E

Elite Mathematics
Pearson Edexcel International GCSE

IGCSE LINEAR · 4MA1

4MA1/2H 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



Dr Eslam Ahmed
Assistant Lecturer, Faculty of Engineering, Cairo University
eliteigcse.com · free for every student

PAST PAPER

4MA1/2H November 2024

November 2024

25	100	2 h
questions	marks	exam time

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

4MA1/2H NOVEMBER 2024

Question 1

3 marks | Algebraic Proof

1 Show that $1\frac{5}{7} \times 2\frac{3}{16} = 3\frac{3}{4}$

(Total for Question 1 is 3 marks)

WORKED SOLUTION

Question 1 · 4MA1/2H November 2024

1 **Evaluate fraction**

$$1\frac{5}{7} = \frac{12}{7}, \qquad 2\frac{3}{16} = \frac{35}{16}$$

$$1\frac{5}{7} \times 2\frac{3}{16} = \frac{12}{7} \times \frac{35}{16}$$

$$= \frac{420}{112} = \frac{15}{4} = 3\frac{3}{4}$$

FINAL ANSWER

$3\frac{3}{4}$.

4MA1/2H NOVEMBER 2024

Question 2

2 marks | Rounding, Estimation & Bounds

2 The length of a table is measured as 1.4 metres correct to one decimal place.

(a) Write down the upper bound of the length of the table.

..... metres

(1)

(b) Write down the lower bound of the length of the table.

..... metres

(1)

(Total for Question 2 is 2 marks)

WORKED SOLUTION

Question 2 · 4MA1/2H November 2024

1 The length is m correct

The length is 1.4 m correct to one decimal place.

2 Half of is

Half of 0.1 is 0.05.

$$1.4 + 0.05 = 1.45$$

$$1.4 - 0.05 = 1.35$$

FINAL ANSWER

(a) 1.45 m, (b) 1.35 m

4MA1/2H NOVEMBER 2024

Question 3

3 marks | Right-Angled Triangles - Pythagoras & Trigonometry

3 The diagram shows triangle PQR

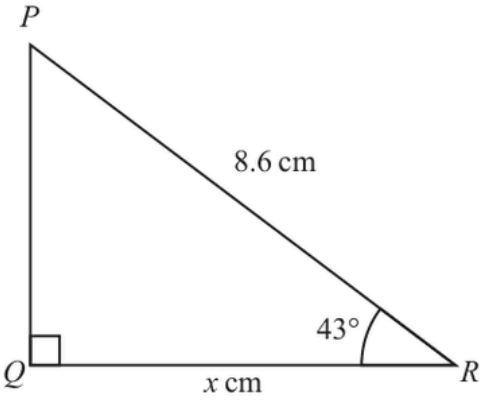


Diagram **NOT** accurately drawn

Work out the value of x
Give your answer correct to one decimal place.

$x =$ .....

(Total for Question 3 is 3 marks)

WORKED SOLUTION

Question 3 · 4MA1/2H November 2024

1 Use trigonometry

In the right-angled triangle, x is adjacent to the $43°$ angle.

$$\cos 43° = \frac{x}{8.6}$$

$$x = 8.6 \cos 43° = 6.289\ldots$$

FINAL ANSWER

6.3 cm.

4MA1/2H NOVEMBER 2024

Question 4

5 marks | Reverse Percentages

4 N is a number.
17% of N is 357

(a) Work out the value of N

$N =$ .....

(2)

In 2019, the population of a village was 650
In 2020, the population of the village was 806

(b) Work out the percentage increase in the population.

..... %

(3)

(Total for Question 4 is 5 marks)

WORKED SOLUTION

Question 4 · 4MA1/2H November 2024

1 **Calculate percentage**

For part (a),

$$17\% \text{ of } N = 357$$

$$0.17N = 357$$

$$N = \frac{357}{0.17} = 2100$$

2 **Calculate percentage**

For part (b), the increase in population is

$$806 - 650 = 156$$

3 **Percentage increase**

Percentage increase:

$$\frac{156}{650} \times 100 = 24$$

FINAL ANSWER

(a) $N = 2100$, (b) 24%

4MA1/2H NOVEMBER 2024

Question 5

4 marks | Probability Toolkit

5 Cody has a biased 5-sided spinner, numbered 1, 2, 3, 4, 5

The table gives the probabilities that when the spinner is spun it will land on 2 or on 3 or on 5

Number	1	2	3	4	5
Probability		0.14	0.17		0.21

The probability that the spinner will land on 1 is the same as the probability that the spinner will land on 4

Cody is going to spin the spinner 400 times.

Work out an estimate for the number of times the spinner will land on 4

(Total for Question 5 is 4 marks)

WORKED SOLUTION

Question 5 · 4MA1/2H November 2024

1 Probabilities of 1 and 4 together

$$1 - (0.14 + 0.17 + 0.21) = 1 - 0.52 = 0.48$$

2 They are equal

$$P(4) = 0.48 \div 2 = 0.24$$

3 Estimate for 400 spins

$$400 \times 0.24 = 96$$

✓ **FINAL ANSWER**

96

4MA1/2H NOVEMBER 2024

Question 6

3 marks | Volume & Surface Area

6 The diagram shows a solid triangular prism.

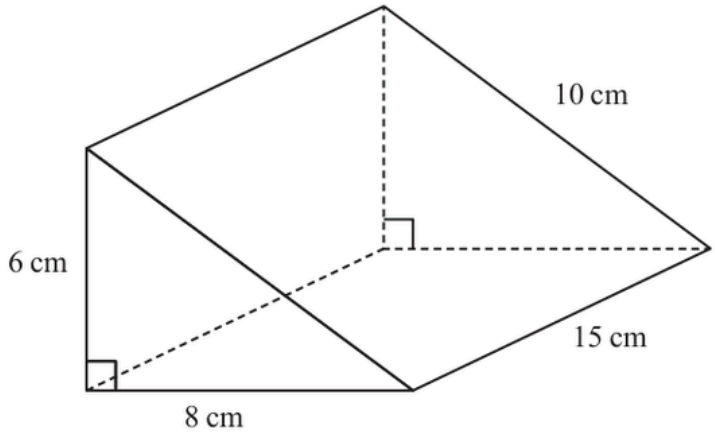


Diagram **NOT** accurately drawn

Work out the **total** surface area of the triangular prism.

..... cm^2

(Total for Question 6 is 3 marks)

WORKED SOLUTION

Question 6 · 4MA1/2H November 2024

1 The triangular end is a

The triangular end is a right triangle with sides 6, 8, and 10.

2 Area of the two triangular

Area of the two triangular ends:

$$2\left(\frac{1}{2} \times 6 \times 8\right) = 48$$

3 Area of the three rectangles

Area of the three rectangles:

$$15(6 + 8 + 10) = 360$$

4 Total surface area

Total surface area:

$$48 + 360 = 408$$

FINAL ANSWER

$408\ \text{cm}^2$.

4MA1/2H NOVEMBER 2024

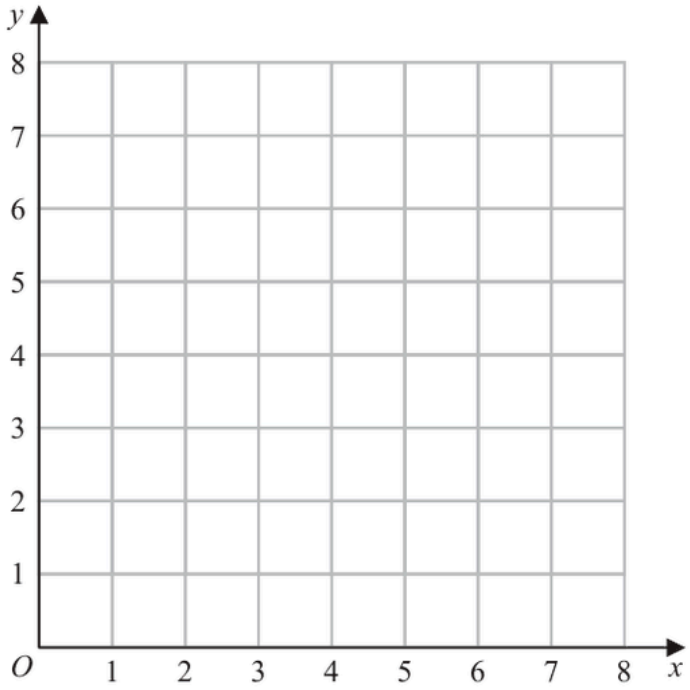
Question 7

4 marks | Inequalities (Solving & Graphing)

7 (a) On the grid, draw the straight line with equation

(i) $x = 3$ (ii) $y = 1$ (iii) $x + y = 7$

Label each line with its equation.



(3)

(b) Show, by shading on the grid, the region that satisfies all three of the inequalities

$x \geqslant 3$ $y \geqslant 1$ $x + y \leqslant 7$

Label the region **R**

(1)

(Total for Question 7 is 4 marks)

WORKED SOLUTION

Question 7 · 4MA1/2H November 2024

1 Draw the boundary lines

Draw the boundary lines:

$$x = 3, \quad y = 1, \quad x + y = 7$$

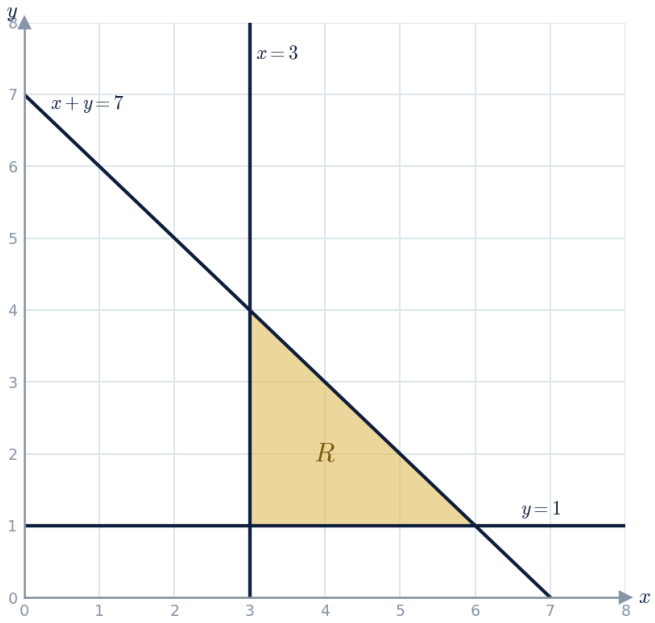
2 **The required region is**

The required region is

$$x \geq 3$$

$$y \geq 1$$

$$x + y \leq 7$$



FINAL ANSWER

Shade $x \geq 3$, $y \geq 1$, $x + y \leq 7$.

4MA1/2H NOVEMBER 2024

Question 8

3 marks | Statistics Toolkit

8 Kim puts 4 bananas in a bag.
The mean weight of the 4 bananas in the bag is 145 grams.

Andy puts one more banana into the bag.
The mean weight of the 5 bananas in the bag is 142 grams.

Work out the weight of the banana that Andy puts into the bag.

..... grams

(Total for Question 8 is 3 marks)

WORKED SOLUTION

Question 8 · 4MA1/2H November 2024

1 The total weight of the

The total weight of the first 4 bananas is

$$4 \times 145 = 580$$

2 The total weight of the

The total weight of the 5 bananas is

$$5 \times 142 = 710$$

3 Weight of the banana Andy

Weight of the banana Andy added:

$$710 - 580 = 130$$

FINAL ANSWER

130 g.

4MA1/2H NOVEMBER 2024

Question 9

3 marks | Compound Interest & Depreciation

9 Nisha invests 20 000 euros for 3 years in a savings account.
She gets 3.5% per year compound interest.

Work out how much money Nisha will have in her savings account at the end of the 3 years.
Give your answer correct to the nearest euro.

..... euros

(Total for Question 9 is 3 marks)

WORKED SOLUTION

Question 9 · 4MA1/2H November 2024

1 The multiplier for compound interest

The multiplier for 3.5% compound interest is

$$1.035$$

2 Use compound interest

After 3 years,

$$20000(1.035)^3 = 22174.3575$$

3 Use compound interest

Correct to the nearest euro,

$$22174.3575 \approx 22174$$

FINAL ANSWER

22174 euros

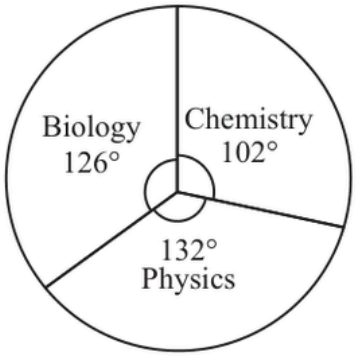
4MA1/2H NOVEMBER 2024

Question 10

5 marks | Statistics Toolkit

10 All the students in year 10 and all the students in year 11 named their favourite science subject from Biology, Chemistry and Physics.

The pie chart shows information about the results for the year 10 students.
The table shows information about the results for the year 11 students.



Pie chart for year 10

science subject	number of students
Biology	$3x + 6$
Chemistry	$5x + 8$
Physics	$7x - 9$

Table for year 11

There are 300 students in year 10
There are 320 students in year 11

More students in year 10 than in year 11 said Biology was their favourite science subject.

How many more?

(Total for Question 10 is 5 marks)

WORKED SOLUTION

Question 10 · 4MA1/2H November 2024

1 **Evaluate fraction**

For year 10, Biology is $126°$ out of $360°$.

$$\frac{126}{360} \times 300 = 105$$

2 **Calculate value**

For year 11:

$$(3x + 6) + (5x + 8) + (7x - 9) = 320$$

$$15x + 5 = 320$$

$$x = 21$$

---

3 **Year 11 Biology**

Year 11 Biology:

$$3(21) + 6 = 69$$

---

4 **Difference**

Difference:

$$105 - 69 = 36$$

✓ **FINAL ANSWER**

36 more students.

4MA1/2H NOVEMBER 2024

Question 11

5 marks | Angles in Polygons & Parallel Lines

11

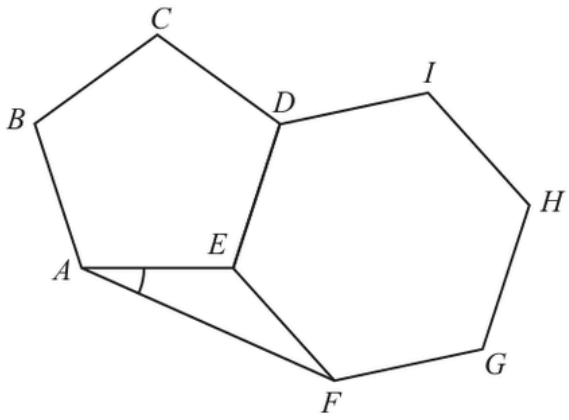


Diagram **NOT** accurately drawn

ABCDE is a regular pentagon.
DEFGHI is a regular hexagon.

AF is a straight line.

Work out the size of angle *EAF*

.....°

(Total for Question 11 is 5 marks)

WORKED SOLUTION

Question 11 · 4MA1/2H November 2024

1 A regular pentagon has interior

A regular pentagon has interior angle

$$108°$$

2 A regular hexagon has interior

A regular hexagon has interior angle

$$120°$$

3 Use trigonometry

At E, the angle inside triangle AEF is

$$360° - 108° - 120° = 132°$$

4 **Use trigonometry**

Also $AE = ED$ and $ED = EF$, so

$$AE = EF$$

---

5 **Use trigonometry**

Triangle AEF is isosceles, so the base angles are equal:

$$\angle EAF = \frac{180^\circ - 132^\circ}{2} = 24^\circ$$

✓ **FINAL ANSWER**

24°.

4MA1/2H NOVEMBER 2024

Question 12

7 marks | Rearranging Formulae

12 (a) Solve $\frac{3x+2}{5} - \frac{2x+1}{3} = x$

Show clear algebraic working.

$x =$ .....

(3)

(b) Make c the subject of the formula $f = \sqrt{\frac{a+bc}{c-d}}$

.....

(4)

(Total for Question 12 is 7 marks)

WORKED SOLUTION

Question 12 · 4MA1/2H November 2024

1 **(a)**

(a)

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

2 **Multiply by 15**

Multiply by 15:

$$3(3x+2) - 5(2x+1) = 15x$$

$$9x + 6 - 10x - 5 = 15x$$

$$1 = 16x$$

$$x = \frac{1}{16}$$

3 **(b)**

(b)

$$f = \sqrt{\frac{a+bc}{c-d}}$$

$$f^2 = \frac{a+bc}{c-d}$$

$$f^2(c-d) = a+bc$$

$$c(f^2-b) = a+df^2$$

FINAL ANSWER

(a) $x = \frac{1}{16}$, (b) $c = \frac{a+df^2}{f^2-b}$

Question 13

6 marks | Cumulative Frequency Diagrams

13 The frequency table gives information about the weights, in kilograms, of 60 parcels in a delivery van.

Weight (w kilograms)	Frequency
$0 < w \leqslant 1$	4
$1 < w \leqslant 2$	15
$2 < w \leqslant 3$	20
$3 < w \leqslant 4$	11
$4 < w \leqslant 5$	6
$5 < w \leqslant 6$	4

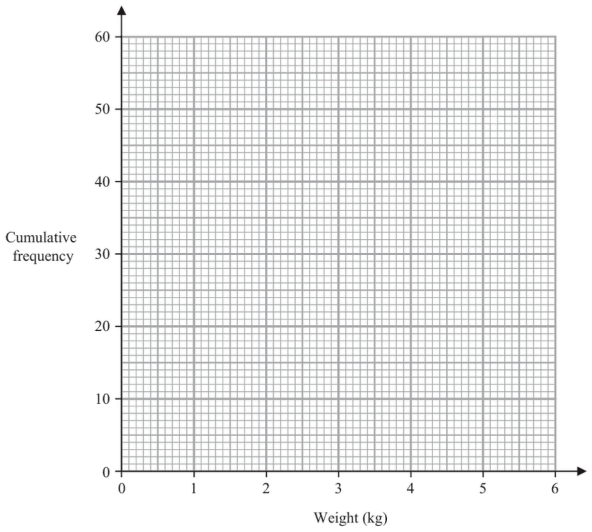
(a) Complete the cumulative frequency table.

Weight (w kilograms)	Cumulative frequency
$0 < w \leqslant 1$	
$0 < w \leqslant 2$	
$0 < w \leqslant 3$	
$0 < w \leqslant 4$	
$0 < w \leqslant 5$	
$0 < w \leqslant 6$	

(1)

(b) On the grid opposite, draw a cumulative frequency graph for your table.

(2)



(c) Use your graph to find an estimate for the median weight of the 60 parcels.

..... kilograms

(1)

(d) Use your graph to find an estimate for the number of these parcels that weigh more than 3.7 kilograms.

.....

(2)

(Total for Question 13 is 6 marks)

1

(a) Running totals

$$4,\ 19,\ 39,\ 50,\ 56,\ 60$$

2

(b) Plot at the upper class boundaries

Plot $(1, 4), (2, 19), (3, 39), (4, 50), (5, 56), (6, 60)$, start at $(0, 0)$, and join with a smooth curve.

3

(c) Median

Read across from $\frac{60}{2} = 30$: about 2.55 kg.

4

(d) Heavier than 3.7 kg

At 3.7 kg the curve reads about 47, so about $60 - 47 = 13$ parcels.

✓ **FINAL ANSWER**

(a) $4, 19, 39, 50, 56, 60$ (c) about 2.55 kg (d) about 13

4MA1/2H NOVEMBER 2024

Question 14

3 marks | Algebraic Roots & Indices

14 Given that $\frac{3^{2n+3}}{3^4} = 3^3 \times 3^{1-2n}$

find the value of n
Show your working clearly.

$n =$ .....

(Total for Question 14 is 3 marks)

WORKED SOLUTION

Question 14 · 4MA1/2H November 2024

1 Use index laws

$$\frac{3^{2n+3}}{3^4} = 3^{2n-1}$$

$$3^3 \times 3^{1-2n} = 3^{4-2n}$$

2 Use index laws

So

$$2n - 1 = 4 - 2n$$

$$4n = 5$$

✓ **FINAL ANSWER**

$n = \frac{5}{4}$

4MA1/2H NOVEMBER 2024

Question 15

2 marks | Algebraic Proof

15 Use algebra to show that $0.7\dot{6}\dot{3} = \frac{42}{55}$

(Total for Question 15 is 2 marks)

WORKED SOLUTION

Question 15 · 4MA1/2H November 2024

1 Let

Let

$$x = 0.7636363\ldots$$

2 Calculate value

Then

$$10x = 7.636363\ldots$$

3 Calculate value

and

$$1000x = 763.636363\ldots$$

4 Subtract

Subtract:

$$990x = 756$$

$$x = \frac{756}{990} = \frac{42}{55}$$

FINAL ANSWER

$0.7636363\ldots = \frac{42}{55}$.

Question 16

5 marks | Circle Theorems

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

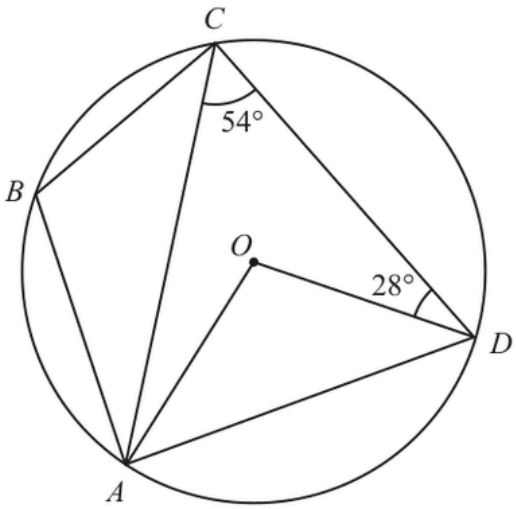


Diagram **NOT** accurately drawn

(a) (i) Work out the size of angle AOD

.....°

(1)

(ii) Give a reason for your answer to part (a)(i)

.....

(1)

(b) Work out the size of angle CAO

.....°

(1)

(c) Work out the size of angle ABC

.....°

(2)

(Total for Question 16 is 5 marks)

1 **(a) The angle at the**

(a) The angle at the centre is twice the angle at the circumference standing on the same arc AD:

$$\angle AOD = 2 \times 54^\circ = 108^\circ$$

2 **Use trigonometry**

(b) Since $OC = OD$, triangle COD is isosceles:

$$\angle OCD = \angle CDO = 28^\circ$$

3 **Use trigonometry**

So

$$\angle COD = 180^\circ - 28^\circ - 28^\circ = 124^\circ$$

4 **Use circle theorem**

Angles around O add to 360°:

$$\angle AOC = 360^\circ - 108^\circ - 124^\circ = 128^\circ$$

5 **Use trigonometry**

Since $OA = OC$,

$$\angle CAO = \frac{180^\circ - 128^\circ}{2} = 26^\circ$$

6 **(c) Angle stands on the**

(c) Angle ABC stands on the major arc AC, so

$$\angle ABC = \frac{360^\circ - 128^\circ}{2} = 116^\circ$$

✓ **FINAL ANSWER**

$\angle AOD = 108^\circ$, $\angle CAO = 26^\circ$, and $\angle ABC = 116^\circ$.

4MA1/2H NOVEMBER 2024

Question 17

3 marks | Vectors

17 Here are two vectors.

$$\overrightarrow{FG} = \begin{pmatrix} -5 \\ 2 \end{pmatrix} \qquad \overrightarrow{HG} = \begin{pmatrix} 4 \\ 14 \end{pmatrix}$$

Calculate the magnitude of the vector $\overrightarrow{HF}$

(Total for Question 17 is 3 marks)

WORKED SOLUTION

Question 17 · 4MA1/2H November 2024

1 Use vectors

$$\overrightarrow{GF} = -\overrightarrow{FG} = \begin{pmatrix} 5 \\ -2 \end{pmatrix}$$

$$\overrightarrow{HF} = \overrightarrow{HG} + \overrightarrow{GF} = \begin{pmatrix} 4 \\ 14 \end{pmatrix} + \begin{pmatrix} 5 \\ -2 \end{pmatrix} = \begin{pmatrix} 9 \\ 12 \end{pmatrix}$$

2 Magnitude

Magnitude:

$$|\overrightarrow{HF}| = \sqrt{9^2 + 12^2} = 15$$

FINAL ANSWER

15.

4MA1/2H NOVEMBER 2024

Question 18

4 marks | Linear Graphs

18 The straight line **L** is perpendicular to the straight line with equation $2x + y = 9$ and passes through the point with coordinates $(8, 11)$

Find an equation for **L**
Give your answer in the form $y = mx + c$

(Total for Question 18 is 4 marks)

WORKED SOLUTION

Question 18 · 4MA1/2H November 2024

1 The given line is

The given line is

$$2x + y = 9$$

$$y = -2x + 9$$

2 Find the gradient

Its gradient is -2, so a perpendicular line has gradient $\frac{1}{2}$.

3 Find the gradient

Line L passes through $(8, 11)$:

$$y - 11 = \frac{1}{2}(x - 8)$$

$$y = \frac{1}{2}x + 7$$

FINAL ANSWER

$y = \frac{1}{2}x + 7$.

4MA1/2H NOVEMBER 2024

Question 19

3 marks | Transformations of Graphs

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

There is only one minimum point on the curve.
The coordinates of this minimum point are (5, 4)

Write down the coordinates of the minimum point on the curve with equation

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

(..... , ...)
(1)

(ii) $y = 3f(x)$

(..... , ...)
(1)

(iii) $y = f(x) - 7$

(..... , ...)
(1)

(Total for Question 19 is 3 marks)

WORKED SOLUTION

Question 19 · 4MA1/2H November 2024

1 The minimum point of is

The minimum point of $y = f(x)$ is

$$(5, 4)$$

2 Read the graph

(i) For

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

3 the graph moves 5 units

the graph moves 5 units left, so the minimum point becomes

$$(0, 4)$$

4 **Read the graph**

(ii) For

$$y = 3f(x)$$

5 **the y coordinate is multiplied**

the y-coordinate is multiplied by 3, so the minimum point becomes

$$(5, 12)$$

6 **Read the graph**

(iii) For

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

7 **the graph moves 7 units**

the graph moves 7 units down, so the minimum point becomes

$$(5, -3)$$

✓ **FINAL ANSWER**

$(0, 4)$, $(5, 12)$, and $(5, -3)$.

4MA1/2H NOVEMBER 2024

Question 20

3 marks | Inequalities (Solving & Graphing)

20 Solve the inequality $10x^2 + 11x - 21 < 0$
Show clear algebraic working.

(Total for Question 20 is 3 marks)

WORKED SOLUTION

Question 20 · 4MA1/2H November 2024

1 Solve inequality

$$10x^2 + 11x - 21 < 0$$

2 Factorise

Factorise:

$$10x^2 + 11x - 21 = (10x + 21)(x - 1)$$

3 The critical values are

The critical values are

$$x = -\frac{21}{10} \quad \text{and} \quad x = 1$$

4 The quadratic is less than

The quadratic is less than 0 between the roots.

✓ FINAL ANSWER

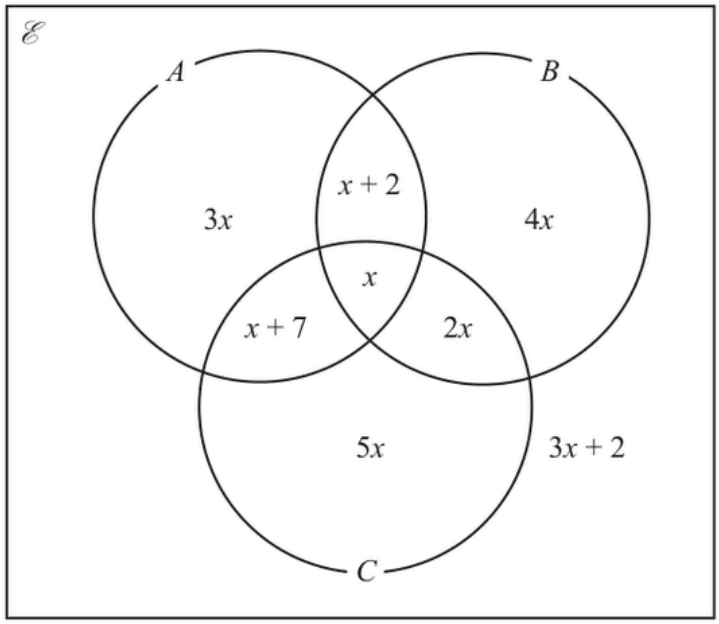
$$-\frac{21}{10} < x < 1$$

4MA1/2H NOVEMBER 2024

Question 21

4 marks | Set Notation & Venn Diagrams

21 The Venn diagram shows information about the numbers of items in set A, set B and set C, where x is an integer.



Given that $\mathrm{n}(A \cup B)' = 26$

find $\mathrm{n}(A' \cap C)$

$\mathrm{n}(A' \cap C) =$ .....

(Total for Question 21 is 4 marks)

WORKED SOLUTION

Question 21 · 4MA1/2H November 2024

1 The complement of contains the

The complement of $A \cup B$ contains the regions outside both A and B. These are $5x$ and $3x + 2$.

2 Calculate value

So $5x + (3x + 2) = 26$, hence $8x + 2 = 26$ and $x = 3$.

3 Calculate statistic

Now $A' \cap C$ means inside C, but not inside A. These are the regions $5x$ and $2x$.

4 Calculate value

So $n(A' \cap C) = 5x + 2x = 7x = 7(3) = 21$.

FINAL ANSWER

21

4MA1/2H NOVEMBER 2024

Question 22

5 marks | Simultaneous Equations

22 Solve the simultaneous equations

$$x^2 + y^2 + y = 3$$

$$x + 2 = y$$

Show clear algebraic working.

(Total for Question 22 is 5 marks)

WORKED SOLUTION

Question 22 · 4MA1/2H November 2024

1 Calculate value

$$x^2 + y^2 + y = 3$$

$$y = x + 2$$

2 Substitute

Substitute:

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

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

$$2x^2 + 5x + 3 = 0$$

$$(2x + 3)(x + 1) = 0$$

3 Evaluate fraction

So

$$x = -\frac{3}{2} \quad \text{or} \quad x = -1$$

4 **Find**

Find y:

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

$$x = -1 \Rightarrow y = 1$$

✓ **FINAL ANSWER**

$(x, y) = \left(-\frac{3}{2}, \frac{1}{2}\right)$ or $(-1, 1)$

4MA1/2H NOVEMBER 2024

Question 23

4 marks | Algebraic Proof

23 Show that $\dfrac{16x^2 - 36}{x - 7} \div \dfrac{2x^2 + 7x + 6}{x^2 - 5x - 14} - (7 + 8x) = n$

where n is an integer to be found.
Show clear algebraic working.

(Total for Question 23 is 4 marks)

WORKED SOLUTION

Question 23 · 4MA1/2H November 2024

1 Evaluate fraction

$$\frac{16x^2 - 36}{x - 7} \div \frac{2x^2 + 7x + 6}{x^2 - 5x - 14} - (7 + 8x)$$

2 Factorise

Factorise:

$$16x^2 - 36 = 4(2x - 3)(2x + 3)$$

$$2x^2 + 7x + 6 = (2x + 3)(x + 2)$$

$$x^2 - 5x - 14 = (x - 7)(x + 2)$$

3 Evaluate fraction

So

$$\frac{4(2x-3)(2x+3)}{x-7} \div \frac{(2x+3)(x+2)}{(x-7)(x+2)} - (7+8x)$$

$$= \frac{4(2x-3)(2x+3)}{x-7} \times \frac{(x-7)(x+2)}{(2x+3)(x+2)} - (7+8x)$$

$$= 4(2x-3) - (7+8x)$$

$$= 8x - 12 - 7 - 8x$$

$$= -19$$

4 Calculate value

So $n = -19$, which is an integer.

FINAL ANSWER

$n = -19$

4MA1/2H NOVEMBER 2024

Question 24

6 marks | Bearings

24 A, B and C are three points on horizontal ground.

$AB = 8.4$ metres $BC = 9.2$ metres

B is on a bearing of 067° from A
C is on a bearing of 129° from B

Calculate the bearing of A from C
Give your answer correct to the nearest degree.

.....°

(Total for Question 24 is 6 marks)

WORKED SOLUTION

Question 24 · 4MA1/2H November 2024

1 Resolve each journey into east

Resolve each journey into east and north components.

2 Use trigonometry

From A to B:

$$\text{east} = 8.4 \sin 67° = 7.7322\ldots$$

$$\text{north} = 8.4 \cos 67° = 3.2821\ldots$$

3 Use trigonometry

From B to C:

$$\text{east} = 9.2 \sin 129° = 7.1497\ldots$$

$$\text{north} = 9.2 \cos 129° = -5.7897\ldots$$

4 **Calculate value**

So from A to C:

$$\text{east} = 14.8820\ldots$$

$$\text{north} = -2.5076\ldots$$

---

5 **Calculate value**

Therefore from C to A:

$$\text{east} = -14.8820\ldots, \qquad \text{north} = 2.5076\ldots$$

---

6 **Use trigonometry**

This direction is west of north.

$$\theta = \tan^{-1}\left(\frac{14.8820\ldots}{2.5076\ldots}\right) = 80.4355\ldots^\circ$$

---

7 **Use bearings**

Bearing of A from C:

$$360^\circ - 80.4355\ldots^\circ = 279.5644\ldots^\circ$$

✓ **FINAL ANSWER**

$\boxed{280^\circ}$

4MA1/2H NOVEMBER 2024

Question 25

5 marks | Circles, Arcs & Sectors

25 The diagram shows an equilateral triangle ABC and a circle with centre O

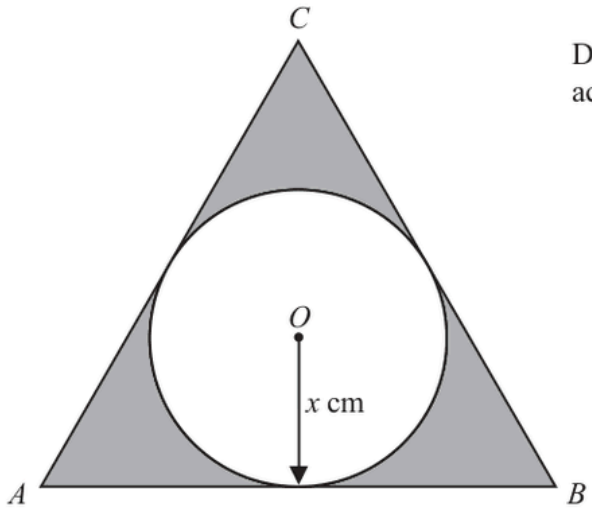


Diagram **NOT** accurately drawn

AB, BC and CA are tangents to the circle.

The radius of the circle is x cm

The total area, in cm^2, of the regions shown shaded in the diagram is nx^2

Find the value of n
Give your answer correct to 3 significant figures.

$n =$ .....

(Total for Question 25 is 5 marks)

WORKED SOLUTION

Question 25 · 4MA1/2H November 2024

1 **Use trigonometry**

The circle has radius x, so the inradius of the equilateral triangle is x.

2 **Use trigonometry**

For an equilateral triangle with side length a,

$$\text{inradius} = \frac{a\sqrt{3}}{6}$$

3 **Simplify surd**

So

$$x = \frac{a\sqrt{3}}{6}$$

$$a = \frac{6x}{\sqrt{3}} = 2\sqrt{3}x$$

4 **Area of the triangle**

Area of the triangle:

$$\frac{\sqrt{3}}{4}a^2 = \frac{\sqrt{3}}{4}(2\sqrt{3}x)^2$$

$$= \frac{\sqrt{3}}{4}(12x^2) = 3\sqrt{3}x^2$$

5 **Area of the circle**

Area of the circle:

$$\pi x^2$$

6 **The shaded area is**

The shaded area is

$$3\sqrt{3}x^2 - \pi x^2$$

$$= (3\sqrt{3} - \pi)x^2$$

7 **Simplify surd**

Therefore

$$n = 3\sqrt{3} - \pi$$

✓ **FINAL ANSWER**

$$\boxed{3\sqrt{3} - \pi}$$