Elite Mathematics
Pearson Edexcel International GCSE

IGCSE LINEAR · 4MA1

4WM2/01R June 2026 Worked Solutions

June 2026 paper rebuilt with the worked solution after each question.

13	2020–2026	Single-paper solutions
paper questions	55 past papers	checked by Dr Eslam



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

4WM2/01R June 2026

June 2026

13	55	2 h
questions	marks	exam time

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

Question 11

4 marks | Volume & Surface Area

11 Here is a solid cylinder.

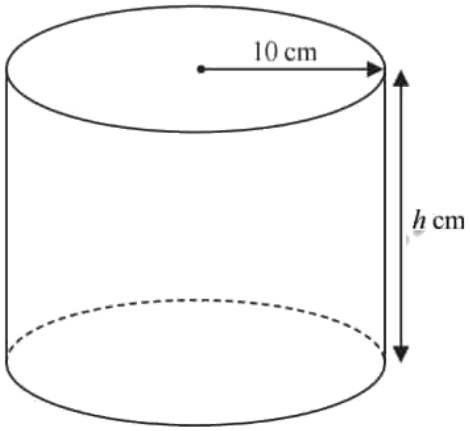


Diagram **NOT** accurately drawn

The radius of the cylinder is 10 cm
The height of the cylinder is h cm

The volume of the cylinder is 5341 cm^3

Work out the **total** surface area of the cylinder.
Give your answer correct to the nearest whole number.

..... cm^2

(Total for Question 11 is 4 marks)

1 **Find h from the volume**

$$\pi(10)^2 h = 5341 \Rightarrow h = \frac{5341}{100\pi} = 17.00\ldots \text{ cm}$$

2 **Curved surface**

$$2\pi r h = 2\pi(10)(17.00\ldots) = 1068.2$$

3 **Two circular ends**

$$2\pi r^2 = 2\pi(10)^2 = 200\pi = 628.31\ldots$$

4 **Total**

$$1068.2 + 628.31\ldots = 1696.5\ldots$$

Keep h unrounded; using $h = 17$ gives 1696.

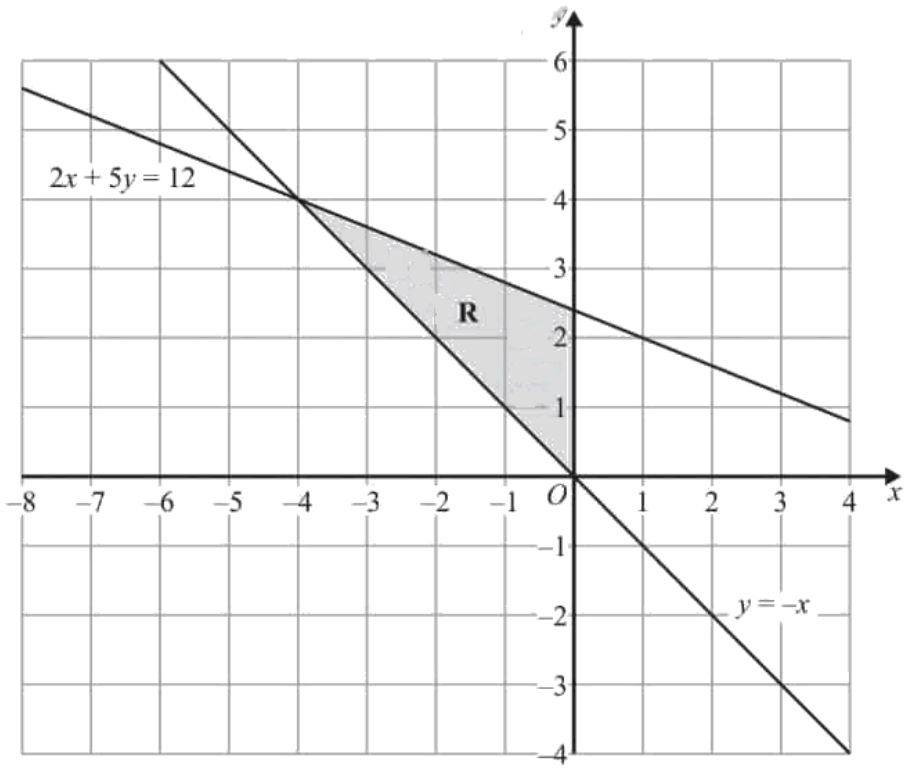
✓ **FINAL ANSWER**

1697 cm^2

Question 12

3 marks | Inequalities (Solving & Graphing)

12



The region **R**, shown shaded in the diagram, is bounded by the y-axis and the straight lines with equations

$$y = -x$$

$$2x + 5y = 12$$

Write down the three inequalities that define **R**

(Total for Question 12 is 3 marks)

1 **Boundary lines**

R lies to the left of the y-axis, above $y = -x$ and below $2x + 5y = 12$.

2 **Inequalities**

$$x \leq 0, \qquad y \geq -x, \qquad 2x + 5y \leq 12$$

3 **Check a point inside R**

$(-1, 2)$: $-1 \leq 0$, $2 \geq 1$, $-2 + 10 = 8 \leq 12$ ✓

✓ **FINAL ANSWER**

$x \leq 0$, $y \geq -x$, $2x + 5y \leq 12$

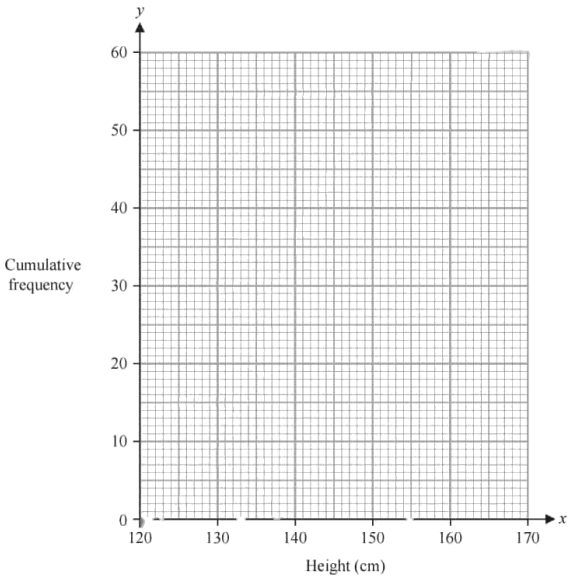
Question 13

6 marks | Cumulative Frequency Diagrams

13 The cumulative frequency table shows information about the heights, in centimetres, of 60 plants.

Height (h cm)	Cumulative frequency
$120 \leqslant h < 130$	8
$120 \leqslant h < 140$	35
$120 \leqslant h < 150$	52
$120 \leqslant h < 160$	58
$120 \leqslant h < 170$	60

(a) On the grid, draw a cumulative frequency graph for this information.



(2)

(b) Use your graph to find an estimate for the median.

..... cm

(1)

(c) Use your graph to find an estimate for the lower quartile.

..... cm

(1)

(d) Use your graph to find an estimate for the number of plants with a height greater than 155 cm

.....

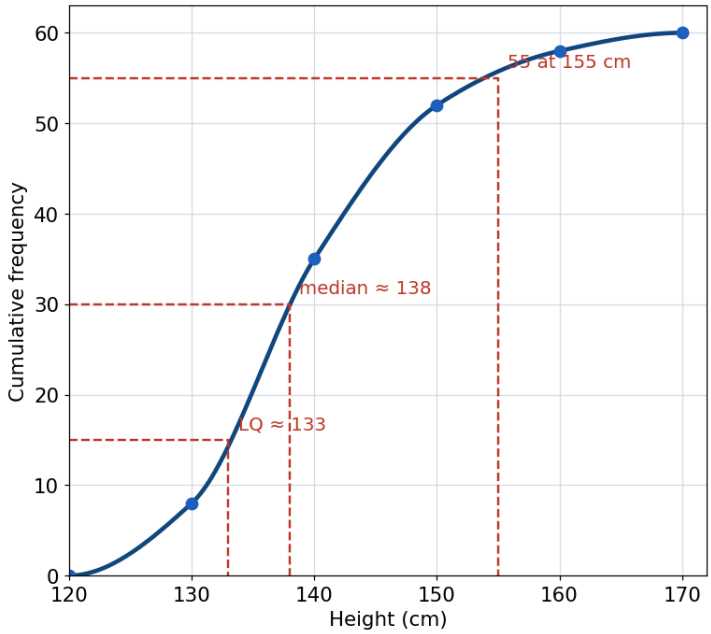
(2)

(Total for Question 13 is 6 marks)

1

(a) Plot at the upper class boundaries

Plot $(130, 8), (140, 35), (150, 52), (160, 58), (170, 60)$, start at $(120, 0)$ and join with a smooth curve.



2

(b) Median

$\frac{1}{2} \times 60 = 30$: read across from 30 → about 138 cm.

3

(c) Lower quartile

$\frac{1}{4} \times 60 = 15$: read across from 15 → about 133 cm.

4

(d) Taller than 155 cm

Up from 155 cm the curve reads about 55, so $60 - 55 = 5$ plants.

✓ **FINAL ANSWER**

(b) 138 cm (c) 133 cm (d) about 5 plants

Question 14

4 marks | Circle Theorems

14

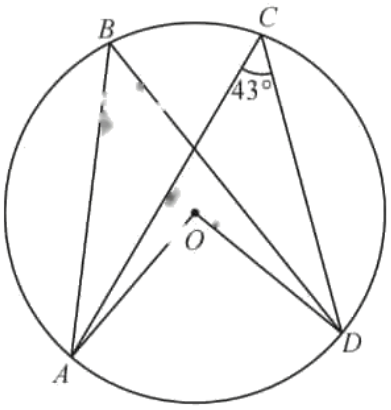


Diagram **NOT** accurately drawn

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

angle $ACD = 43°$

(a) (i) Find the size of angle ABD

..... °

(1)

(ii) Give a reason for your answer.

.....

.....

(1)

(b) Find the size of the reflex angle AOD

..... °

(2)

(Total for Question 14 is 4 marks)

1 **(a)(i) Same segment**

$$\angle ABD = \angle ACD = 43^\circ$$

2 **(a)(ii) Reason**

Angles in the same segment are equal (both stand on the arc AD).

3 **(b) Angle at the centre**

$$\angle AOD = 2 \times 43^\circ = 86^\circ \quad \text{(angle at centre is twice the angle at the circumference)}$$

4 **Reflex angle**

$$360^\circ - 86^\circ = 274^\circ$$

✓ **FINAL ANSWER**

(a) 43°, angles in the same segment are equal (b) 274°

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Question 15

2 marks | Statistics Toolkit

15 Mina recorded the times taken, in minutes, by 11 people to complete a puzzle.
Here are her results.

2 2 3 6 7 8 9 12 13 17 20

Find the interquartile range of these times.

..... minutes

(Total for Question 15 is 2 marks)

WORKED SOLUTION

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1 Positions of the quartiles

$n = 11$: LQ is the $\frac{11+1}{4} = 3$rd value, UQ is the 9th value.

2 Read from the ordered list

$2, 2, \mathbf{3}, 6, 7, 8, 9, 12, \mathbf{13}, 17, 20$: LQ $= 3$, UQ $= 13$.

3 Interquartile range

$$13 - 3 = 10$$

✓ **FINAL ANSWER**

10 minutes

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Question 16

3 marks | Direct & Inverse Proportion

16 m is directly proportional to r^2

$m = 180$ when $r = 6$

Find a formula for m in terms of r

(Total for Question 16 is 3 marks)

WORKED SOLUTION

Question 16 · 4WM2/01R June 2026

1 Write the proportion

$$m = kr^2$$

2 Find k

$$180 = k(6)^2 \Rightarrow k = 5$$

3 Formula

$$m = 5r^2$$

FINAL ANSWER

$m = 5r^2$

Question 17

4 marks | Functions

17 The functions f and g are such that

$$f(x) = x^2 - 5$$
$$g(x) = 2x + 1$$

Solve $fg(x) = 2gf(x)$
Show clear algebraic working.

$x =$ .....

(Total for Question 17 is 4 marks)

1 **fg(x): put g into f**

$$\mathrm{fg}(x) = (2x+1)^2 - 5 = 4x^2 + 4x - 4$$

2 **gf(x): put f into g**

$$\mathrm{gf}(x) = 2(x^2-5) + 1 = 2x^2 - 9, \qquad 2\,\mathrm{gf}(x) = 4x^2 - 18$$

3 **Solve**

$$4x^2 + 4x - 4 = 4x^2 - 18 \Rightarrow 4x = -14 \Rightarrow x = -3.5$$

✓ **FINAL ANSWER**

$x = -3.5$

Question 18

5 marks | Vectors

18 Here are two vectors.

$$\overrightarrow{OA} = \begin{pmatrix} 4 \\ -3 \end{pmatrix} \qquad \overrightarrow{BA} = \begin{pmatrix} -15 \\ 8 \end{pmatrix}$$

(a) Find $2\overrightarrow{AO}$ as a column vector.

$2\overrightarrow{AO} = \begin{pmatrix} \ldots\ldots \\ \ldots\ldots \end{pmatrix}$

(1)

(b) Find $\overrightarrow{OB}$ as a column vector.

$\overrightarrow{OB} = \begin{pmatrix} \ldots\ldots \\ \ldots\ldots \end{pmatrix}$

(2)

(c) Calculate the magnitude of the vector $\overrightarrow{BA}$

.....

(2)

(Total for Question 18 is 5 marks)

1 **(a) Reverse OA and double**

$$\overrightarrow{AO} = \begin{pmatrix} -4 \\ 3 \end{pmatrix}, \qquad 2\overrightarrow{AO} = \begin{pmatrix} -8 \\ 6 \end{pmatrix}$$

2 **(b) Route O → A → B**

$$\overrightarrow{OB} = \overrightarrow{OA} + \overrightarrow{AB} = \begin{pmatrix} 4 \\ -3 \end{pmatrix} + \begin{pmatrix} 15 \\ -8 \end{pmatrix} = \begin{pmatrix} 19 \\ -11 \end{pmatrix}$$

3 **(c) Magnitude**

$$|\overrightarrow{BA}| = \sqrt{(-15)^2 + 8^2} = \sqrt{289} = 17$$

✓ **FINAL ANSWER**

(a) $\begin{pmatrix} -8 \\ 6 \end{pmatrix}$ (b) $\begin{pmatrix} 19 \\ -11 \end{pmatrix}$ (c) 17

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Question 19

3 marks | Rearranging Formulae

19 Make x the subject of $y = \frac{3x+5}{4-2x}$

(Total for Question 19 is 3 marks)

WORKED SOLUTION

Question 19 · 4WM2/01R June 2026

1 Multiply out the fraction

$$y(4-2x) = 3x+5 \Rightarrow 4y-2xy = 3x+5$$

2 Collect x terms on one side

$$4y-5 = 3x+2xy = x(3+2y)$$

3 Divide

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

✓ **FINAL ANSWER**

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

Question 20

5 marks | Volume & Surface Area

20 The diagram shows a solid shape.

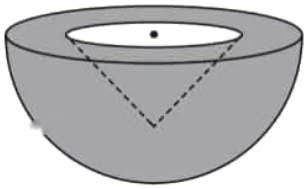


Diagram **NOT** accurately drawn

The solid shape is made by removing a cone from a hemisphere.

The radius of the cone is x cm
The height of the cone is x cm

The radius of the hemisphere is $2x$ cm

The volume of the solid shape is $\frac{3645}{8}\pi$ cm^3

Find the outer curved surface area of the solid shape.
Give your answer correct to the nearest whole number.

..... cm^2

(Total for Question 20 is 5 marks)

1 **Volume of the solid**

$$\tfrac{2}{3}\pi(2x)^3 - \tfrac{1}{3}\pi x^2(x) = \tfrac{16}{3}\pi x^3 - \tfrac{1}{3}\pi x^3 = 5\pi x^3$$

2 **Solve for x**

$$5\pi x^3 = \frac{3645}{8}\pi \Rightarrow x^3 = \frac{729}{8} \Rightarrow x = 4.5$$

3 **Outer curved surface = curved hemisphere**

Radius $2x = 9$:

$$2\pi(9)^2 = 162\pi = 508.9\ldots$$

FINAL ANSWER

509 cm^2

Question 21

5 marks | Simultaneous Equations

21 Solve the simultaneous equations

$$y^2 = x^2 + 7$$
$$y = 3x - 5$$

Show clear algebraic working.

(Total for Question 21 is 5 marks)

1 **Substitute y = 3x − 5**

$$(3x-5)^2 = x^2 + 7 \Rightarrow 9x^2 - 30x + 25 = x^2 + 7$$

2 **Simplify and factorise**

$$8x^2 - 30x + 18 = 0 \Rightarrow 4x^2 - 15x + 9 = 0 \Rightarrow (x-3)(4x-3) = 0$$

3 **Find y for each x**

$x = 3 \Rightarrow y = 4$;\quad $x = \frac{3}{4} \Rightarrow y = \frac{9}{4} - 5 = -\frac{11}{4}$

✓ **FINAL ANSWER**

$x = 3,\ y = 4$ and $x = \frac{3}{4},\ y = -\frac{11}{4}$

Question 23

5 marks | Differentiation & Turning Points

23 A particle is moving along a straight line that passes through the fixed point O

The displacement, s metres, of the particle from O at time t seconds is given by

$$s = 15t^2 - t^3 + 12$$

Find the maximum velocity of the particle where $0 < t < 11$
Show clear algebraic working.

..... m/s

(Total for Question 23 is 5 marks)

1 **Velocity**

$$v = \frac{ds}{dt} = 30t - 3t^2$$

2 **Maximum when dv/dt = 0**

$$\frac{dv}{dt} = 30 - 6t = 0 \Rightarrow t = 5 \quad \left(\frac{d^2v}{dt^2} = -6 < 0, \text{ a maximum}\right)$$

3 **Maximum velocity**

$$v = 30(5) - 3(5)^2 = 75$$

✓ **FINAL ANSWER**

75 m/s

Question 25

6 marks | Sequences

25 Here are the first four terms of an arithmetic series.

$$(k + 2) \qquad (k + 5) \qquad (k + 8) \qquad (k + 11)$$

The sum of the first $2n$ terms of the series is 4 times the sum of the first n terms of the series.

Work out the numerical value of the 100th term of the series.
Show your working clearly.

(Total for Question 25 is 6 marks)

1 First term and difference

$a = k + 2,\ d = 3.$

2 Use the sum formula

$$\frac{2n}{2}\left[2a + (2n-1)3\right] = 4 \times \frac{n}{2}\left[2a + (n-1)3\right]$$

3 Simplify (divide by n)

$$2a + 6n - 3 = 4a + 6n - 6 \Rightarrow 2a = 3 \Rightarrow a = 1.5,\ k = -\tfrac{1}{2}$$

4 100th term

$$a + 99d = 1.5 + 99(3) = 298.5$$

✓ **FINAL ANSWER**

298.5