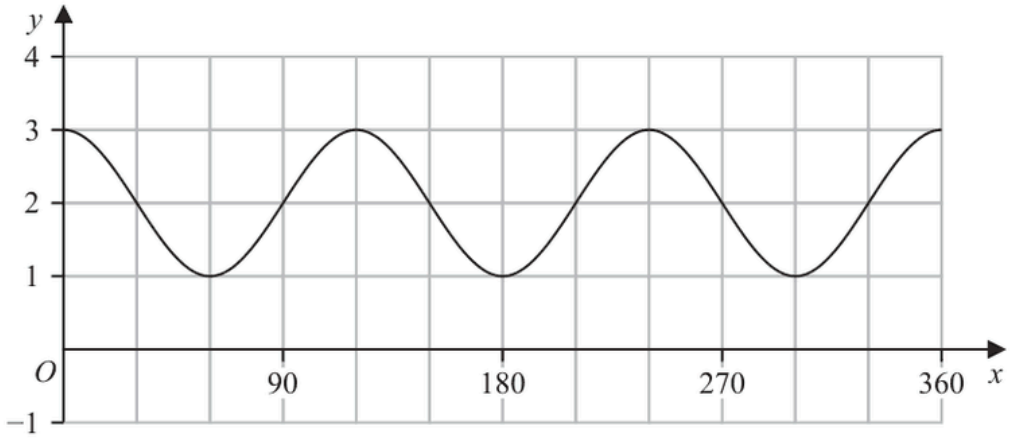
The coordinates of this minimum point are $(8, 1)$

(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)

1 The transformation y f (4

The transformation *y* = *f*(4*x*) represents a horizontal stretch by a scale factor of $frac14$. The x-coordinate is multiplied by $frac14$ while the y-coordinate stays the same.

$$textNewminimum = leftbigl(8timesfrac14, 1rightbigr) = (2, 1)$$

2 Answer

(2,1)

Step 1: Find the vertical shift *b*. The standard *y* = cos (*x*) graph fluctuates between − 1 and 1, centered at *y* = 0. The given graph fluctuates between a minimum of *y* = 1 and a maximum of *y* = 3. The center line is $frac3 + 12 = 2$. Therefore, *b* = 2.

Step 1: Find the frequency multiplier *a*. The period of the given graph completes one full cycle between *x* = 0 and *x* = 90[∘] (it starts at 3, dips to 1, and returns to 3 at 90[∘]). The standard cosine period is 360[∘].

Missing open brace for superscript

Missing open brace for superscript

FINAL ANSWER

a = 4, *b* = 2

4WM2/01 NOVEMBER 2025

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)

WORKED SOLUTION

Question 26 · 4WM2/01 November 2025

1 Find common difference

Step 1: Find the common difference *d*. The *n*th term is given by *u*_{*n*} = *a* + (*n*−1)*d*.

*u*₂₀ = 10 + 19*d* = 86

19*d* = 76

$$d = frac7619 = 4$$

2 Use sum formula

Step 2: Use the sum formula to form an equation in terms of *N*.

$$S_N = fracN2left\[2a + (N-1)dright\]$$

Substitute the known values *S*_{*N*} = 5194, *a* = 10, and *d* = 4:

$$5194 = fracN2left\[2(10) + (N-1)(4)right\]$$

3 Solve quadratic equation

Step 3: Simplify and solve the quadratic equation. Multiply by 2 to clear the fraction:

10388 = *N*

$$20 + 4 * N * -4$$

10388 = *N*(4*N*+16)

4*N*² + 16*N* − 10388 = 0

4 Divide the entire equation by

Divide the entire equation by 4 to make it simpler:

*N*² + 4*N* − 2597 = 0

5 Use quadratic formula

Step 4: Use the quadratic formula to find *N*.

$$N = frac-bpmsqrtb^2 - 4ac2a$$

$$N = frac-4pmsqrt16 - 4(1)(-2597)2$$

$$N = frac-4pmsqrt16 + 103882$$

$$N = frac-4pmsqrt104042$$

$$N = frac-4pm1022$$

6 Evaluate fraction

Since *N* must be a positive integer, we discard the negative root:

$$N = frac-4 + 1022 = frac982 = 49$$

✓ FINAL ANSWER

N = 49 Always double-check that your *N* (number of terms) evaluates to a positive whole integer. If it ends up as a decimal or fraction, recheck your arithmetic progression formulas.