2025.S34

2025J003A1EL

Coimisiún na Scrúduithe Stáit
State Examinations Commission

Junior Cycle Final Examination 2025

Mathematics

Higher Level

Friday 6 June Afternoon 1:30 - 3:30

270 marks

Examination Number

Date of Birth

For example, 3rd February 2005 is entered as 03 02 05

Centre Stamp

Instructions

There are 13 questions on this examination paper. Answer **all** questions.

Questions do not necessarily carry equal marks. To help you manage your time during this examination, a maximum time for each question is suggested. If you remain within these times you should have about 10 minutes left to review your work.

Write your Examination Number in the box on the front cover.

Write your answers in blue or black pen. You may use pencil in graphs and diagrams only.

This examination booklet will be scanned and your work will be presented to an examiner on screen. Anything that you write outside of the answer areas may not be seen by the examiner.

Write all answers into this booklet. There is space for extra work at the back of the booklet.
If you need to use it, label any extra work clearly with the question number and part.

The superintendent will give you a copy of the *Formulae and Tables* booklet. You must return it at the end of the examination. You are not allowed to bring your own copy into the examination.

In general, diagrams are not to scale.

You may lose marks if your solutions do not include supporting work.

You may lose marks if you do not include the appropriate units of measurement, where relevant.

You may lose marks if you do not give your answers in simplest form, where relevant.

Write the make and model of your calculator(s) here:

Question 1 **(Suggested maximum time: 5 minutes)**

(a) A sports shop sells 3 different brands of running shoes, **A**, **B**, and **C**.

Each brand comes in the 4 different colours and 4 different sizes shown in the table below.

Brand	Colour	Size
A	Red	7
B	Blue	8
C	Black	9
	Yellow	10

How many **different** choices of running shoe does the shop sell?
For example, one choice would be brand **B**, yellow, and size 7.

(b) A pair of running shoes normally cost €140.
In a sale, they cost €93·80.

Work out the **percentage discount** in the sale.

Question 2 **(Suggested maximum time: 10 minutes)**

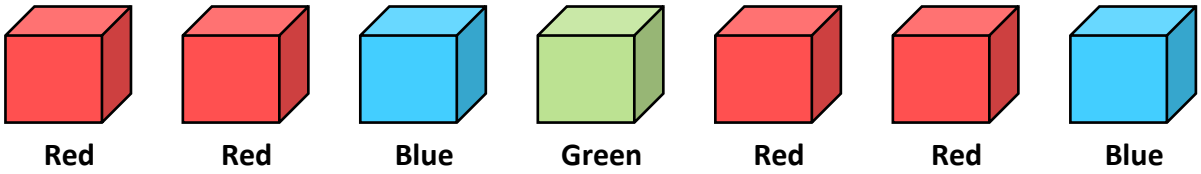
(a) Write down the next two terms in each of the following sequences.
The type of each sequence is given.

(i) **Linear**: 1, 5, 9, ☐, ☐

(ii) **Tripling**: 4, 12, 36, ☐, ☐

(iii) **Quadratic**: 12, 19, 23, ☐, ☐

(b) Amy makes a sequence using coloured blocks.
The first 7 blocks in the sequence are shown below.
The pattern repeats every 4 blocks.



(i) What colour is the 10th block in the sequence?

(ii) Amy picks one block at random from the first 25 blocks in the sequence.
What is the probability that this block is **red**?

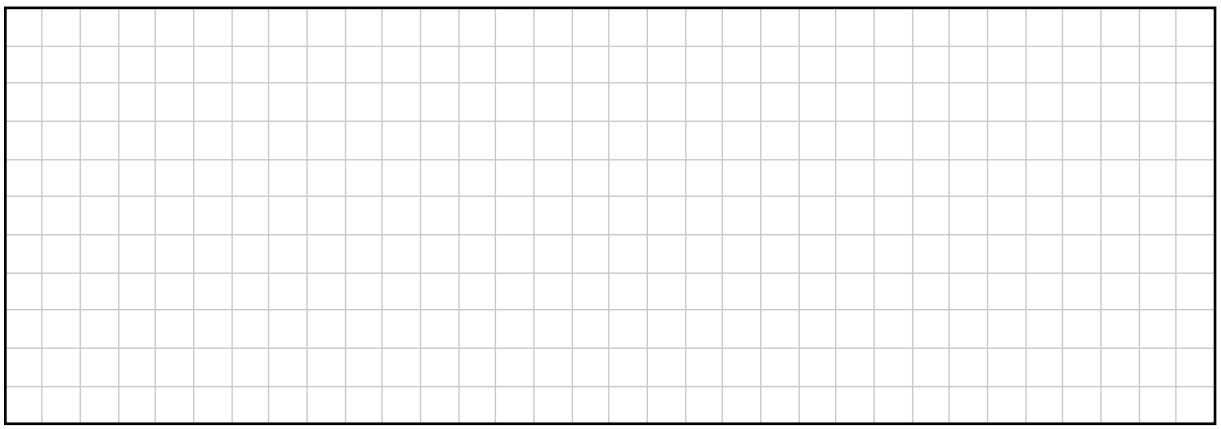
Question 3 **(Suggested maximum time: 5 minutes)**

Mae decides to paint her living room.
She needs supplies to carry out the work and someone to do the work.

She makes estimates of how much these will cost, and makes the bill below to show this information. Some of the values are missing, and are labelled **A**, **B**, **C**, **D**, **E**, and **F**.

Item Description	Unit Price	×	Number of Units	=	Total Cost
Tin of paint	€42·50	×	3	=	**A.**
Paint brush	€6·99	×	**B.**	=	€13·98
Dust sheet and tape pack	€33·80	×	1	=	**C.**
Labour	€120 a day	×	3·5	=	**D.**
	Subtotal				€595·28
	VAT @ 13·5%				**E.**
	Total Cost				**F.**

(a) Work out the missing values labelled **A**, **B**, **C**, and **D**. Fill your answers into the table.



(b) Work out the missing value labelled **E**, the VAT. This is $13{\cdot}5\%$ of the **Subtotal**.
Give your answer correct to 2 decimal places.

(c) Work out the missing value labelled **F**, the **Total Cost** including the VAT.
Give your answer correct to 2 decimal places.

Question 4 **(Suggested maximum time: 10 minutes)**

12 students sit class tests in Art and Business on Monday.
The students' marks in both subjects are as follows:

Art		
54	49	47
71	52	50
51	34	62
47	46	37

Business		
59	64	52
67	68	67
59	65	54
53	66	69

(a) Complete the back-to-back stem and leaf diagram below to show the students' marks.

Art		Business
	3	
	4	
	5	
	6	
	7	
Key: $4\|5\| = 54$ marks		**Key:** $\|5\|3 = 53$ marks

(b) **Based on the shape** of the stem and leaf diagram, write a sentence to compare the students' results in Art and in Business. You should refer to how well students did, on average, **and** to how spread out the marks are.

(c) Work out the **range** of the marks for Business.

(d) Michael is one of the 12 students. He sits the Business test again, and gets a higher mark than the first time he took the test. When the teacher uses Michael's new mark and works out the range of the marks, the range does **not** change.

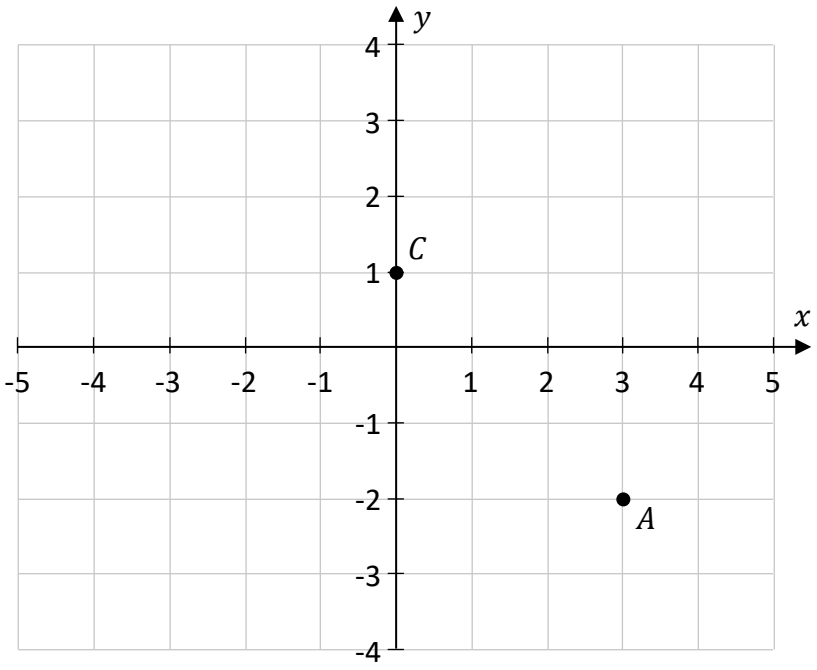
Explain how this could happen.

(e) A 13th student, Ajani, was absent for the two tests on Monday.
He sits the tests the following day.
When his mark is included, the **mean mark** in **Art increases** from 50 to 51.

Work out Ajani's mark in Art.

Question 5 **(Suggested maximum time: 5 minutes)**

The points A and C are shown on the co-ordinate diagram below.



(a) Write the co-ordinates of the points A and C in the spaces below.

$A =$ (,) $C =$ (,)

B, D, and E are three more points.

(b) **Plot and label** the point $B\ (4, 3)$ on the diagram on the **previous page**.

(c) $ABCD$ is a **parallelogram**.
Use this information to **plot and label** the point D on the diagram on the **previous page**.

(d) The point C is the **midpoint** of the line segment $[AE]$.
Write down the co-ordinates of the point E.

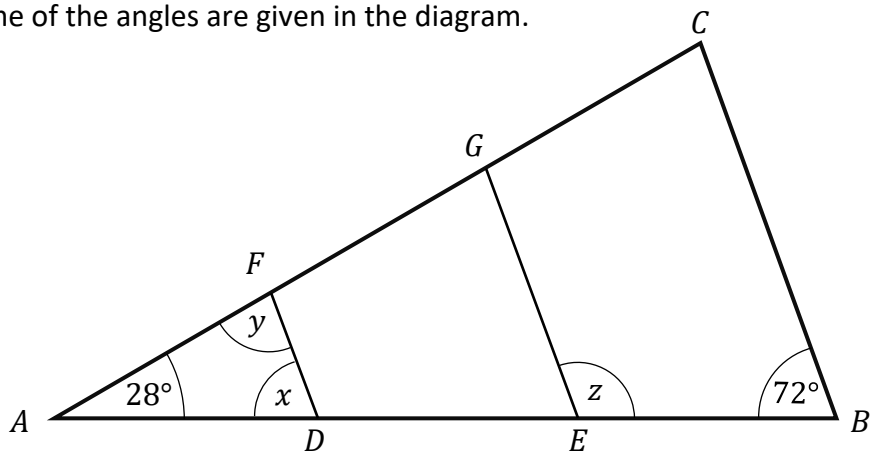
$E = (\quad , \quad)$

Question 6 **(Suggested maximum time: 10 minutes)**

(a) The line segment $[PQ]$ is show below.

Divide the line segment $[PQ]$ into **three equal** lengths, without measuring it.
Show all of your construction lines clearly.

The diagram below shows a triangle ABC. The points D and E are on $[AB]$ and the points F and G are on $[AC]$, so that DF, EG and BC are all parallel.
The size of some of the angles are given in the diagram.



(b) **(i)** Work out the size of the angles marked x, y, and z in the diagram.

$x =$ _____ $y =$ _____ $z =$ _____

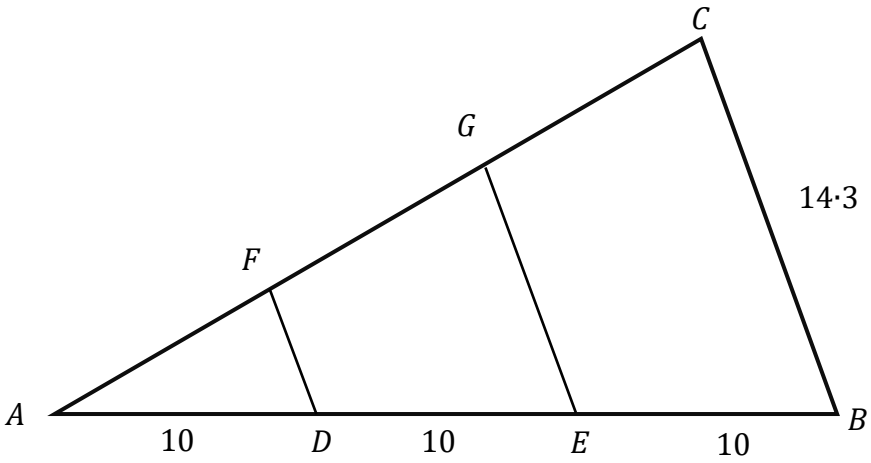
(ii) Explain why the triangles ABC and ADF are **similar** but **not congruent**.

Similar:

Not congruent:

(c) The same triangles are shown again below.
This time, the lengths of some sides are shown.
$|AD| = |DE| = |EB| = 10$ and $|BC| = 14{\cdot}3$.

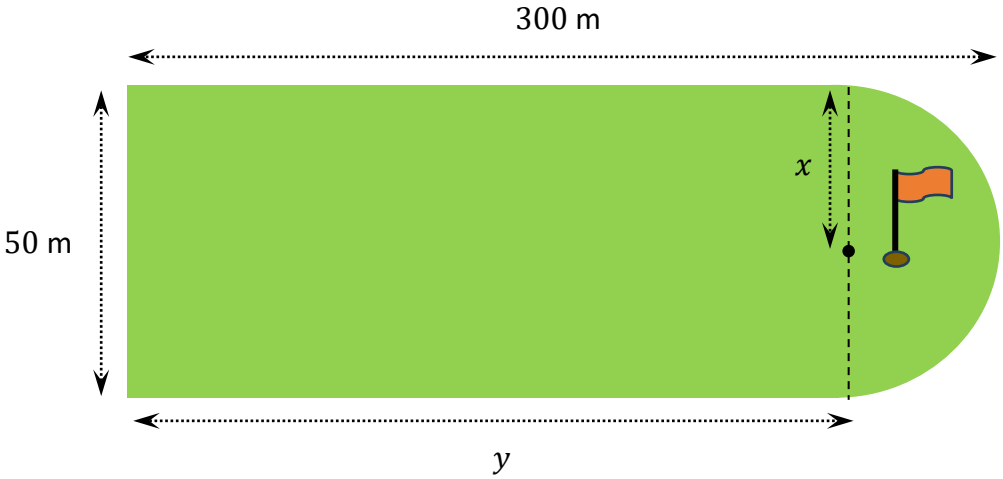
Using similar triangles, work out the length $|GE|$.



Question 7 **(Suggested maximum time: 15 minutes)**

One section of a golf course, shown in the diagram below, is in the shape of a rectangle with a semi-circle at one end.

This shape has a width of 50 m and a total length of 300 m, as shown.



(a) **(i)** Work out the distances marked x and y on the diagram.
x is the **radius** of the semicircle.

$x =$ _____ $y =$ _____

(ii) Hence, work out the **total area** of this section of the golf course.
Give your answer correct to the nearest m^2.

(b) Maciej is spreading fertiliser on the whole golf course.
The packet of fertiliser has these instructions:

> Use 6 litres of fertiliser per 250 m^2 of ground to be covered.

Maciej needs to cover $809\,371$ m^2 with fertiliser.
How many litres of fertiliser will Maciej need to use?
Give your answer correct to the nearest whole number.

(c) The fertiliser is made up of three ingredients, **A**, **B**, and **C**, in the following ratio:

A	:	**B**	:	**C**
1	:	$\frac{3}{2}$	:	$\frac{5}{3}$

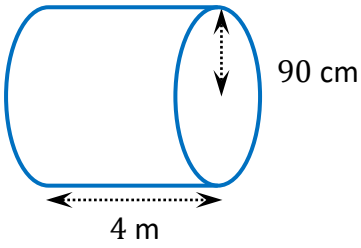
Work out the number of **millilitres** of **B** in 1 litre of fertiliser.

This question continues on the next page.

(d) The tank for spreading fertiliser is in the shape of a cylinder.

The radius of the tank is 90 **centimetres** and its length is 4 metres, as shown in the diagram on the right.

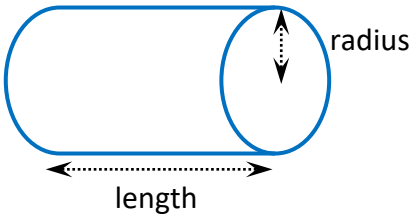
Work out the **volume** of the tank.
Give your answer in m^3, correct to 2 decimal places.



(e) This diagram on the right shows a different cylindrical tank, which has a volume of $\frac{81\pi}{125}$ m^3.

Its length is **three times** as long as its radius, as shown.

Work out the radius of this tank, in metres.

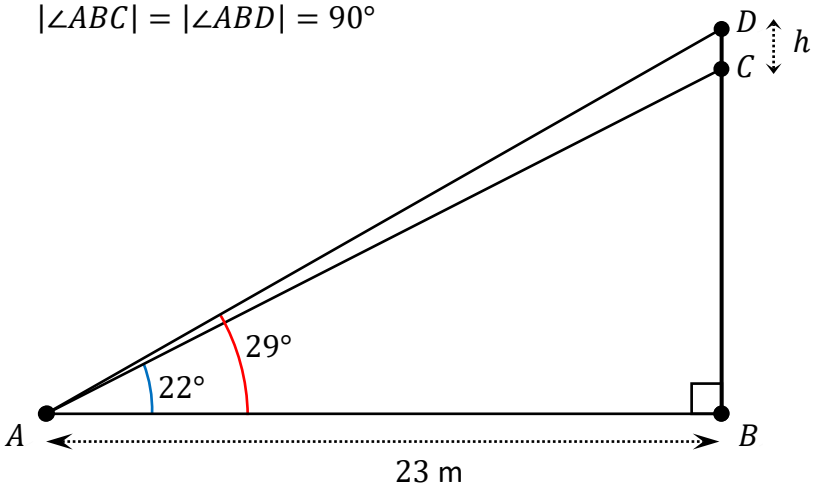


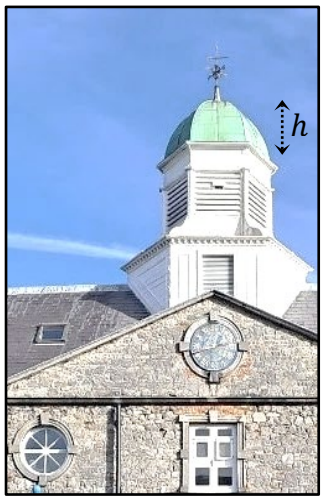
Question 8 **(Suggested maximum time: 5 minutes)**

(a) Cos $A = 0{\cdot}27$. Work out the size of the angle A, correct to the nearest degree.

(b) Olga would like to know the vertical height, h, of the roof of a building. Olga takes the following measurements and shows them on the diagram below, where $h = |DC|$:

$|\angle CAB| = 22°$
$|\angle DAB| = 29°$
$|AB| = 23$ m
$|\angle ABC| = |\angle ABD| = 90°$



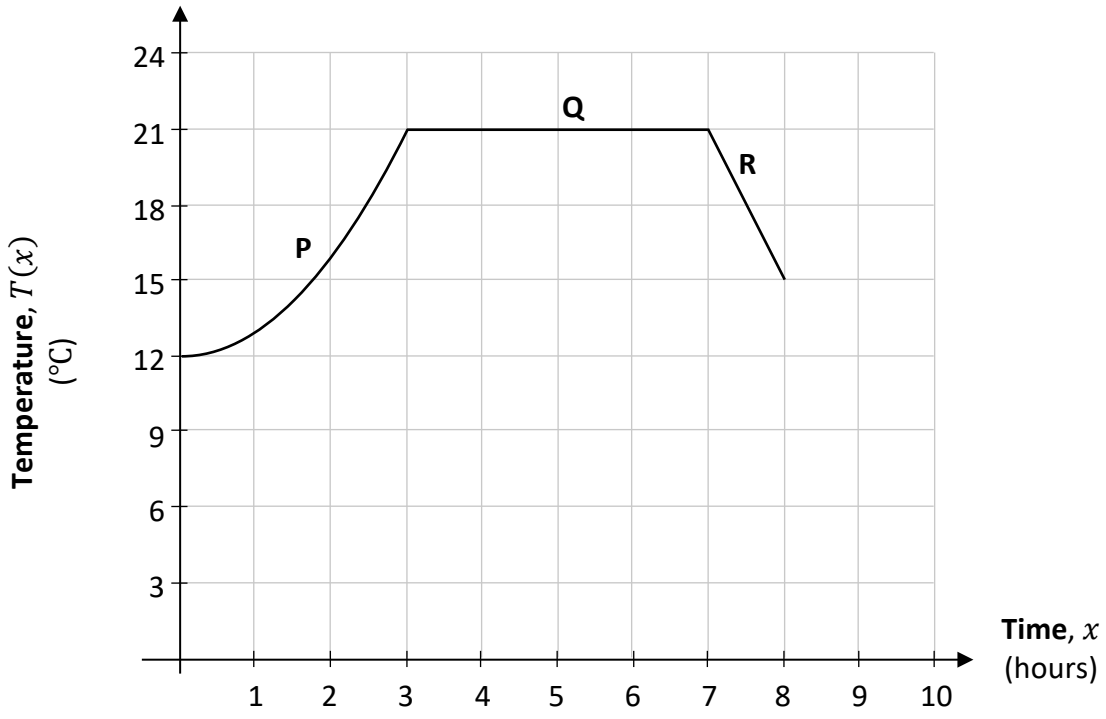


Use trigonometry to work out the vertical height, h, of the roof.
Give your answer correct to 1 decimal place.

Question 9 **(Suggested maximum time: 15 minutes)**

Fiadh records the temperature in her kitchen, in degrees Celsius (°C), over $\boldsymbol{10}$ hours.
$\boldsymbol{T(x)}$ is the temperature $\boldsymbol{x}$ hours after Fiadh starts recording it, for $\boldsymbol{0 \leq x \leq 10}$.

The graph below shows $\boldsymbol{T(x)}$ for **the first 8 hours**. It is in three sections, labelled **P**, **Q**, and **R**.
Use the information in the graph to answer parts **(a)** to **(f)**.



(a) Estimate how long it takes for the temperature to reach 20°C for the first time.
Give your answer in hours, correct to 1 decimal place. Show your work on the graph.

(b) For how many hours does the temperature remain constant, for $0 \leq x \leq 8$?

Section **S** of the graph goes from $x = 8$ to $x = 10$, with $T(8) = 15$.
During section **S** of the graph, the rate of change of the temperature is $+3$°C per hour.

(c) Use this to **draw** section **S** of the graph on the diagram above, for $8 \leq x \leq 10$, $x \in \mathbb{R}$.

(d) The table below gives a function for the temperature in each of the three sections, **P**, **Q**, and **R**. Write the correct letter (**P**, **Q**, or **R**) in the appropriate space in the table to show which function corresponds to each section of the graph. **Use each letter only once**.

Section (**P**, **Q**, or **R**)	**During this section, the function for the temperature is:**
	$T(x) = 21$
	$T(x) = x^2 + 12$
	$T(x) = -6x + 63$

(e) Which of the following functions gives the temperature in section **S** of the graph (the section you drew in part **(c)**)? Tick (✓) **one** box only.

Justify your answer, for example, by checking points in section **S**.

$T(x) = 3x - 9$ ☐ $T(x) = -3x - 12$ ☐ $T(x) = 3x + 12$ ☐

Justification:

(f) Remember that the graph shows the temperature in Fiadh's kitchen.
The temperature in Fiadh's bedroom is always $3°\mathbb{C}$ **less** than the temperature in the kitchen.

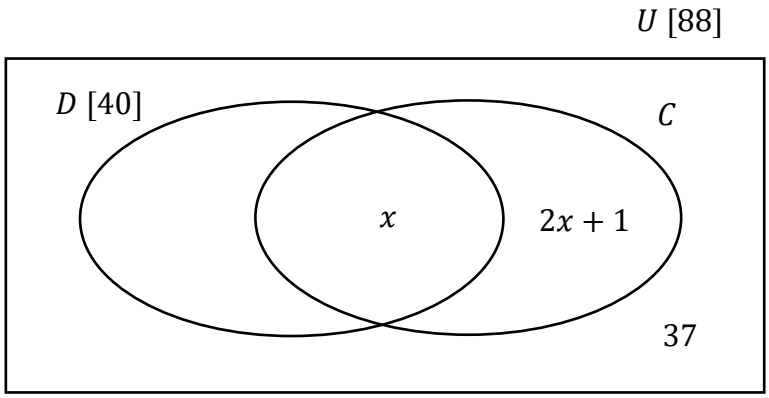
On the diagram on the **previous page**, **draw** a graph to show the temperature in Fiadh's bedroom for the first 8 hours ($0 \leq x \leq 8, x \in \mathbb{R}$). Use the same axes and scales.

Question 10 **(Suggested maximum time: 5 minutes)**

There are 88 students in 3rd year in a school.

The Venn diagram below shows the number of these students who are members of the debating club (D) and the chess club (C). Some of these values are given in terms of x, where $x \in \mathbb{N}$.

In total, there are 40 students in the debating club (D).
There are 37 students in neither club.



(a) **(i)** Fill in the missing value in the Venn diagram, in terms of x.

(ii) Hence, or otherwise, work out the value of x.

(b) Michael is in the set $D \setminus C$.
What information does this give about the clubs that Michael is in?

Question 11 **(Suggested maximum time: 5 minutes)**

(a) Simplify $5x^2 - 7x + 3x^2 - 6x$.

(b) Divide $(x^3 + 11x^2 + 15x - 27)$ by $(x + 3)$.

Question 12 **(Suggested maximum time: 10 minutes)**

(a) The function $f(x)$ is:

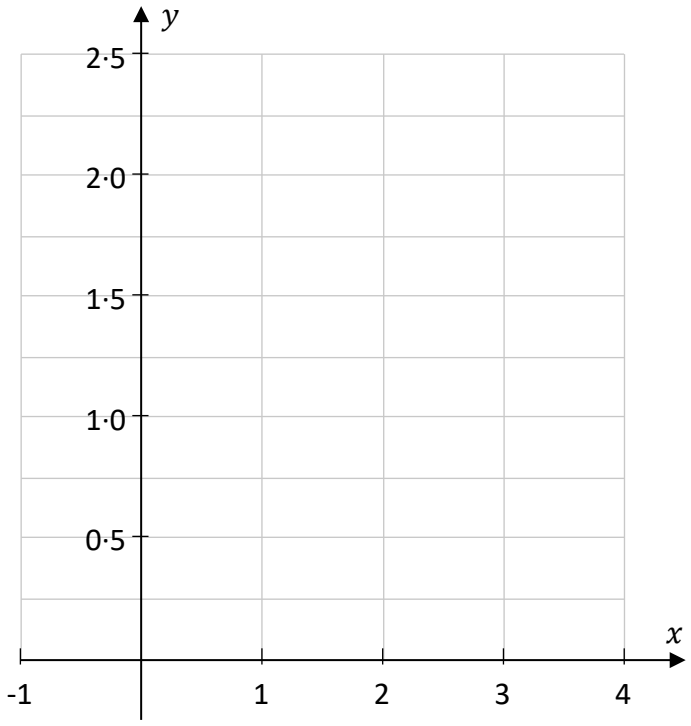
$$f(x) = \frac{2}{x+2}$$

for $x > -2$.

(i) Complete the table below, showing the values for $f(x)$ for the given values of x. Give values correct to 2 decimal places, where appropriate.

x	-1	0	1	2	3	4
$f(x)$		1		$0{\cdot}5$	$0{\cdot}4$	

(ii) Use the values in the table to draw the graph of the function $y = f(x)$ on the axes below, for $-1 \leq x \leq 4$, $x \in \mathbb{R}$.



(b) Solve the following simultaneous equations to find the value of x and the value of y:

$$3x + 4y = 29$$
$$2x + y = 9$$

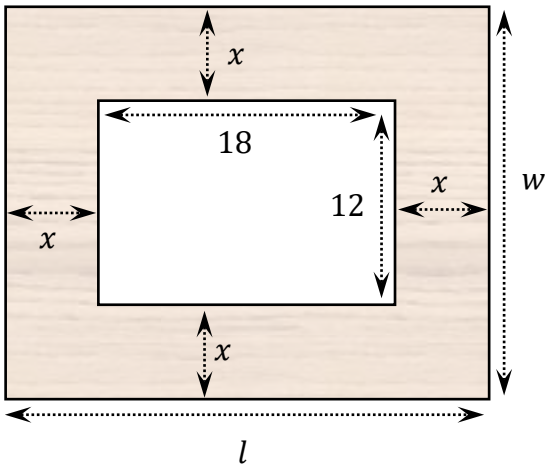
$x =$ _____ $y =$ _____

Question 13 **(Suggested maximum time: 10 minutes)**

In this question, all lengths are in cm.

The diagram below shows a rectangular frame for a photo, where $w, l, x \in \mathbb{R}$.

The width of the frame is w and the length is l.
There is a rectangular hole in the middle for the photo, measuring 12 by 18.
The internal width of the frame is x, as shown.



(a) The length of the frame $l = 18 + 2x$.
Write the **width** of the frame, w, in terms of x.

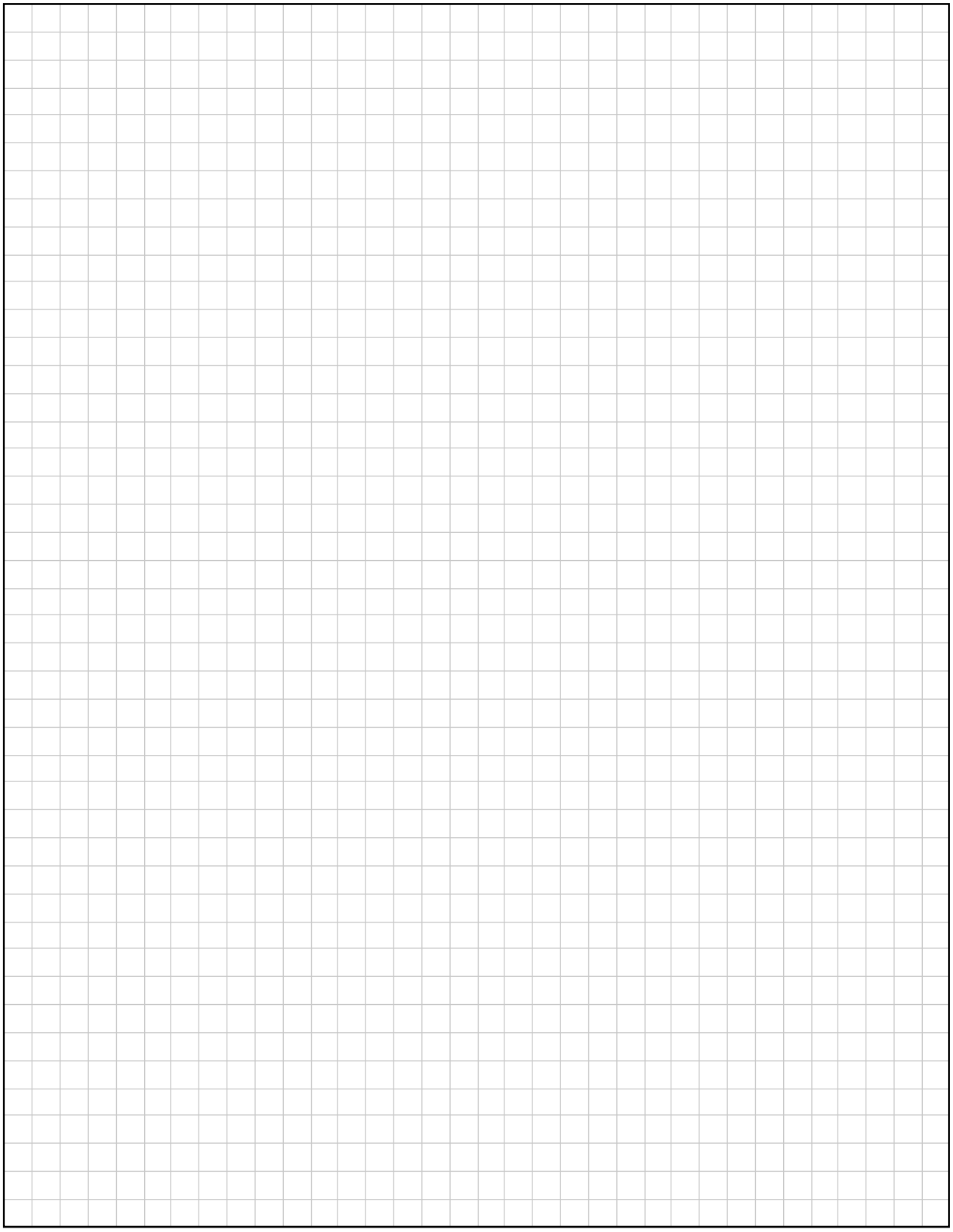
(b) Hence, show that:

$$l \times w = 4x^2 + 60x + 216$$

(c) $l \times w = 648$ cm^2.

Use this, and the information from part **(b)**, to find the value of x.
Give your answer in cm, correct to 1 decimal place.

Page for extra work.
Label any extra work clearly with the question number and part.



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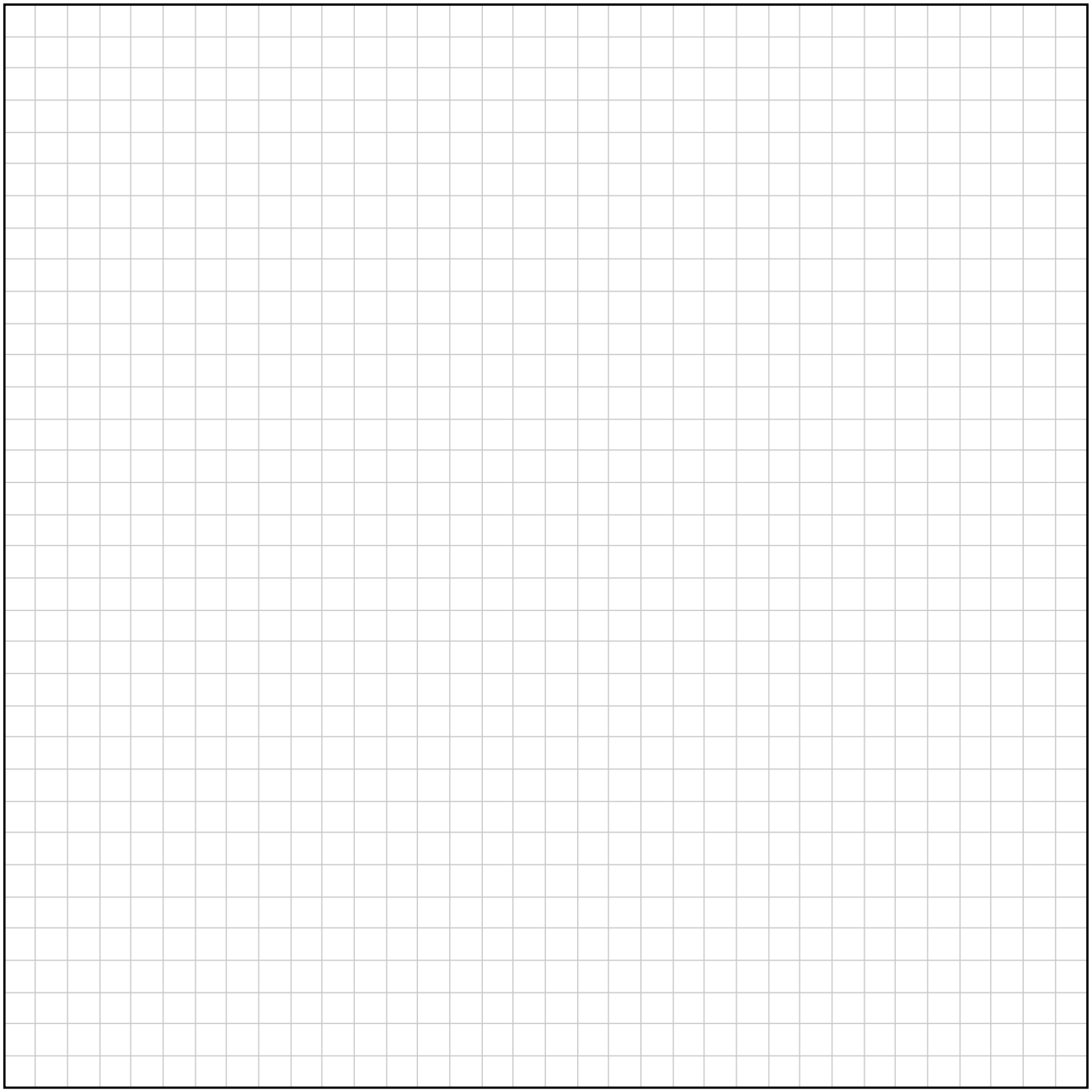

Acknowledgements

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Image on page 17: State Examinations Commission

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Junior Cycle Final Examination – Higher Level

Mathematics

Friday 6 June

Afternoon 1:30 - 3:30