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Elite Mathematics
Pearson Edexcel International GCSE

IGCSE LINEAR · 4MA1

4MA1/2HR June 2025 Worked Solutions

June 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

4MA1/2HR June 2025

June 2025

26	100	2 h
questions	marks	exam time

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

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Question 1

5 marks | Linear Equations

1 (a) Factorise fully $18c - 45cd$

.....

(2)

(b) Solve $\frac{5 - 2x}{6} = 3x - 4$

Show clear algebraic working.

$x =$ .....

(3)

(Total for Question 1 is 5 marks)

WORKED SOLUTION

Question 1 · 4MA1/2HR June 2025

1 **(a)**

(a)

$$18c - 45cd = 9c(2 - 5d)$$

2 **(b)**

(b)

$$\frac{5 - 2x}{6} = 3x - 4$$

$$5 - 2x = 18x - 24$$

$$29 = 20x$$

$$x = \frac{29}{20}$$

FINAL ANSWER

(a) $9c(2 - 5d)$, (b) $x = \frac{29}{20}$

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Question 2

3 marks | Prime Factors, HCF & LCM

2 Write 1400 as a product of powers of its prime factors.
Show your working clearly.

(Total for Question 2 is 3 marks)

WORKED SOLUTION

Question 2 · 4MA1/2HR June 2025

1 Find the LCM

$$1400 = 14 \times 100$$

$$1400 = (2 \times 7)(2^2 \times 5^2)$$

$$1400 = 2^3 \times 5^2 \times 7$$

FINAL ANSWER

$2^3 \times 5^2 \times 7$

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Question 3

3 marks | Simultaneous Equations

3 Solve the simultaneous equations

$$3x + 2y = 10$$
$$3x - 4y = 16$$

Show clear algebraic working.

$x =$ .....

$y =$ .....

(Total for Question 3 is 3 marks)

WORKED SOLUTION

Question 3 · 4MA1/2HR June 2025

1 Solve simultaneous equations

$$3x + 2y = 10$$

$$3x - 4y = 16$$

2 Solve simultaneous equations

Subtract the second equation from the first:

$$6y = -6$$

$$y = -1$$

3 Solve simultaneous equations

Substitute into $3x + 2y = 10$:

$$3x + 2(-1) = 10$$

$$3x = 12$$

$$x = 4$$

FINAL ANSWER

$x = 4,\ y = -1.$

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Question 4

5 marks | Reverse Percentages

4 Joshua is going to cover a floor with tiles for a customer.
The area of the floor is 45 m^2

Joshua buys one box of tiles for each 1.5 m^2 of floor area.
Each box of tiles costs £64

Joshua also buys 5 bags of tile adhesive.
Each bag of tile adhesive costs £12

Joshua charges the customer £3000

Work out his percentage profit.
Give your answer correct to one decimal place.

..... %

(Total for Question 4 is 5 marks)

WORKED SOLUTION

Question 4 · 4MA1/2HR June 2025

1 Number of boxes of tiles

Number of boxes of tiles:

$$\frac{45}{1.5} = 30$$

2 Cost of tiles

Cost of tiles:

$$30 \times 64 = 1920$$

3 Cost of adhesive

Cost of adhesive:

$$5 \times 12 = 60$$

4 Total cost

Total cost:

$$1920 + 60 = 1980$$

5 **Profit**

Profit:

$$3000 - 1980 = 1020$$

6 **Percentage profit**

Percentage profit:

$$\frac{1020}{1980} \times 100 = 51.515\ldots\% $$

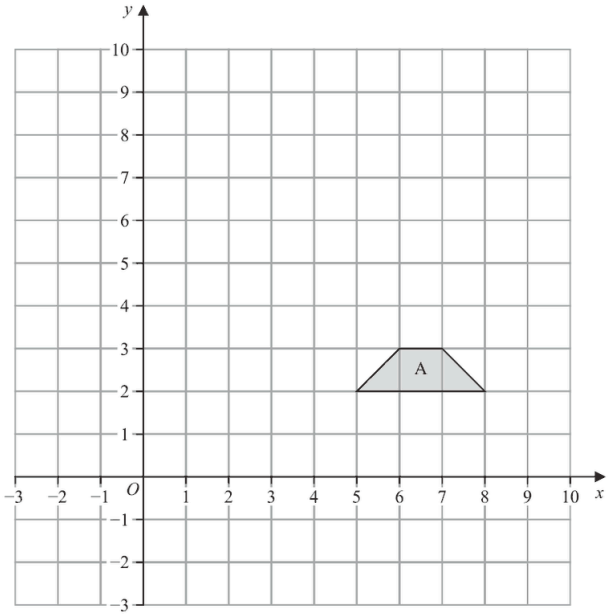
✓ **FINAL ANSWER**

51.5%

Question 5

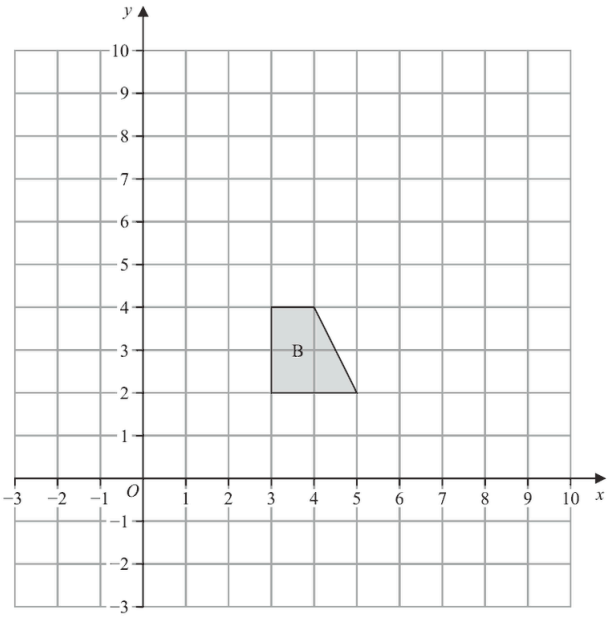
4 marks | Transformations

5



(a) On the grid above, reflect shape **A** in the line $y = x$

(2)



(b) On the grid above, enlarge shape **B** by scale factor 2 with centre (1, 1)

(2)

(Total for Question 5 is 4 marks)

1

(a) Reflection in swaps each

(a) Reflection in $y = x$ swaps each coordinate:

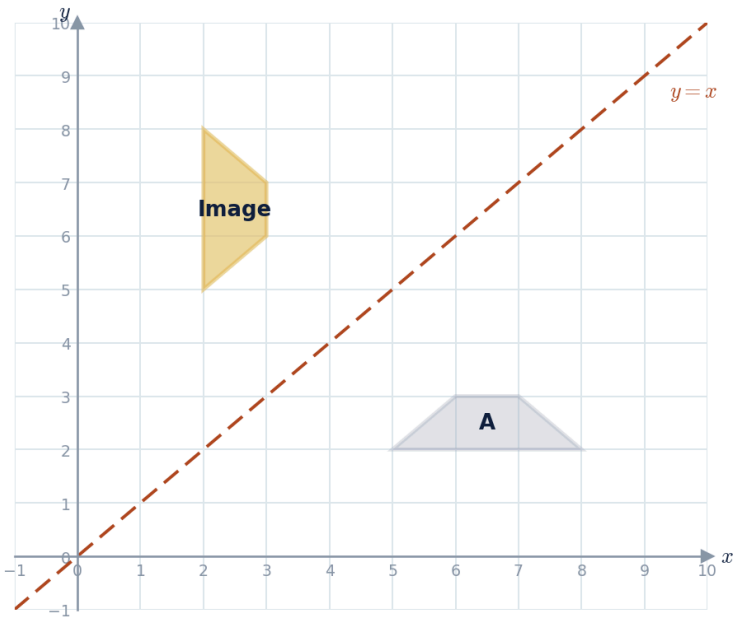
$$(x, y) \mapsto (y, x)$$

2

The image of has vertices

The image of A has vertices

$$(2, 5),\ (2, 8),\ (3, 7),\ (3, 6)$$



3

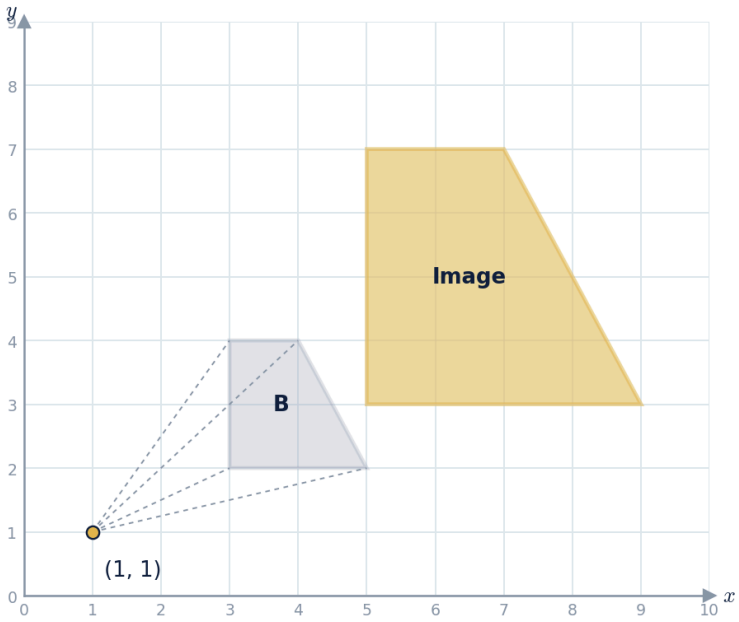
(b) Enlarge by scale factor

(b) Enlarge B by scale factor 2 from centre $(1, 1)$.

4 **The vertices become**

The vertices become

$$(5,3),\ (9,3),\ (7,7),\ (5,7)$$



FINAL ANSWER

(a) vertices $(2,5),(2,8),(3,7),(3,6)$; (b) vertices $(5,3),(9,3),(7,7),(5,7)$.

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Question 6

5 marks | Algebraic Roots & Indices

6 (a) Write down the value of 5^0

.....

(1)

$$\frac{5^9 \times 5^{-3}}{5^{-2}} = 5^k$$

(b) Find the value of k

$k =$ .....

(2)

(c) Simplify fully $\left(2d^4e^5\right)^3$

.....

(2)

(Total for Question 6 is 5 marks)

WORKED SOLUTION

Question 6 · 4MA1/2HR June 2025

1 **Use index laws**

$$5^0 = 1$$

2 **Use index laws**

For part (b),

$$\frac{5^9 \times 5^{-3}}{5^{-2}} = 5^{9+(-3)-(-2)} = 5^8$$

3 **Use index laws**

So

$$k = 8$$

4 **Use index laws**

For part (c),

$$(2d^4e^5)^3 = 2^3 d^{4\times 3} e^{5\times 3}$$

$$= 8d^{12}e^{15}$$

FINAL ANSWER

(a) $\mathbf{1}$, (b) $\boldsymbol{k = 8}$, (c) $\boldsymbol{8d^{12}e^{15}}$.

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Question 7

2 marks | Standard & Compound Units

7 The mass of a silver coin is 48.3 g
The density of silver is 10.5 g/cm^3

Work out the volume of the silver coin.

..... cm^3

(Total for Question 7 is 2 marks)

WORKED SOLUTION

Question 7 · 4MA1/2HR June 2025

1 Use

Use

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

2 Calculate volume

So

$$\text{volume} = \frac{\text{mass}}{\text{density}} = \frac{48.3}{10.5} = 4.6$$

FINAL ANSWER

$4.6\ \text{cm}^3$.

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Question 8

3 marks | Statistics Toolkit

8 The mean of 7 numbers is 60

The mean of 3 of the numbers is 46

Work out the mean of the other 4 numbers.

(Total for Question 8 is 3 marks)

WORKED SOLUTION

Question 8 · 4MA1/2HR June 2025

1 The total of the 7

The total of the 7 numbers is

$$7 \times 60 = 420$$

2 The total of the 3

The total of the 3 numbers is

$$3 \times 46 = 138$$

3 The total of the other

The total of the other 4 numbers is

$$420 - 138 = 282$$

4 Their mean is

Their mean is

$$\frac{282}{4} = 70.5$$

✓ FINAL ANSWER

70.5.

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Question 9

3 marks | Reverse Percentages

9 In a sale, normal prices are reduced by 15%

The sale price of a dishwasher is 612 Swiss francs.

Work out the normal price of the dishwasher.

..... Swiss francs

(Total for Question 9 is 3 marks)

WORKED SOLUTION

Question 9 · 4MA1/2HR June 2025

1 **A reduction of means the**

A reduction of 15% means the sale price is 85% of the normal price.

$$0.85 \times \text{normal price} = 612$$

$$\text{normal price} = \frac{612}{0.85} = 720$$

FINAL ANSWER

720 Swiss francs

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Question 10

2 marks | Linear Graphs

10 A straight line, **L**, is parallel to the line with equation $y = 2 - 5x$
The line **L** passes through the point $(0, 6)$

Find an equation of the line **L**

(Total for Question 10 is 2 marks)

WORKED SOLUTION

Question 10 · 4MA1/2HR June 2025

1 The line has gradient

The line

$$y = 2 - 5x$$

has gradient -5.

2 A parallel line has the

A parallel line has the same gradient, so line L has form

$$y = -5x + c$$

3 Find the gradient

Line L passes through $(0, 6)$, so

$$6 = c$$

FINAL ANSWER

$y = -5x + 6$.

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Question 11

5 marks | Right-Angled Triangles - Pythagoras & Trigonometry

11 The diagram shows two triangles, ADE and CDB

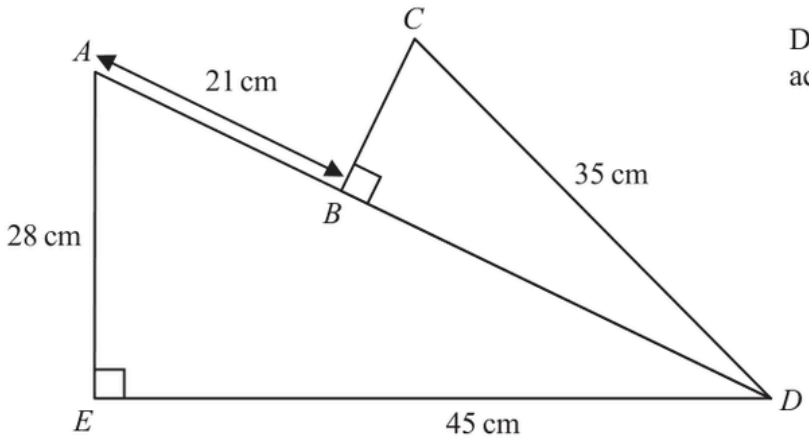


Diagram **NOT** accurately drawn

ABD is a straight line.

$AE = 28\,\text{cm}$ $ED = 45\,\text{cm}$ $AB = 21\,\text{cm}$ $CD = 35\,\text{cm}$

angle AED = angle $CBD = 90°$

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

..... cm^2

(Total for Question 11 is 5 marks)

WORKED SOLUTION

Question 11 · 4MA1/2HR June 2025

1 **Use trigonometry**

In right-angled triangle AFD,

$$AD^2 = 28^2 + 45^2$$

$$AD^2 = 2809$$

$$AD = 53$$

2 **Use trigonometry**

Since $AB = 21$,

$$BD = 53 - 21 = 32$$

3 **Use trigonometry**

In right-angled triangle CBD,

$$CB^2 = 35^2 - 32^2$$

$$CB^2 = 201$$

$$CB = \sqrt{201}$$

---

4 **Area of triangle is**

Area of triangle CDB is

$$\frac{1}{2} \times BD \times CB$$

$$\text{Area} = \frac{1}{2} \times 32 \times \sqrt{201} = 226.9\ldots$$

✓ **FINAL ANSWER**

$227\ \text{cm}^2$ to 3 significant figures.

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Question 12

3 marks | Compound Interest & Depreciation

12 Osman buys a car for \$16 000

The car depreciates at a rate of 12% each year for the first 2 years.
In the third year, the car depreciates at a rate of $x\%$

At the end of 3 years, the value of the car is \$11 461.12

Work out the value of x

(Total for Question 12 is 3 marks)

WORKED SOLUTION

Question 12 · 4MA1/2HR June 2025

1 Use compound interest

After the first 2 years,

$$16000(0.88)^2 = 12390.40$$

2 Use compound interest

In the third year, the value becomes 11461.12, so

$$12390.40\left(1 - \frac{x}{100}\right) = 11461.12$$

$$1 - \frac{x}{100} = \frac{11461.12}{12390.40} = 0.925$$

$$x = 7.5$$

FINAL ANSWER

$x = 7.5$

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Question 13

5 marks | Expanding Brackets

13 (a) Factorise $4x^2 - 25y^2$

.....

(2)

(b) Show that $4x(x + 3)(2x - 5)$ can be written in the form $ax^3 + bx^2 + cx$ where a, b and c are integers to be found.

(3)

(Total for Question 13 is 5 marks)

WORKED SOLUTION

Question 13 · 4MA1/2HR June 2025

1 **(a)**

(a)

$$4x^2 - 25y^2 = (2x - 5y)(2x + 5y)$$

2 **(b)**

(b)

$$4x(x + 3)(2x - 5)$$

3 **Factorise expression**

First,

$$(x + 3)(2x - 5) = 2x^2 + x - 15$$

4 **Factorise expression**

Then

$$4x(2x^2 + x - 15) = 8x^3 + 4x^2 - 60x$$

5 **Factorise expression**

So $a = 8$, $b = 4$, and $c = -60$.

FINAL ANSWER

(a) $(2x - 5y)(2x + 5y)$, (b) $8x^3 + 4x^2 - 60x$

Question 14

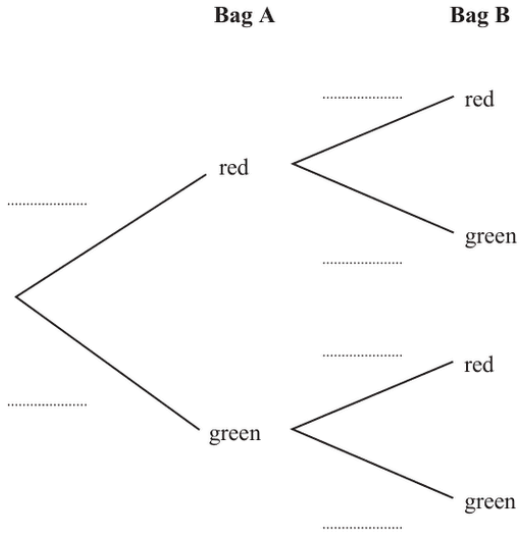
7 marks | Tree Diagrams & Conditional Probability

14 Sara has two bags, **A** and **B**

In bag **A**, there are only 5 red beads and 4 green beads.
In bag **B**, there are only 7 red beads and 3 green beads.

Sara takes at random a bead from bag **A**
She then takes at random a bead from bag **B**

(a) Use this information to complete the probability tree diagram.



(2)

(b) Work out the probability that Sara takes two red beads.

.....

(2)

Sara puts the beads back into their original bags.

Sara also has a box of beads.
In the box, there are only red beads and green beads.

When a bead is taken at random from the box, the probability that it is a green bead is $\frac{2}{11}$

Sara takes at random a bead from bag **A**
She then takes at random a bead from bag **B**
She then takes at random a bead from the box.

(c) Work out the probability that Sara takes more red beads than green beads.

.....

(3)

(Total for Question 14 is 7 marks)

1

(a) Complete the tree

Bag A: red $\frac{5}{9}$, green $\frac{4}{9}$.

Bag B (on both branches): red $\frac{7}{10}$, green $\frac{3}{10}$.

2

(b) Two red beads

$$\frac{5}{9} \times \frac{7}{10} = \frac{35}{90} = \frac{7}{18}$$

3

(c) More red than green with three beads

She needs at least two reds: RRR, RRG, RGR or GRR. The box gives red $\frac{9}{11}$, green $\frac{2}{11}$.

4

(c) Add the four cases

$$\frac{5\cdot7\cdot9 + 5\cdot7\cdot2 + 5\cdot3\cdot9 + 4\cdot7\cdot9}{9\cdot10\cdot11} = \frac{315+70+135+252}{990} = \frac{772}{990} = \frac{386}{495}$$

✓ **FINAL ANSWER**

(a) $\frac{5}{9}$, $\frac{4}{9}$; $\frac{7}{10}$, $\frac{3}{10}$ on both branches (b) $\frac{7}{18}$ (c) $\frac{386}{495}$

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Question 15

3 marks | Circle Theorems

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

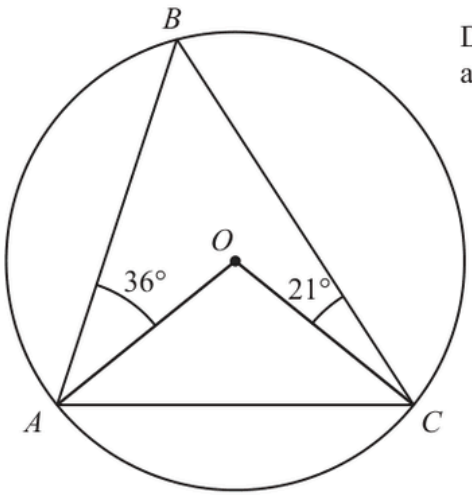


Diagram **NOT** accurately drawn

Angle $BAO = 36°$
Angle $BCO = 21°$

Work out the size of angle ACO

.....°

(Total for Question 15 is 3 marks)

WORKED SOLUTION

Question 15 · 4MA1/2HR June 2025

1 Use trigonometry

Since $OA = OB$, triangle AOB is isosceles:

$$\angle ABO = 36°$$

2 Use trigonometry

So

$$\angle AOB = 180° - 36° - 36° = 108°$$

3 Use trigonometry

Since $OB = OC$, triangle BOC is isosceles:

$$\angle OBC = 21°$$

4 **Use trigonometry**

So

$$\angle BOC = 180° - 21° - 21° = 138°$$

---

5 **Use circle theorem**

Angles around O add to $360°$:

$$\angle AOC = 360° - 108° - 138° = 114°$$

---

6 **Use trigonometry**

Since $OA = OC$,

$$\angle ACO = \frac{180° - 114°}{2} = 33°$$

✓ **FINAL ANSWER**

$33°$.

4MA1/2HR JUNE 2025

Question 16

3 marks | Algebraic Proof

16 Show that $\frac{4}{3\sqrt{5}+7}$ can be written in the form $a-\sqrt{b}$ where a and b are integers.

Show each stage of your working.

(Total for Question 16 is 3 marks)

WORKED SOLUTION

Question 16 · 4MA1/2HR June 2025

1 **Simplify surd**

$$\frac{4}{3\sqrt{5}+7} \times \frac{7-3\sqrt{5}}{7-3\sqrt{5}} = \frac{4(7-3\sqrt{5})}{49-45}$$

$$= 7-3\sqrt{5}$$

2 **Simplify surd**

Since $3\sqrt{5} = \sqrt{45}$,

$$7-3\sqrt{5} = 7-\sqrt{45}$$

✓ **FINAL ANSWER**

$7-\sqrt{45}$, so $a = 7$ and $b = 45$.

4MA1/2HR JUNE 2025

Question 17

4 marks | Rearranging Formulae

17 Make k the subject of $p = \dfrac{8k^2 + 5}{7 - 3k^2}$

(Total for Question 17 is 4 marks)

WORKED SOLUTION

Question 17 · 4MA1/2HR June 2025

1 Rearrange formula

$$p = \frac{8k^2 + 5}{7 - 3k^2}$$

$$p(7 - 3k^2) = 8k^2 + 5$$

$$7p - 5 = k^2(3p + 8)$$

$$k^2 = \frac{7p - 5}{3p + 8}$$

FINAL ANSWER

$$k = \pm\sqrt{\frac{7p-5}{3p+8}}$$

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Question 18

3 marks | Vectors

18 OAB is a triangle.

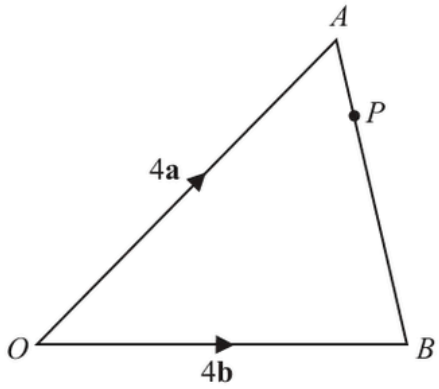


Diagram **NOT** accurately drawn

$\overrightarrow{OA} = 4\mathbf{a}$

$\overrightarrow{OB} = 4\mathbf{b}$

P is the point on AB such that $AP : PB = 1 : 3$

(a) Write down $\overrightarrow{AB}$ in terms of **a** and **b**

.....

(1)

(b) Express $\overrightarrow{OP}$ in terms of **a** and **b**
Give your answer in its simplest form.

.....

(2)

(Total for Question 18 is 3 marks)

WORKED SOLUTION

Question 18 · 4MA1/2HR June 2025

1 **Use vectors**

$$\overrightarrow{AB} = \overrightarrow{OB} - \overrightarrow{OA} = 4\mathbf{b} - 4\mathbf{a}$$

2 **Use vectors**

Since $AP : PB = 1 : 3$, point P is one quarter of the way from A to B.

$$\overrightarrow{AP} = \frac{1}{4}\overrightarrow{AB} = \frac{1}{4}(4\mathbf{b} - 4\mathbf{a}) = \mathbf{b} - \mathbf{a}$$

$$\overrightarrow{OP} = \overrightarrow{OA} + \overrightarrow{AP} = 4\mathbf{a} + \mathbf{b} - \mathbf{a} = 3\mathbf{a} + \mathbf{b}$$

FINAL ANSWER

$\overrightarrow{AB} = 4\mathbf{b} - 4\mathbf{a}$, and $\overrightarrow{OP} = 3\mathbf{a} + \mathbf{b}$.

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Question 19

3 marks | Functions

19 The functions f and g are such that

$$f(x) = 3x - 4 \text{ where } x > 2$$

$$g(x) = \frac{x}{2x+1}$$

(a) State the value of x that cannot be included in any domain of g

.....

(1)

(b) Find $gf(x)$
Give your answer in its simplest form.

$gf(x) =$ .....

(2)

(Total for Question 19 is 3 marks)

WORKED SOLUTION

Question 19 · 4MA1/2HR June 2025

1 **Evaluate fraction**

$$f(x) = 3x - 4, \qquad g(x) = \frac{x}{2x+1}$$

2 **(a) The denominator of cannot**

(a) The denominator of g cannot be zero:

$$2x + 1 = 0$$

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

3 **(b)**

(b)

$$gf(x) = g(f(x))$$

$$gf(x) = \frac{3x-4}{2(3x-4)+1}$$

$$gf(x) = \frac{3x-4}{6x-7}$$

FINAL ANSWER

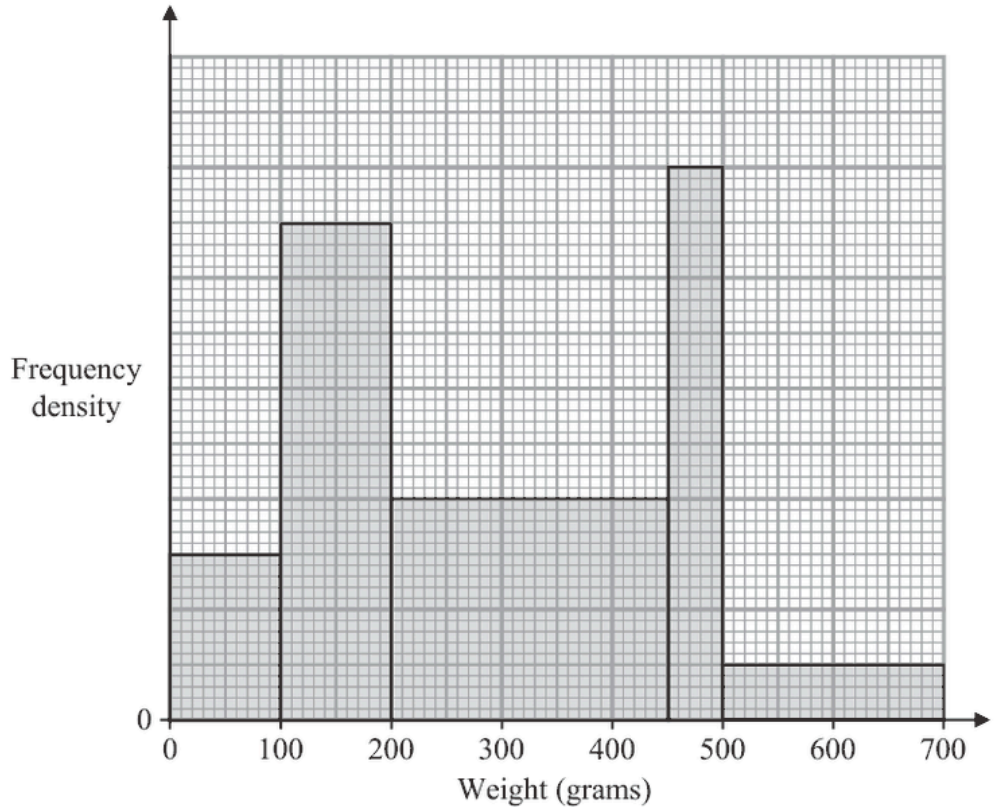
Excluded value $-\frac{1}{2}$, and $gf(x) = \dfrac{3x-4}{6x-7}$.

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Question 20

4 marks | Histograms

20 The histogram gives some information about the weights, in grams, of some books.



75 books weigh less than 100 grams.

A book is chosen at random.

Find an estimate for the probability that this book weighs between 400 grams and 600 grams.

(Total for Question 20 is 4 marks)

WORKED SOLUTION

Question 20 · 4MA1/2HR June 2025

1 **Use histogram**

For a histogram,

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

2 **Use frequency table**

For books weighing less than 100 g, the frequency is 75 and the class width is 100, so

$$\text{frequency density} = \frac{75}{100} = 0.75$$

3 **Use histogram**

Using this scale from the histogram, the frequency densities are:

$$0.75,\ 2.25,\ 1.0,\ 2.5,\ 0.25$$

4 **The total number of books**

The total number of books is

$$(100)(0.75) + (100)(2.25) + (250)(1.0) + (50)(2.5) + (200)(0.25)$$

$$= 75 + 225 + 250 + 125 + 50 = 725$$

5 **Calculate value**

For weights between 400 g and 600 g:

$$(50)(1.0) + (50)(2.5) + (100)(0.25)$$

$$= 50 + 125 + 25 = 200$$

6 **Calculate probability**

So the probability is

$$\frac{200}{725} = \frac{8}{29}$$

✓ **FINAL ANSWER**

$\frac{8}{29}$ or 0.276 to 3 significant figures

4MA1/2HR JUNE 2025

Question 21

3 marks | Inequalities (Solving & Graphing)

21 Solve the inequality $2x^2 - 7x - 15 > 0$

Show clear algebraic working.

(Total for Question 21 is 3 marks)

WORKED SOLUTION

Question 21 · 4MA1/2HR June 2025

1 Solve inequality

$$2x^2 - 7x - 15 > 0$$

2 Factorise

Factorise:

$$2x^2 - 7x - 15 = (2x + 3)(x - 5)$$

3 The critical values are

The critical values are

$$x = -\frac{3}{2} \quad \text{and} \quad x = 5$$

4 The quadratic is greater than

The quadratic is greater than 0 outside the roots.

FINAL ANSWER

$x < -\frac{3}{2}$ or $x > 5$

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Question 22

5 marks | Differentiation & Turning Points

22 The diagram shows a solid cuboid.

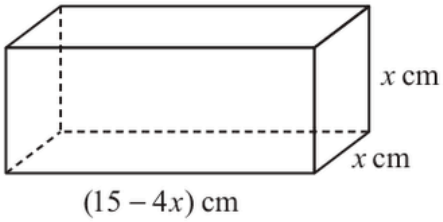


Diagram **NOT** accurately drawn

The volume of the cuboid is V cm^3

Find the maximum value of V

(Total for Question 22 is 5 marks)

WORKED SOLUTION

Question 22 · 4MA1/2HR June 2025

1 **The cuboid has dimensions**

The cuboid has dimensions

$$x, \quad x, \quad 15 - 4x$$

2 **Calculate value**

So

$$V = x^2(15 - 4x)$$

$$V = 15x^2 - 4x^3$$

3 **Differentiate**

Differentiate:

$$\frac{dV}{dx} = 30x - 12x^2$$

4 **Calculate value**

At a maximum,

$$30x - 12x^2 = 0$$

$$6x(5 - 2x) = 0$$

5 **The useful value is**

The useful value is

$$x = 2.5$$

---

6 **Calculate volume**

Now substitute into the volume:

$$V = (2.5)^2(15 - 4(2.5))$$

$$V = 6.25 \times 5$$

$$V = 31.25$$

✓ **FINAL ANSWER**

$31.25\ \text{cm}^3$

4MA1/2HR JUNE 2025

Question 23

3 marks | 3D Pythagoras & Trigonometry

23 The diagram shows a triangular prism, $ABCDEF$, with a horizontal rectangular base $ABCD$

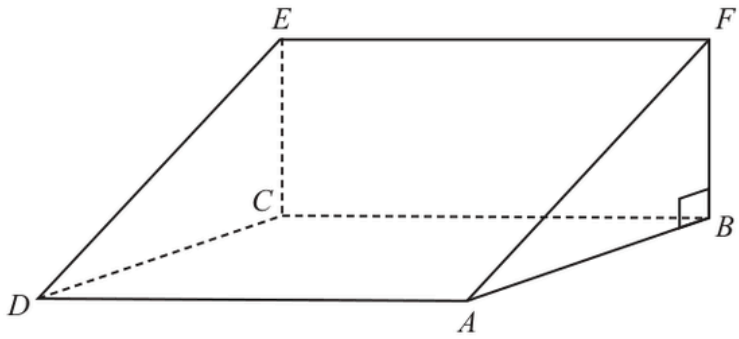


Diagram **NOT** accurately drawn

M is the midpoint of the line AC

$AC = 40\,\text{cm}$ angle $CAE = 35°$ angle $ABF = 90°$

Work out the size of angle CME
Give your answer correct to 3 significant figures.

.....°

(Total for Question 23 is 3 marks)

WORKED SOLUTION

Question 23 · 4MA1/2HR June 2025

1 Use trigonometry

$$AC = 40$$

2 The point is vertically above

The point E is vertically above C, so triangle ACE is right-angled at C.

$$\angle CAE = 35°$$

$$\tan 35° = \frac{CE}{AC}$$

$$CE = 40 \tan 35°$$

3 **Find the midpoint**

Since M is the midpoint of AC,

$$CM = 20$$

---

4 **Use trigonometry**

In right triangle CME,

$$\tan \angle CME = \frac{CE}{CM}$$

$$\tan \angle CME = \frac{40 \tan 35°}{20}$$

$$\tan \angle CME = 2 \tan 35°$$

$$\angle CME = 54.5°$$

✓ **FINAL ANSWER**

$54.5°$

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Question 24

6 marks | Linear Graphs

24 PQ is a straight line drawn on a square grid, with a scale of 1 cm for 1 unit on each axis.

P has coordinates $(-5,\ a)$ and Q has coordinates $(7,\ 3a)$ where $a > 0$

The length of PQ is $4\sqrt{10}$ cm

Find an equation of the perpendicular bisector of PQ
Give your answer in the form $y = mx + c$ where m and c are integers.

(Total for Question 24 is 6 marks)

WORKED SOLUTION

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1 Calculate value

$$P = (-5, a), \qquad Q = (7, 3a)$$

2 Simplify surd

The length of PQ is $4\sqrt{10}$, so

$$\sqrt{(7-(-5))^2 + (3a-a)^2} = 4\sqrt{10}$$

$$\sqrt{12^2 + (2a)^2} = 4\sqrt{10}$$

3 Square both sides

Square both sides:

$$144 + 4a^2 = 160$$

$$4a^2 = 16$$

$$a^2 = 4$$

4 Solve inequality

Since $a > 0$,

$$a = 2$$

5 **Calculate value**

So

$$P = (-5, 2), \qquad Q = (7, 6)$$

---

6 **The midpoint of is**

The midpoint of PQ is

$$\left(\frac{-5+7}{2}, \frac{2+6}{2}\right) = (1, 4)$$

---

7 **The gradient of is**

The gradient of PQ is

$$\frac{6-2}{7-(-5)} = \frac{4}{12} = \frac{1}{3}$$

---

8 **Find the gradient**

So the gradient of the perpendicular bisector is

$$-3$$

---

9 **Calculate value**

Using point $(1, 4)$:

$$y - 4 = -3(x - 1)$$

$$y = -3x + 7$$

✓ **FINAL ANSWER**

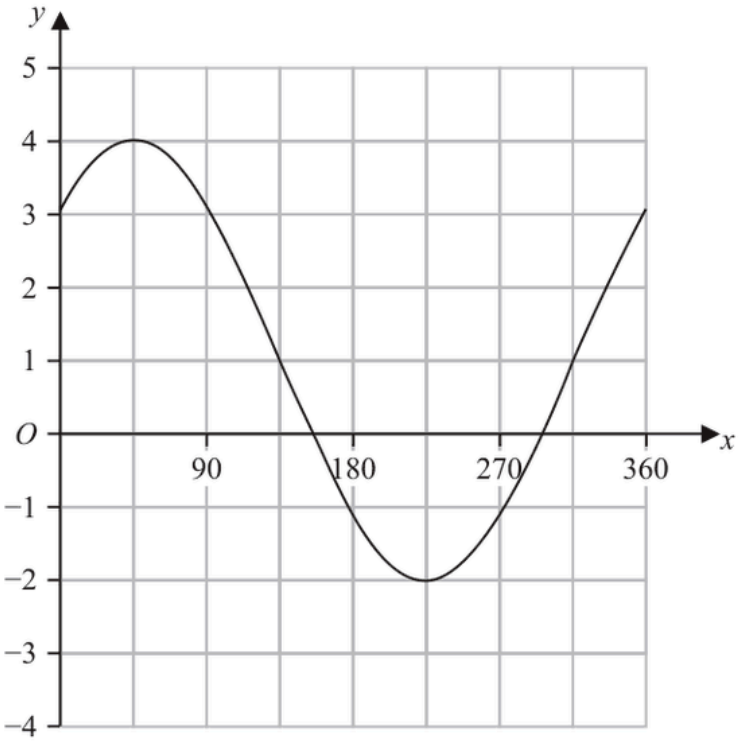
$$\boxed{y = -3x + 7}$$

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Question 25

3 marks | Graphs of Functions

25 The graph of $y = a\sin(x + b)^\circ + c$ for $0 \leqslant x \leqslant 360$ is drawn on the grid below.



Find a suitable value for a, for b and for c

$a =$ .....

$b =$ .....

$c =$ .....

(Total for Question 25 is 3 marks)

WORKED SOLUTION

Question 25 · 4MA1/2HR June 2025

1 **Read the graph**

From the graph,

$$\text{maximum} = 4$$

$$\text{minimum} = -2$$

2 **The amplitude is**

The amplitude is

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

3 **The centre line is**

The centre line is

$$c = \frac{4 + (-2)}{2} = 1$$

4 **Use trigonometry**

The maximum is about $45°$. For a sine graph, a maximum happens when the angle inside the sine is $90°$, so

$$45 + b = 90$$

$$b = 45$$

✓ **FINAL ANSWER**

$a = 3,\ b = 45,\ c = 1$

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Question 26

5 marks | Volume & Surface Area

26 The diagram shows a solid hemisphere, H

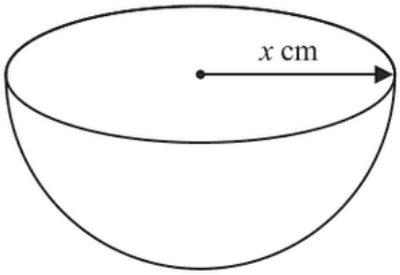


Diagram **NOT** accurately drawn

The radius of H is x cm
The volume of H is 6174π cm^3

A bowl is made by removing a solid hemisphere from H such that the uniform thickness of the bowl is 2 cm

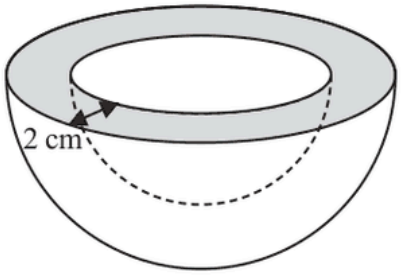


Diagram **NOT** accurately drawn

Work out the **total** surface area of the bowl.
Give your answer in terms of π

..... cm^2

(Total for Question 26 is 5 marks)

WORKED SOLUTION

Question 26 · 4MA1/2HR June 2025

1 **The volume of a hemisphere**

The volume of a hemisphere is

$$\frac{2}{3}\pi r^3$$

2 **Evaluate fraction**

For the original hemisphere H,

$$\frac{2}{3}\pi x^3 = 6174\pi$$

3 **Cancel**

Cancel π:

$$\frac{2}{3}x^3 = 6174$$

$$x^3 = 9261$$

$$x = 21$$

4 **The outer radius of the**

The outer radius of the bowl is 21 cm.

5 **Calculate value**

The thickness is 2 cm, so the inner radius is

$$21 - 2 = 19$$

6 **Total surface area of the**

Total surface area of the bowl is:

7 **outer curved hemisphere inner curved**

- outer curved hemisphere
- inner curved hemisphere
- flat annular rim

8 **Outer curved surface area**

Outer curved surface area:

$$2\pi(21)^2 = 882\pi$$

9 **Inner curved surface area**

Inner curved surface area:

$$2\pi(19)^2 = 722\pi$$

10 **Flat rim area**

Flat rim area:

$$\pi(21^2 - 19^2) = 80\pi$$

---

11 **Total**

Total:

$$882\pi + 722\pi + 80\pi = 1684\pi$$

✓ **FINAL ANSWER**

$\boxed{1684\pi \text{ cm}^2}$