Elite Mathematics
Pearson Edexcel International GCSE

IGCSE LINEAR · 4MA1

4MA1/1H November 2024 Worked Solutions

November 2024 paper rebuilt with the worked solution after each question.

25	2020–2026	Single-paper solutions
paper questions	52 past papers	checked by Dr Eslam



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PAST PAPER

4MA1/1H November 2024

November 2024

25	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 | Averages from Frequency Tables

1 The table shows some information about the hourly rates of pay of 60 workers.

Hourly rate of pay (p dollars)	Frequency
$10 < p \leqslant 15$	18
$15 < p \leqslant 20$	16
$20 < p \leqslant 25$	14
$25 < p \leqslant 30$	8
$30 < p \leqslant 35$	4

(a) Write down the modal class.

.....

(1)

(b) Work out an estimate for the mean hourly rate of pay of the 60 workers.

..... dollars

(4)

(Total for Question 1 is 5 marks)

WORKED SOLUTION

Question 1 · 4MA1/1H November 2024

1 **The modal class is the**

The modal class is the class with the greatest frequency:

$$10 < p \leq 15$$

2 **Use midpoints**

Use midpoints $12.5, 17.5, 22.5, 27.5, 32.5$.

$$12.5(18) + 17.5(16) + 22.5(14) + 27.5(8) + 32.5(4) = 1170$$

$$\text{estimated mean} = \frac{1170}{60} = 19.5$$

FINAL ANSWER

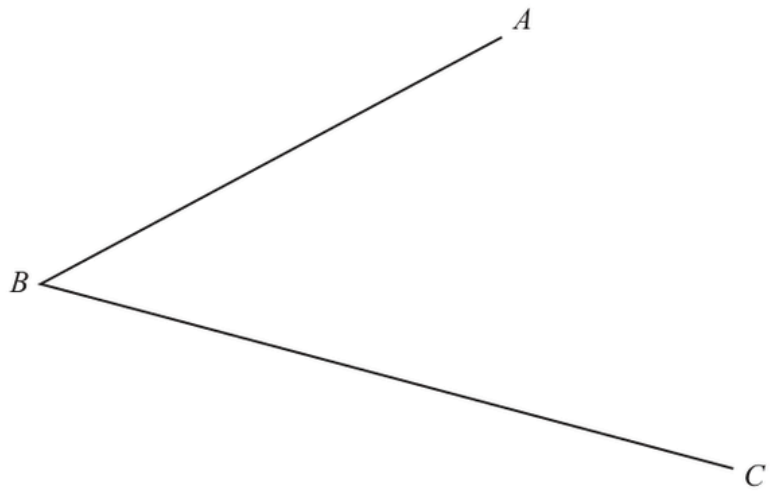
modal class $10 < p \leq 15$, estimated mean 19.5 dollars.

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Question 2

2 marks | Constructions & Loci

2 Use ruler and compasses only to construct the bisector of angle ABC
You must show all your construction lines.

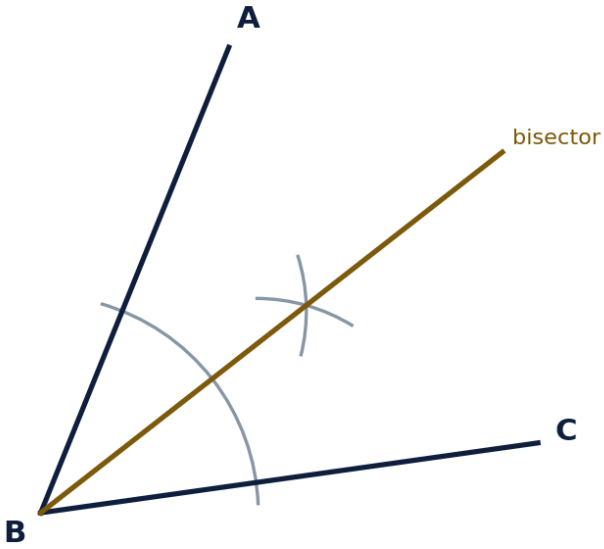


(Total for Question 2 is 2 marks)

1 Construction answer

To construct the bisector of angle ABC:

1. Draw an arc centred at B cutting both arms of the angle.
2. From the two cut points, draw equal arcs inside the angle.
3. Draw the line from B through the intersection of these arcs.



FINAL ANSWER

The constructed ray is the angle bisector of ABC.

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Question 3

6 marks | Linear Equations

3 (a) Simplify $\left(p^3\right)^5$

.....

(1)

(b) Expand and simplify $2n(4n+3)+n(n-4)$

.....

(2)

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

Show clear algebraic working.

$x =$ .....

(3)

(Total for Question 3 is 6 marks)

WORKED SOLUTION

Question 3 · 4MA1/1H November 2024

1 **(a)**

(a) $(p^3)^5 = p^{15}$.

2 **(b)**

(b)

$$2n(4n+3)+n(n-4) = 8n^2+6n+n^2-4n = 9n^2+2n$$

3 **(c)**

(c)

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

$$2x+5 = 12-3x$$

$$5x = 7$$

FINAL ANSWER

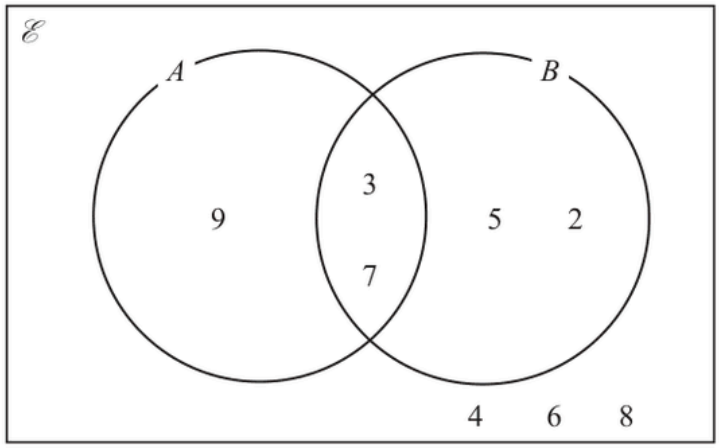
(a) p^{15}, (b) $9n^2 + 2n$, (c) $x = \frac{7}{5}$

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Question 4

3 marks | Set Notation & Venn Diagrams

4 Here is a Venn diagram.



(a) List the members of the set B

.....

(1)

(b) List the members of the set $A \cap B$

.....

(1)

(c) List the members of the set A'

.....

(1)

(Total for Question 4 is 3 marks)

WORKED SOLUTION

Question 4 · 4MA1/1H November 2024

1 **The members of are all**

The members of B are all the numbers inside circle B, including the overlap:

$$B = \{2, 3, 5, 7\}$$

2 **The members of are the**

The members of $A \cap B$ are the numbers in both circles:

$$A \cap B = \{3, 7\}$$

3 Calculate statistic

A' means all the numbers in the universal set that are not in A:

$$A' = \{2, 4, 5, 6, 8\}$$

FINAL ANSWER

(a) $\{2, 3, 5, 7\}$, (b) $\{3, 7\}$, (c) $\{2, 4, 5, 6, 8\}$

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Question 5

4 marks | Volume & Surface Area

5 The diagram shows a cylinder.

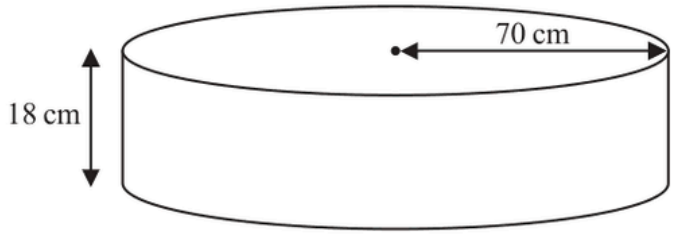


Diagram **NOT** accurately drawn

The radius of the cylinder is 70 cm
The height of the cylinder is 18 cm

Work out the volume of the cylinder.
Give your answer in litres correct to the nearest litre.

..... litres

(Total for Question 5 is 4 marks)

WORKED SOLUTION

Question 5 · 4MA1/1H November 2024

1 Calculate area

$$V = \pi r^2 h = \pi(70)^2(18)$$

$$V = 277088.472\ldots \text{ cm}^3$$

2 Calculate area

Since $1000 \text{ cm}^3 = 1$ litre,

$$277088.472\ldots \text{ cm}^3 = 277.088\ldots \text{ litres}$$

FINAL ANSWER

277 litres.

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Question 6

2 marks | Prime Factors, HCF & LCM

6 $A = 2^3 \times 5^4 \times 7 \times 11$

$B = 2^2 \times 5^2 \times 7^2$

$C = 2^2 \times 5^3 \times 7^4$

Find the highest common factor (HCF) of A, B and C
Write your answer as a product of prime factors.

(Total for Question 6 is 2 marks)

WORKED SOLUTION

Question 6 · 4MA1/1H November 2024

1 Find the LCM

$$A = 2^3 \times 5^4 \times 7 \times 11$$

$$B = 2^2 \times 5^2 \times 7^2$$

$$C = 2^2 \times 5^3 \times 7^4$$

2 Find the LCM

The HCF of A, B, and C uses the smallest power of each prime common to all three.

$$2^2, \quad 5^2, \quad 7$$

3 Find the LCM

The prime 11 is not in all three numbers, so it is not included.

$$\text{HCF} = 2^2 \times 5^2 \times 7$$

✓ **FINAL ANSWER**

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

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Question 7

4 marks | Percentages

7 Shop **A** and Shop **B** have offers for buying the same type of laptop.

The normal price of the laptop in Shop **A** is different to the normal price of the laptop in Shop **B**

Shop A	**Shop B**
Our normal price £475 Get 16% off our normal price	Get 15% off our normal price Only pay £408

Which shop gives more money off their normal price?
Show your working clearly.

(Total for Question 7 is 4 marks)

WORKED SOLUTION

Question 7 · 4MA1/1H November 2024

1 Shop A discount

Shop A discount:

$$16\% \text{ of } 475 = 0.16 \times 475 = 76$$

2 Calculate percentage

Shop B: 408 euros is 85% of the normal price.

$$\text{normal price} = 408 \div 0.85 = 480$$

3 Shop B discount

Shop B discount:

$$480 - 408 = 72$$

4 Calculate percentage

Since

$$76 > 72$$

5

Shop A gives the greater

Shop A gives the greater discount.

✓ **FINAL ANSWER**

Shop A gives the greater discount.

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Question 8

6 marks | Inequalities (Solving & Graphing)

8 (a) (i) Factorise $x^2 + 5x - 24$

.....

(2)

(ii) Hence, solve $x^2 + 5x - 24 = 0$

.....

(1)

(b) Solve the inequality $3y + 5 > 7y - 10$

Show clear algebraic working.

.....

(3)

(Total for Question 8 is 6 marks)

WORKED SOLUTION

Question 8 · 4MA1/1H November 2024

1 **(a)(i)**

(a)(i)

$$x^2 + 5x - 24 = (x + 8)(x - 3)$$

2 **Solve quadratic equation**

(a)(ii) $x = -8$ or $x = 3$.

3 **(b)**

(b)

$$3y + 5 > 7y - 10$$

$$15 > 4y$$

$$y < \frac{15}{4}$$

FINAL ANSWER

$(x + 8)(x - 3)$, $x = -8$ or $x = 3$, $y < \frac{15}{4}$

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Question 9

3 marks | Standard Form

9 (a) Write 8.4×10^{-5} as an ordinary number.

.....

(1)

(b) Work out $(6.5 \times 10^{-40}) \times (8 \times 10^{185})$
Give your answer in standard form.

.....

(2)

(Total for Question 9 is 3 marks)

WORKED SOLUTION

Question 9 · 4MA1/1H November 2024

1 Convert standard form

$$8.4 \times 10^{-5} = 0.000084$$

2 Convert standard form

For part (b),

$$(6.5 \times 10^{-40})(8 \times 10^{185}) = 52 \times 10^{145}$$

3 Write this in standard form

Write this in standard form:

$$52 \times 10^{145} = 5.2 \times 10^{146}$$

✓ **FINAL ANSWER**

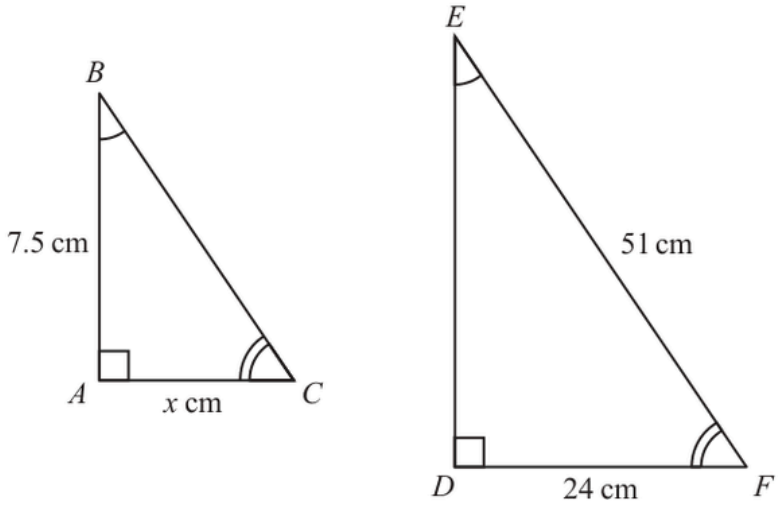
(a) 0.000084, (b) 5.2×10^{146}

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Question 10

5 marks | Similar Shapes

10 Here are two similar triangles.



Diagrams **NOT** accurately drawn

Work out the value of x
Show your working clearly.

$x =$ .....

(Total for Question 10 is 5 marks)

WORKED SOLUTION

Question 10 · 4MA1/1H November 2024

1 **Use trigonometry**

In the larger triangle,

$$DE^2 = 51^2 - 24^2$$

$$DE = 45$$

2 **The scale factor from the**

The scale factor from the large triangle to the small triangle is

$$\frac{7.5}{45} = \frac{1}{6}$$

3 Evaluate fraction

So

$$x = 24 \times \frac{1}{6} = 4$$

FINAL ANSWER

$x = 4$.

Question 11

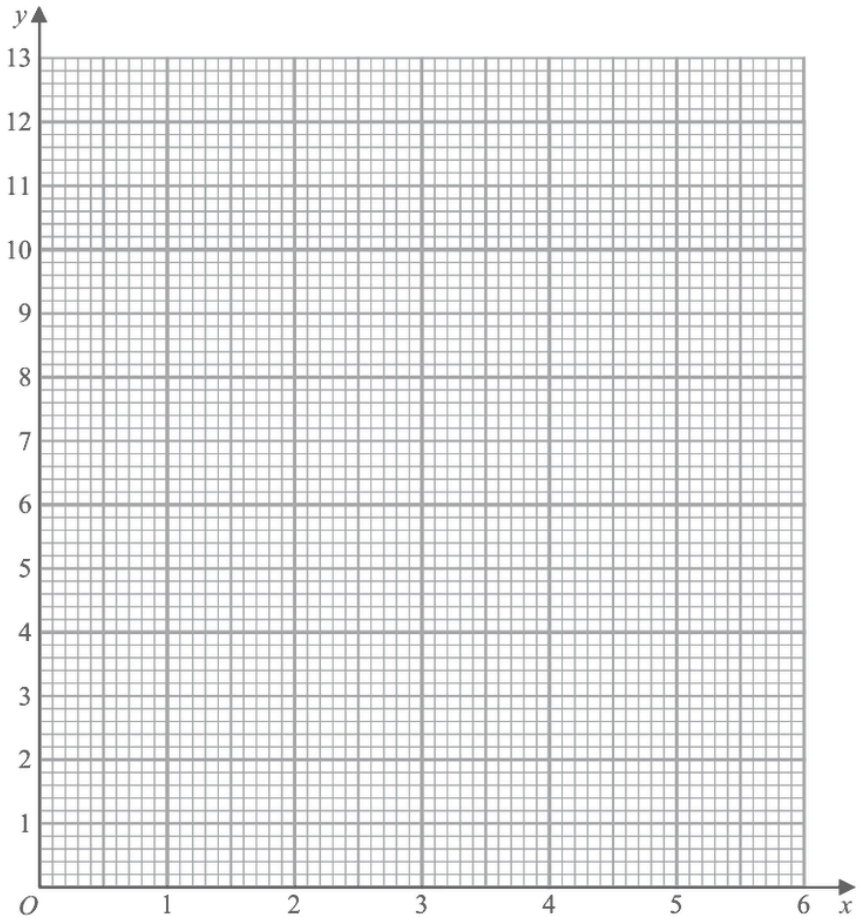
4 marks | Graphs of Functions

11 (a) Complete the table of values for $y = 2\left(x + \frac{1}{x}\right)$

x	0.5	1	2	3	4	5	6
y			5	6.7			12.3

(2)

(b) On the grid, draw the graph of $y = 2\left(x + \frac{1}{x}\right)$ for $0.5 \leqslant x \leqslant 6$



(2)

(Total for Question 11 is 4 marks)

1 Read the graph

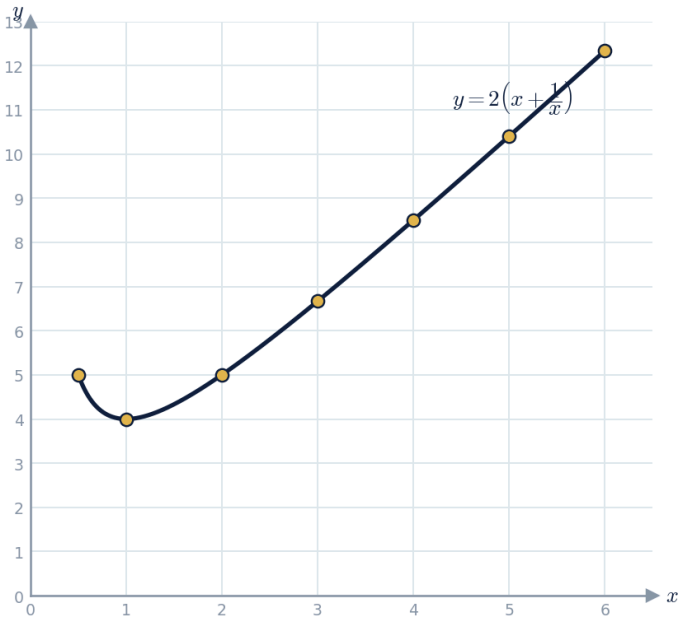
$$y = 2\left(x + \frac{1}{x}\right)$$

2 The completed table is

The completed table is:

x	0.5	1	2	3	4	5	6
y	5	4	5	6.7	8.5	10.4	12.3

3 Plot the points and join them with a smooth curve.



FINAL ANSWER

Missing values are $5, 4, 8.5, 10.4$.

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Question 12

4 marks | Right-Angled Triangles - Pythagoras & Trigonometry

12 ABC is a right-angled triangle.
D is a point on BC

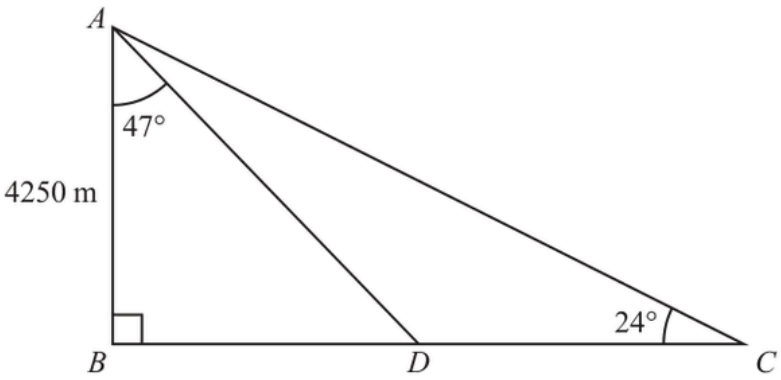


Diagram **NOT** accurately drawn

$AB = 4250$ m angle $BAD = 47°$ angle $BCA = 24°$

Work out the length of DC
Give your answer correct to the nearest integer.

..... m

(Total for Question 12 is 4 marks)

WORKED SOLUTION

Question 12 · 4MA1/1H November 2024

1 **Use trigonometry**

In triangle ABD,

$$\tan 47° = \frac{BD}{4250}$$

$$BD = 4250 \tan 47° = 4557.567\ldots$$

2 **Use trigonometry**

In triangle ABC,

$$\tan 24^\circ = \frac{4250}{BC}$$

$$BC = \frac{4250}{\tan 24^\circ} = 9545.656\ldots$$

$$DC = BC - BD = 4988.089\ldots$$

FINAL ANSWER

$4988\ \text{m}$.

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Question 13

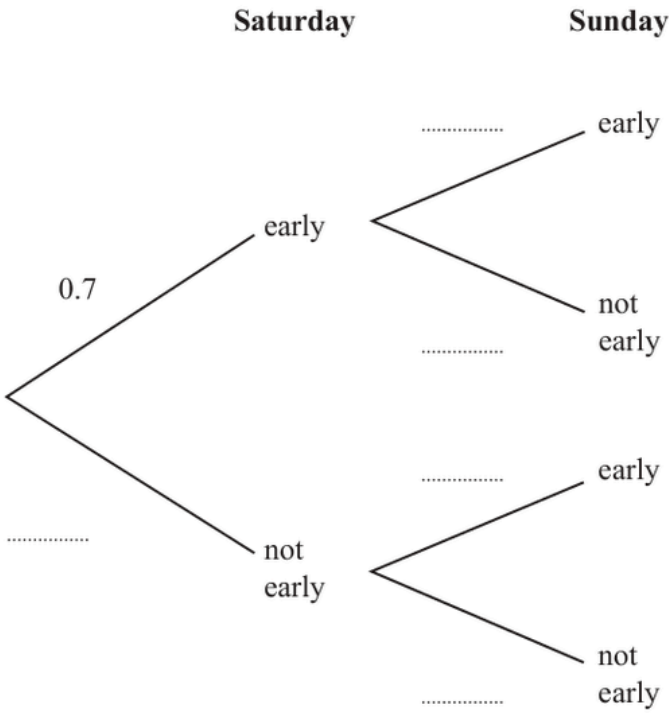
4 marks | Tree Diagrams & Conditional Probability

13 The probability that Thomas gets to work early on Saturday is 0.7

If Thomas gets to work early on Saturday, the probability that he will get to work early on Sunday is 0.9

If Thomas does **not** get to work early on Saturday, the probability that he will get to work early on Sunday is 0.6

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



(2)

(b) Work out the probability that Thomas gets to work early on both Saturday and Sunday.

.....

(2)

(Total for Question 13 is 4 marks)

WORKED SOLUTION

Question 13 · 4MA1/1H November 2024

1 **(a) Complete the tree**

Saturday: not early 0.3.

After early: Sunday early 0.9, not early 0.1. After not early: Sunday early 0.6, not early 0.4.

2 (b) Early on both days

$$0.7 \times 0.9 = 0.63$$

FINAL ANSWER

(a) 0.3; $0.9, 0.1$; $0.6, 0.4$ (b) 0.63

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Question 14

3 marks | Direct & Inverse Proportion

14 B is inversely proportional to the square of d

$B = 0.25$ when $d = 12$

Find a formula for B in terms of d

(Total for Question 14 is 3 marks)

WORKED SOLUTION

Question 14 · 4MA1/1H November 2024

1 Find inverse function

B is inversely proportional to d^2, so

$$B = \frac{k}{d^2}$$

2 Use when

Use $B = 0.25$ when $d = 12$:

$$0.25 = \frac{k}{12^2}$$

$$k = 0.25 \times 144 = 36$$

3 Find inverse function

Therefore

$$B = \frac{36}{d^2}$$

FINAL ANSWER

$B = \frac{36}{d^2}$.

4MA1/1H NOVEMBER 2024

Question 15

3 marks | Expanding Brackets

15 Write $3x(2x-1)(5x+4)$ in the form ax^3+bx^2+cx where a, b and c are integers.

(Total for Question 15 is 3 marks)

WORKED SOLUTION

Question 15 · 4MA1/1H November 2024

1 Expand brackets

$$3x(2x-1)(5x+4)$$

2 Expand brackets

First expand the two brackets:

$$(2x-1)(5x+4) = 10x^2+8x-5x-4$$

$$= 10x^2+3x-4$$

3 Expand brackets

Now multiply by $3x$:

$$3x(10x^2+3x-4) = 30x^3+9x^2-12x$$

FINAL ANSWER

$30x^3+9x^2-12x$

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Question 16

4 marks | Circles, Arcs & Sectors

16 $OAPB$ is a sector of a circle, centre O

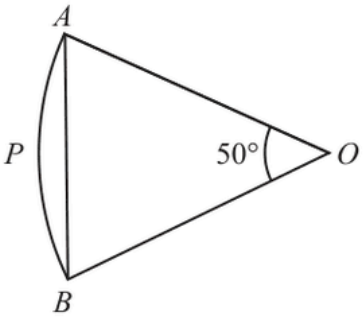


Diagram **NOT** accurately drawn

Angle $AOB = 50°$

Area of triangle $OAB = 120\ \text{cm}^2$

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

..... cm^2

(Total for Question 16 is 4 marks)

WORKED SOLUTION

Question 16 · 4MA1/1H November 2024

1 Use trigonometry

For triangle OAB,

$$120 = \frac{1}{2}r^2 \sin 50°$$

$$r^2 = \frac{240}{\sin 50°}$$

2 Area of sector

Area of sector $OAPB$:

$$\frac{50}{360}\pi r^2 = \frac{50}{360}\pi\left(\frac{240}{\sin 50°}\right) = 136.701\ldots$$

FINAL ANSWER

$137\ \text{cm}^2$.

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Question 17

4 marks | Algebraic Proof

17 (a) Express $\sqrt{675}$ in the form $n\sqrt{27}$ where n is a positive integer.

.....

(1)

(b) Show that $\dfrac{5-\sqrt{2}}{\sqrt{2}-1}$ can be written in the form $a+b\sqrt{2}$ where a and b are integers.

(3)

(Total for Question 17 is 4 marks)

WORKED SOLUTION

Question 17 · 4MA1/1H November 2024

1 **(a)**

(a)

$$\sqrt{675} = \sqrt{25 \times 27} = 5\sqrt{27}$$

2 **Calculate value**

So $n = 5$.

3 **(b)**

(b)

$$\frac{5-\sqrt{2}}{\sqrt{2}-1} \times \frac{\sqrt{2}+1}{\sqrt{2}+1} = \frac{(5-\sqrt{2})(\sqrt{2}+1)}{2-1}$$

$$= 5\sqrt{2} + 5 - 2 - \sqrt{2}$$

$$= 3 + 4\sqrt{2}$$

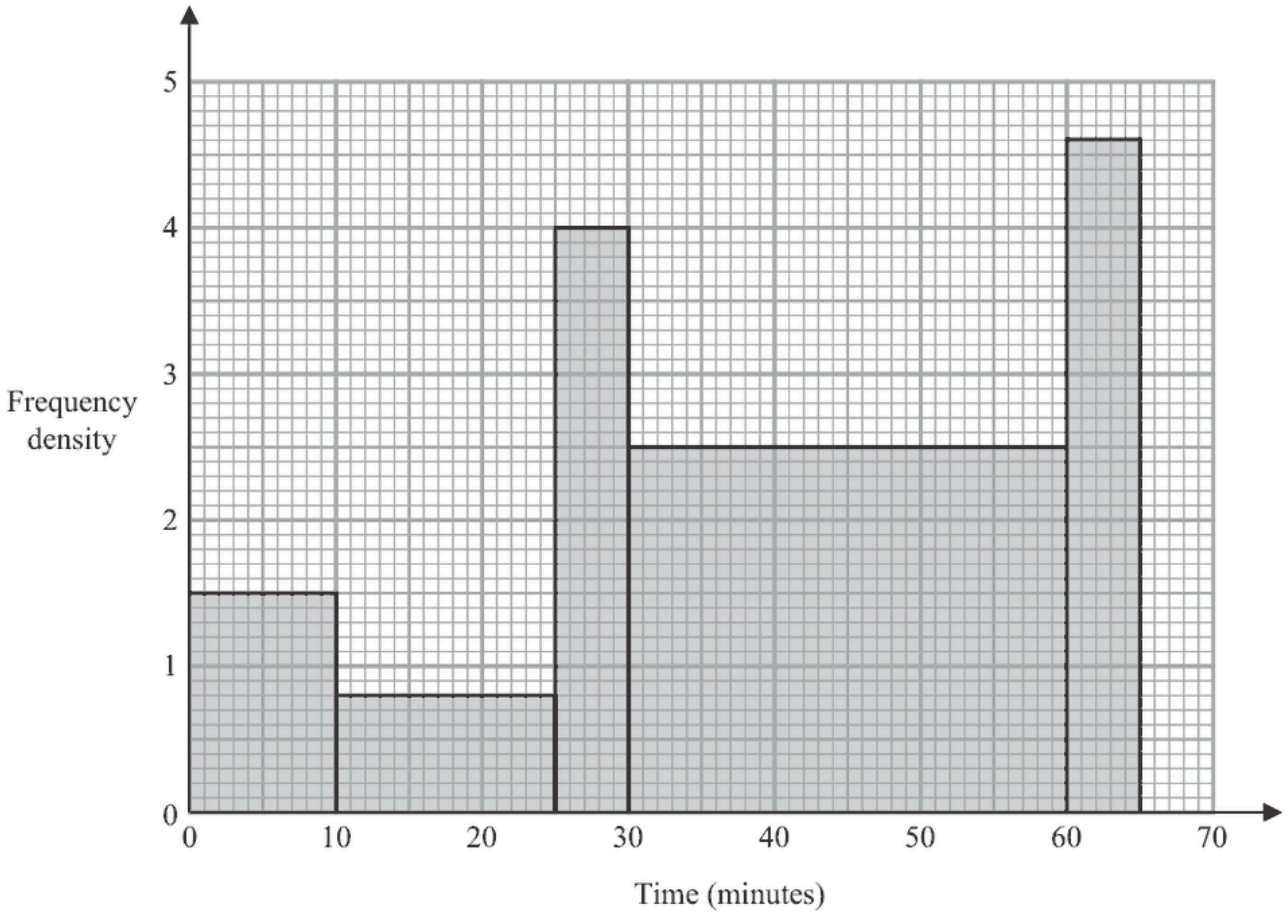
✓ **FINAL ANSWER**

$n = 5$, and $3 + 4\sqrt{2}$.

Question 18

4 marks | Histograms

18 The histogram shows information about the times some students took to complete a puzzle.



Work out an estimate for the fraction of these students who took between 20 minutes and 60 minutes to complete the puzzle.

(Total for Question 18 is 4 marks)

1 Estimate the frequencies from each

Estimate the frequencies from each bar:

$$0 \text{ to } 10: \ 10(1.5) = 15$$

$$10 \text{ to } 25: \ 15(0.8) = 12$$

$$25 \text{ to } 30: \ 5(4) = 20$$

$$30 \text{ to } 60: \ 30(2.5) = 75$$

$$60 \text{ to } 65: \ 5(4.6) = 23$$

2 Total frequency

Total frequency:

$$15 + 12 + 20 + 75 + 23 = 145$$

3 Between and minutes

Between 20 and 60 minutes:

$$5(0.8) + 20 + 75 = 99$$

$$\text{fraction} = \frac{99}{145}$$

FINAL ANSWER

$\frac{99}{145}$.

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Question 19

5 marks | Sequences

19 An arithmetic series has first term a and common difference d

The sum of the first 30 terms of the arithmetic series is 4395

The sum of the 10th term and the 20th term is 284

Work out the sum of the first 45 terms of the arithmetic series.
Show clear algebraic working.

(Total for Question 19 is 5 marks)

WORKED SOLUTION

Question 19 · 4MA1/1H November 2024

1 Let the first term be

Let the first term be a and the common difference be d.

$$S_{30} = 4395$$

$$\frac{30}{2}(2a + 29d) = 4395$$

$$2a + 29d = 293$$

2 The 8th term plus the

The 8th term plus the 20th term is 284:

$$(a + 7d) + (a + 19d) = 284$$

$$2a + 26d = 284$$

3 Subtract the equations

Subtract the equations:

$$3d = 9$$

$$d = 3$$

4 **Find the nth term**

Then

$$2a + 26(3) = 284$$

$$2a = 206$$

$$a = 103$$

---

5 **Find the nth term**

Now find S_{45}:

$$S_{45} = \frac{45}{2}(2a + 44d)$$

$$S_{45} = \frac{45}{2}(206 + 132) = 7605$$

✓ **FINAL ANSWER**

7605.

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Question 20

4 marks | Differentiation & Turning Points

20 The curve with equation $y = 2x^4 - 64x$ has a minimum point.

Find an equation of the tangent to the curve at the minimum point.
Show clear algebraic working.

(Total for Question 20 is 4 marks)

WORKED SOLUTION

Question 20 · 4MA1/1H November 2024

1 Find the gradient

$$y = 2x^4 - 64x$$

2 Differentiate

Differentiate:

$$\frac{dy}{dx} = 8x^3 - 64$$

3 Find the gradient

At the minimum point, the gradient is 0.

$$8x^3 - 64 = 0$$

$$8x^3 = 64$$

$$x^3 = 8$$

$$x = 2$$

4 Find the coordinate

Find the y-coordinate:

$$y = 2(2)^4 - 64(2)$$

$$y = 32 - 128 = -96$$

5 **The tangent at a minimum**

The tangent at a minimum point is horizontal, so its equation is

$$y = -96$$

✓ **FINAL ANSWER**

$y = -96$

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Question 21

3 marks | Rounding, Estimation & Bounds

21 $T = \dfrac{x^2 + y^2}{w}$

$x = 28.4$ correct to 1 decimal place.

$y = 17$ correct to 2 significant figures.

$w = 90$ correct to the nearest 5

Calculate the upper bound for the value of T

Give your answer correct to 3 significant figures.
Show your working clearly.

(Total for Question 21 is 3 marks)

WORKED SOLUTION

Question 21 · 4MA1/1H November 2024

1 Estimate the value

$$T = \frac{x^2 + y^2}{w}$$

2 Find upper bound

For the upper bound, use the upper bounds of x and y, and the lower bound of w.

$$x < 28.45, \quad y < 17.5, \quad w \geq 87.5$$

$$T_{\text{upper}} = \frac{28.45^2 + 17.5^2}{87.5} = 12.7503\ldots$$

3 Estimate the value

Correct to 3 significant figures,

$$12.7503\ldots \approx 12.8$$

FINAL ANSWER

12.8

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Question 22

3 marks | Volume & Surface Area

22 The diagram shows a bowl in the shape of a hemisphere.
The bowl is made from metal.

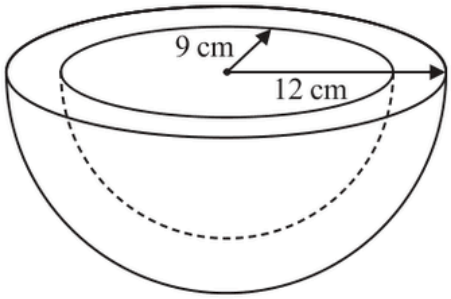


Diagram **NOT** accurately drawn

The outer radius of the bowl is 12 cm
The inner radius of the bowl is 9 cm

The thickness of the bowl is uniform.

Work out the volume of the metal.
Give your answer correct to the nearest whole number.

..... cm^3

(Total for Question 22 is 3 marks)

WORKED SOLUTION

Question 22 · 4MA1/1H November 2024

1 **The bowl is a hemispherical**

The bowl is a hemispherical shell.

2 **The volume of the metal**

The volume of the metal is:

$$\text{outer hemisphere volume} - \text{inner hemisphere volume}$$

3 **Volume of a hemisphere**

Volume of a hemisphere:

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

4 **Calculate volume**

So

$$\text{metal volume} = \frac{2}{3}\pi(12)^3 - \frac{2}{3}\pi(9)^3$$

$$= \frac{2}{3}\pi(12^3 - 9^3)$$

$$= \frac{2}{3}\pi(1728 - 729)$$

$$= 666\pi$$

$$= 2092.3007\ldots$$

✓ **FINAL ANSWER**

$\boxed{2092\ \text{cm}^3}$

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Question 23

5 marks | Graphs of Functions

23 The curve **C** has equation $y = x^2 - 8x - 9$
The straight line **L** has equation $y = k$ where k is an integer.

C and **L** intersect at the points A and B

The coordinates of point A are (p, k)
The coordinates of point B are (q, k)

Given that $p - q = 14$

find the value of k
Show clear algebraic working.

$k =$ .....

(Total for Question 23 is 5 marks)

WORKED SOLUTION

Question 23 · 4MA1/1H November 2024

1 The curve is

The curve is

$$y = x^2 - 8x - 9$$

2 The line is

The line is

$$y = k$$

3 Read the graph

At the intersection points,

$$x^2 - 8x - 9 = k$$

$$x^2 - 8x - (9 + k) = 0$$

4 **Read the graph**

The two roots are p and q.

5 **Solve quadratic equation**

For this quadratic,

$$p + q = 8$$

6 **We are also given**

We are also given

$$p - q = 14$$

7 **Solve the two equations**

Solve the two equations:

$$2p = 22$$

$$p = 11$$

$$q = -3$$

8 **Read the graph**

Use one root in $y = x^2 - 8x - 9$:

$$k = 11^2 - 8(11) - 9$$

$$k = 121 - 88 - 9$$

$$k = 24$$

✓ **FINAL ANSWER**

$k = 24$

Question 24

6 marks | Vectors

24 OAB is a triangle.

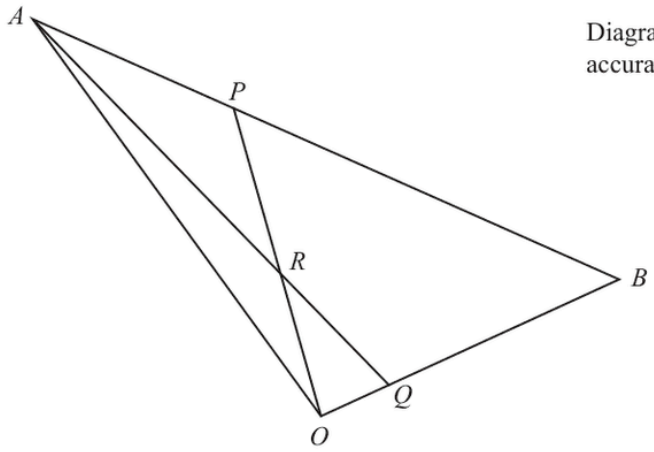


Diagram **NOT** accurately drawn

$\overrightarrow{OA} = 10\mathbf{a}$ $\overrightarrow{OB} = 10\mathbf{b}$

ARQ and ORP are straight lines.

$\overrightarrow{AP} = \frac{1}{4}\overrightarrow{AB}$ and $\overrightarrow{OQ} = \frac{1}{5}\overrightarrow{OB}$

Write the following vectors in terms of **a** and **b**
Simplify your answers.

(i) $\overrightarrow{AQ}$

.....

(1)

(ii) $\overrightarrow{OP}$

.....

(1)

(iii) $\overrightarrow{OR}$

.....

(4)

(Total for Question 24 is 6 marks)

1 **Read the graph**

$$\vec{OA} = 10\mathbf{a}, \qquad \vec{OB} = 10\mathbf{b}$$

2 **Read the graph**

Also,

$$\vec{AP} = \frac{1}{4}\vec{AB}$$

3 **Read the graph**

and

$$\vec{OQ} = \frac{1}{5}\vec{OB}$$

4 **Read the graph**

For part (i),

$$\vec{OQ} = 2\mathbf{b}$$

$$\vec{AQ} = \vec{OQ} - \vec{OA}$$

$$\vec{AQ} = 2\mathbf{b} - 10\mathbf{a}$$

5 **Read the graph**

For part (ii),

$$\vec{AB} = 10\mathbf{b} - 10\mathbf{a}$$

$$\vec{AP} = \frac{1}{4}(10\mathbf{b} - 10\mathbf{a})$$

$$\vec{AP} = \frac{5}{2}\mathbf{b} - \frac{5}{2}\mathbf{a}$$

$$\vec{OP} = \vec{OA} + \vec{AP}$$

$$\vec{OP} = 10\mathbf{a} - \frac{5}{2}\mathbf{a} + \frac{5}{2}\mathbf{b}$$

$$\vec{OP} = \frac{15}{2}\mathbf{a} + \frac{5}{2}\mathbf{b}$$

6 **Read the graph**

For part (iii), R lies on OP, so

$$\vec{OR} = t\vec{OP}$$

---

7 **Read the graph**

It also lies on AQ, so

$$\vec{OR} = \vec{OA} + s\vec{AQ}$$

$$\vec{OR} = 10\mathbf{a} + s(2\mathbf{b} - 10\mathbf{a})$$

$$\vec{OR} = (10 - 10s)\mathbf{a} + 2s\mathbf{b}$$

---

8 **Read the graph**

Equate with

$$t\left(\frac{15}{2}\mathbf{a} + \frac{5}{2}\mathbf{b}\right)$$

$$\frac{15}{2}t = 10 - 10s$$

$$\frac{5}{2}t = 2s$$

---

9 **Solve equation**

From the second equation,

$$s = \frac{5}{4}t$$

---

10 **Substitute**

Substitute:

$$\frac{15}{2}t = 10 - \frac{25}{2}t$$

$$20t = 10$$

$$t = \frac{1}{2}$$

---

11 **Read the graph**

So

$$\vec{OR} = \frac{1}{2}\vec{OP}$$

$$\vec{OR} = \frac{15}{4}\mathbf{a} + \frac{5}{4}\mathbf{b}$$

✓ **FINAL ANSWER**

$\vec{AQ} = 2\mathbf{b} - 10\mathbf{a}$, $\vec{OP} = \frac{15}{2}\mathbf{a} + \frac{5}{2}\mathbf{b}$, $\vec{OR} = \frac{15}{4}\mathbf{a} + \frac{5}{4}\mathbf{b}$

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Question 25

4 marks | Functions

25 The function f is such that $f(x) = 2x^2 - 24x + 7$ where $x \geqslant 6$

Find the inverse function $f^{-1}(x)$

$f^{-1}(x) =$ .....

(Total for Question 25 is 4 marks)

WORKED SOLUTION

Question 25 · 4MA1/1H November 2024

1 Calculate value

$$f(x) = 2x^2 - 24x + 7$$

2 Complete the square

Complete the square:

$$f(x) = 2(x^2 - 12x) + 7$$

$$f(x) = 2[(x - 6)^2 - 36] + 7$$

$$f(x) = 2(x - 6)^2 - 65$$

3 Let

Let $y = f(x)$.

$$y = 2(x - 6)^2 - 65$$

$$y + 65 = 2(x - 6)^2$$

$$\frac{y + 65}{2} = (x - 6)^2$$

4 **Simplify surd**

Since $x \geq 6$, take the positive square root:

$$x - 6 = \sqrt{\frac{y+65}{2}}$$

$$x = 6 + \sqrt{\frac{y+65}{2}}$$

---

5 **Replace by**

Replace y by x.

✓ **FINAL ANSWER**

$$f^{-1}(x) = 6 + \sqrt{\frac{x+65}{2}}$$