



Coimisiún na Scrúduithe Stáit  
State Examinations Commission

## Junior Cycle Final Examination 2026

# Mathematics

## Higher Level

Friday 5 June Afternoon 1:30 - 3:30

270 marks

Examination Number

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Date of Birth

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

Centre Stamp

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## 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:

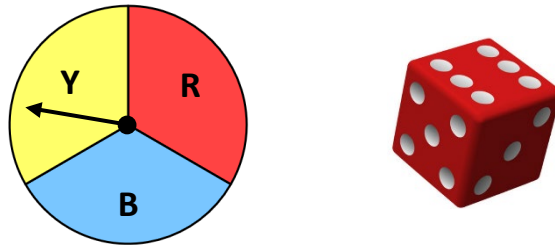
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**Question 1** (Suggested maximum time: 5 minutes)

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A game consists of spinning a fair spinner and rolling a fair six-sided die.

The spinner has three equal coloured sectors: red (**R**), yellow (**Y**), and blue (**B**).



- (a) Complete the table below to show all 18 possible outcomes of the game. Two have already been done for you.  
For example, **R3** means red on the spinner and 3 on the die.

|         |   | Die |   |    |   |    |   |
|---------|---|-----|---|----|---|----|---|
|         |   | 1   | 2 | 3  | 4 | 5  | 6 |
| Spinner | R |     |   | R3 |   |    |   |
|         | Y |     |   |    |   |    |   |
|         | B |     |   |    |   | B5 |   |

- (b)** Each outcome in the table is equally likely.  
The game is played once. Find the probability that the outcome is:

- (i) red on the spinner.

[illegible]

- (ii) blue on the spinner **and** an even number on the die.

[illegible]

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

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

- (a) 60 students were asked how much time they spent on their phone on a particular day. The results are shown in the frequency table below.

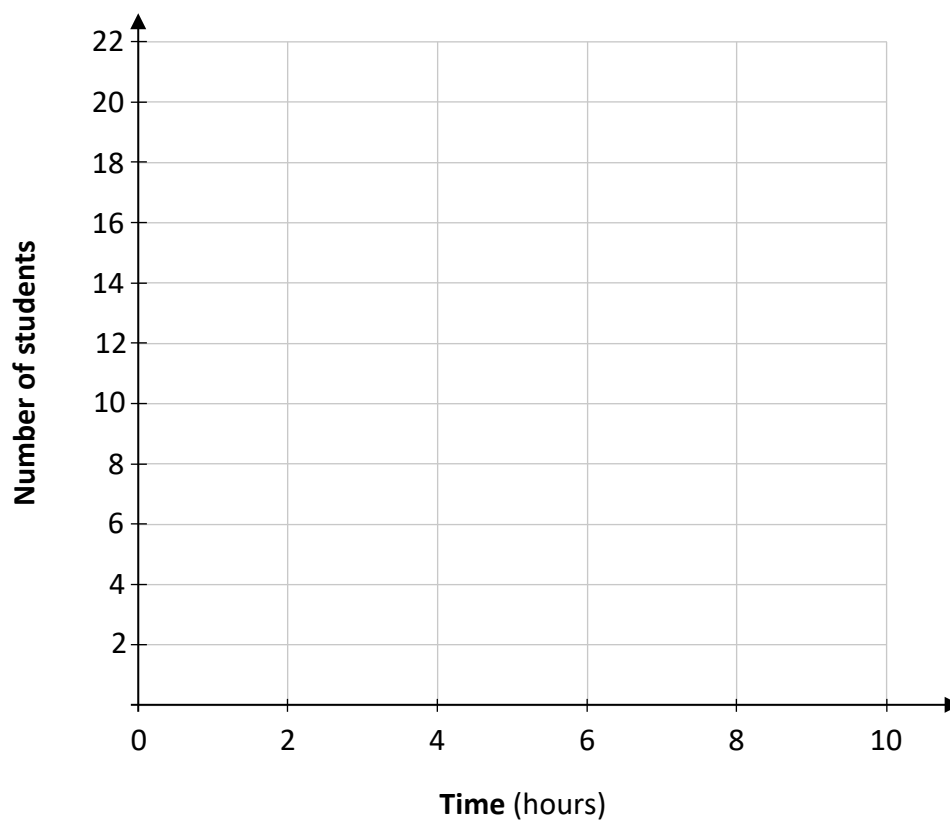
| Time (hours)       | 0 – 2 | 2 – 4 | 4 – 6 | 6 – 8 | 8 – 10 |
|--------------------|-------|-------|-------|-------|--------|
| Number of students | 21    | 20    | 14    | 4     | 1      |

[Note: 2 – 4 means 2 hours or more but less than 4 hours, and so on.]



Use the information from the table to answer parts (a)(i), (a)(ii), and (a)(iii).

- (i) Draw a **histogram** to show the information in the table. Use the axes and scales below.



- (ii) Find the **maximum** number of students who could have spent **less than 3 hours** on their phone.

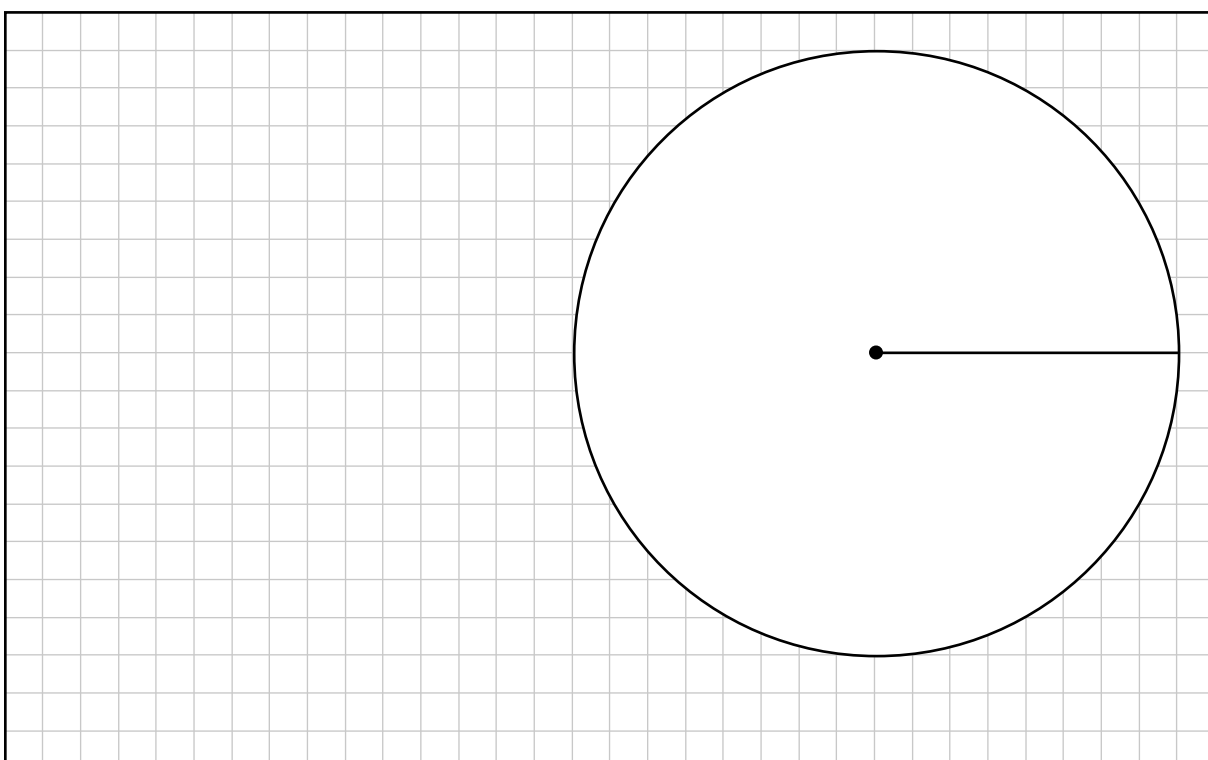
[illegible]

- (iii) Use **mid-interval** values to estimate the **mean** amount of time the 60 students spent on their phone.  
Give your answer in hours, correct to 1 decimal place.

- (b) The 60 students were also asked what the most common use of their phone was. The results are shown in the table below.

| Most common use    | Social Media | Video Streaming | Gaming | Messaging |
|--------------------|--------------|-----------------|--------|-----------|
| Number of students | 30           | 10              | 6      | 14        |

Complete the **pie chart** below to show the information in the table above. Label each sector **and** the size of each angle clearly. Show any workings out.

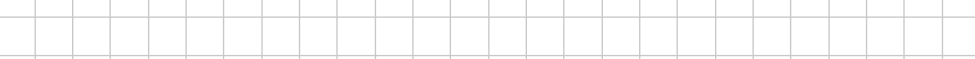


### Question 3

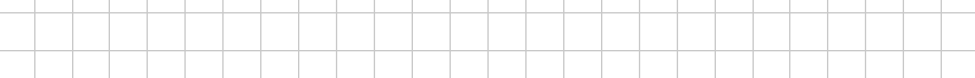
**(Suggested maximum time: 10 minutes)**

- (a) Martina buys a new car from the UK.
- (i) The cost of the car is £21 250 sterling.  
The exchange rate is €1 = £0.85 sterling.

Show that the cost of the car in euro is €25 000.



- (ii) Martina pays a customs charge of €3375.  
Write this charge as a percentage of €25 000.



- (b)** Martina has a gross annual income of €50 000.  
Martina pays income tax on her gross income at the rates given in the table below.

| Annual Income | Tax Rate |
|---------------|----------|
| First €40 000 | 20%      |
| Balance       | 40%      |

- (i)** Work out Martina's annual income tax at each of these two rates (20% and 40%).

Income tax at 20% = €\_\_\_\_\_

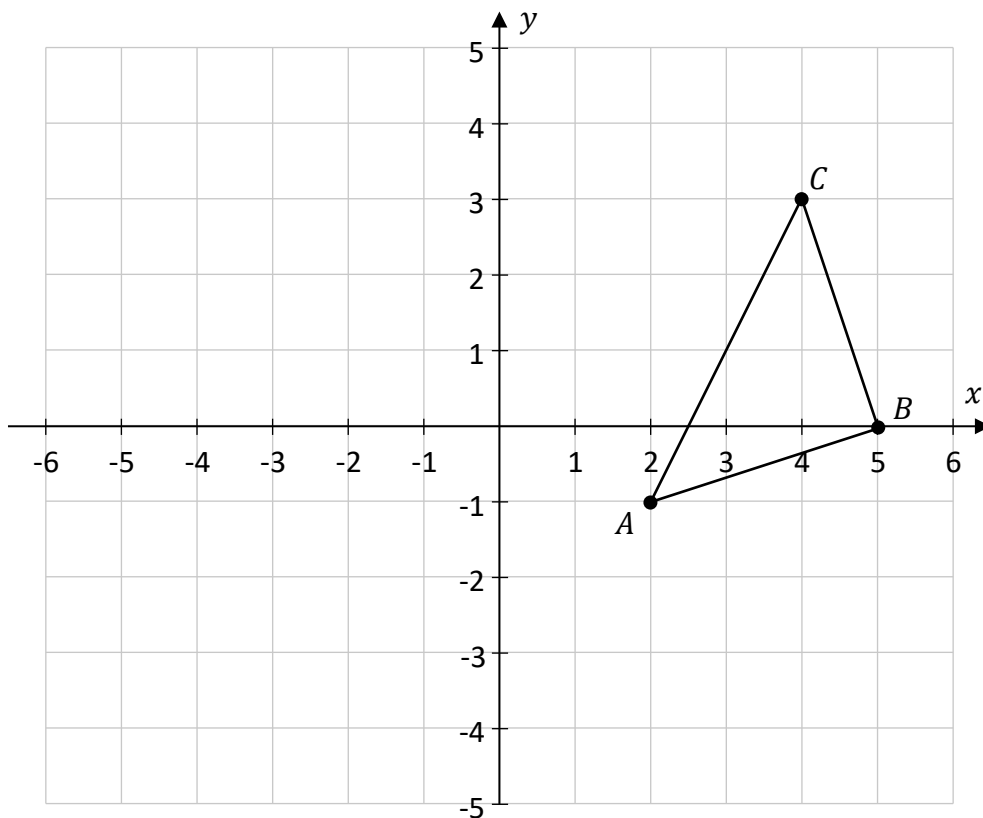
Income tax at 40% = €\_\_\_\_\_

- (ii) Martina has annual tax credits of €3300.  
Work out Martina's **net annual income**.

- (iii) Martina gets a pay rise and her net annual income increases by €4800.  
Work out Martina's new **gross annual income**.

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

The co-ordinate diagram below shows the triangle  $ABC$ .

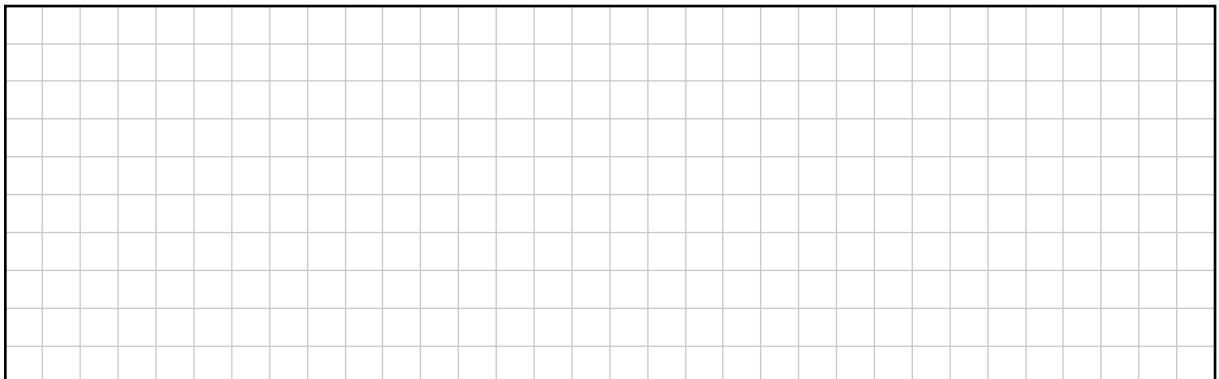


- (a) The point  $A$  has co-ordinates  $(2, -1)$ .  
Write the co-ordinates of the point  $B$  and the point  $C$  in the spaces below.

$$B = \left( \quad , \quad \right) \quad C = \left( \quad , \quad \right)$$

- (b) The equation of the line  $AC$  is  $y = 2x + k$ , where  $k \in \mathbb{Z}$ .

Find the value of  $k$ .



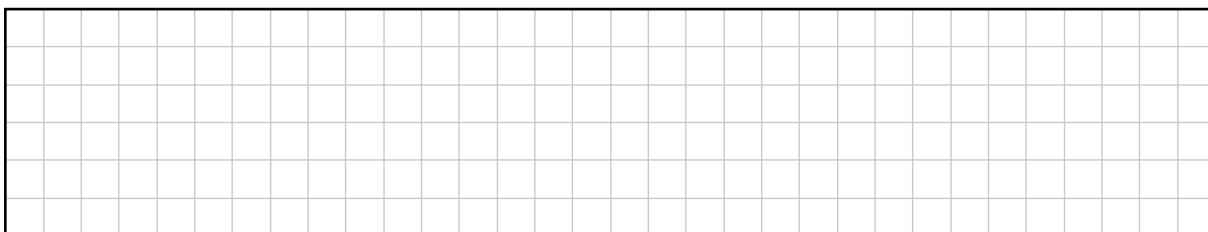
- (c) Without measuring the diagram, investigate if the triangle  $ABC$  is an **isosceles** triangle. Use calculations to support your answer.

*Hint:* It might be useful to find the distance  $|AB|$ .

|                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Triangle <math>ABC</math> is an <b>isosceles</b> triangle:</p> <p>(Tick (✓) <b>one</b> box only)</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p>True</p> <input style="width: 30px; height: 20px;" type="checkbox"/> </div> <div style="text-align: center;"> <p>False</p> <input style="width: 30px; height: 20px;" type="checkbox"/> </div> </div> |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

- (d) The triangle  $A'B'C'$  is the image of the triangle  $ABC$  under **central symmetry** in the origin  $(0, 0)$ .

**Draw** and **label** the triangle  $A'B'C'$  on the co-ordinate diagram on the **previous page**.

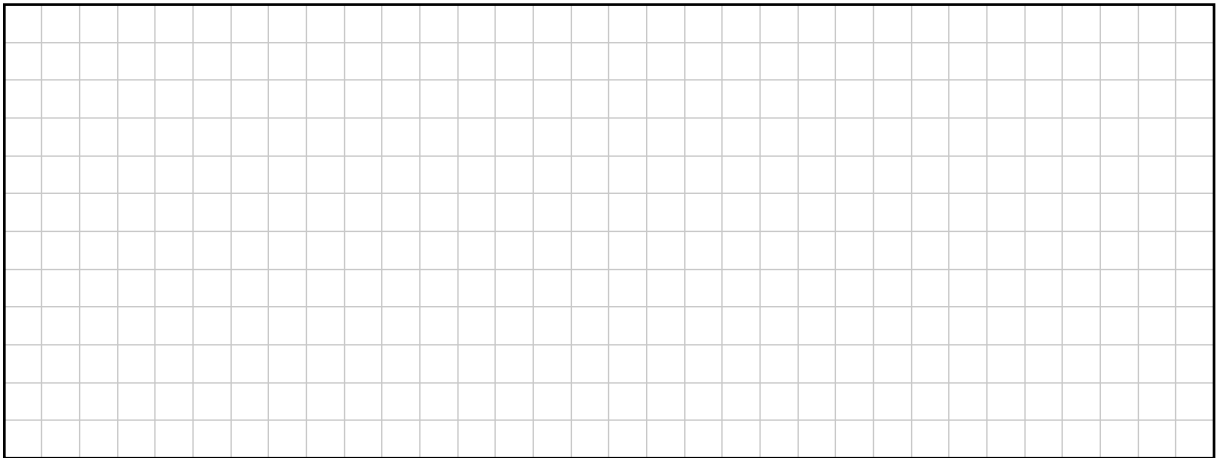


**Question 5**

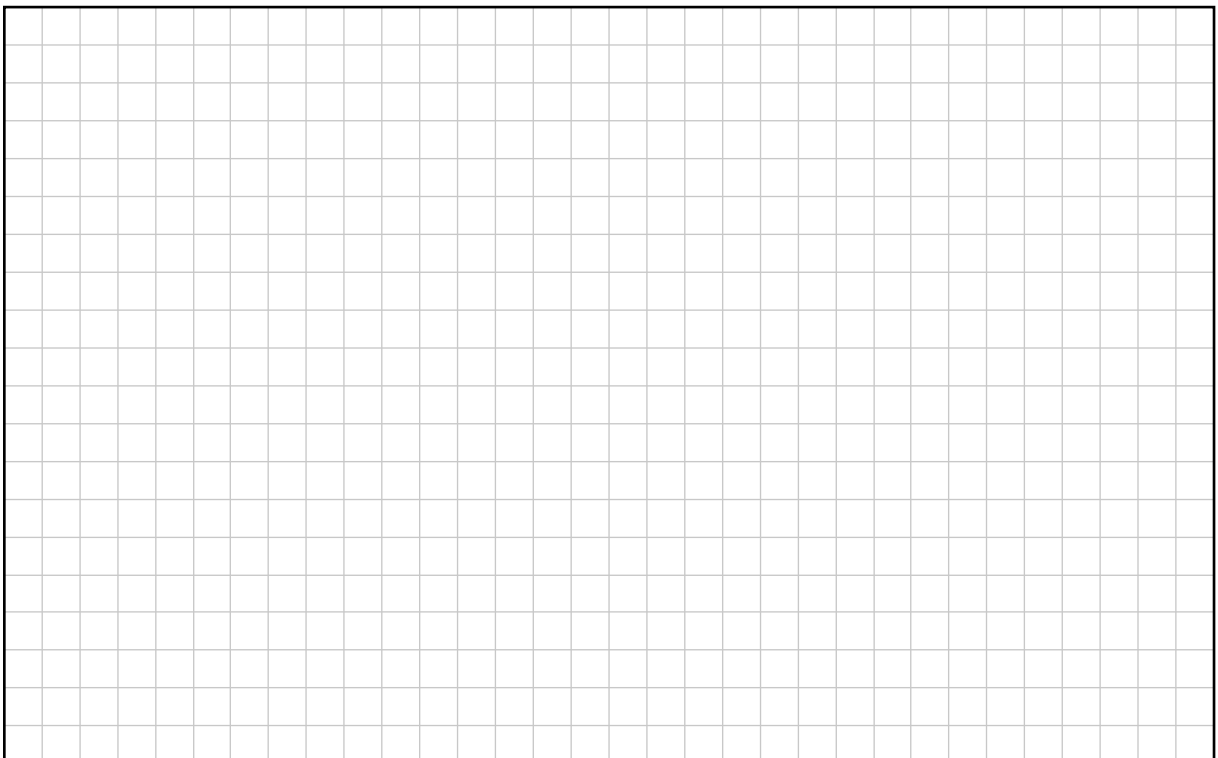
**(Suggested maximum time: 5 minutes)**

- (a)** Viktoria is 9 years old and Senan is 11 years old.  
€120 is divided between them in the ratio of their ages.

How much money does Viktoria get?



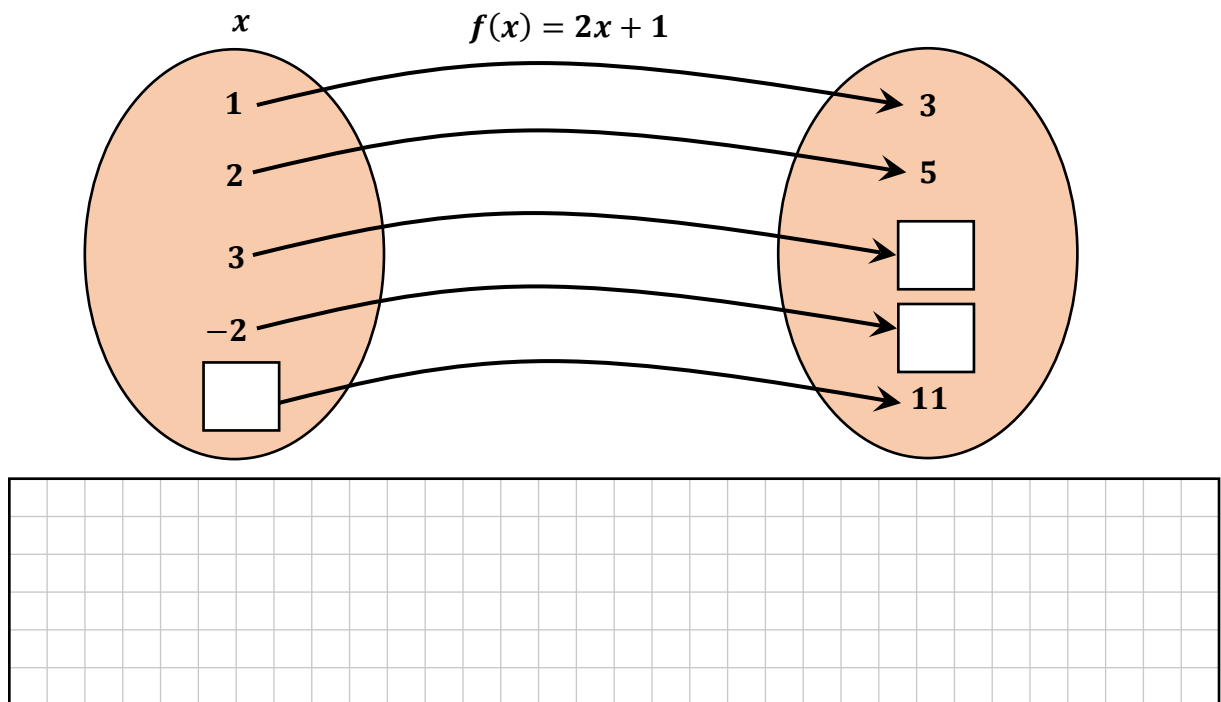
- (b)** The distance from the Sun to Mars is approximately 250 million km.  
Light travels at a speed of approximately 300 000 km per second.  
Use this to work out the time it takes light to travel from the Sun to Mars.  
Give your answer in **minutes**, correct to 1 decimal place.



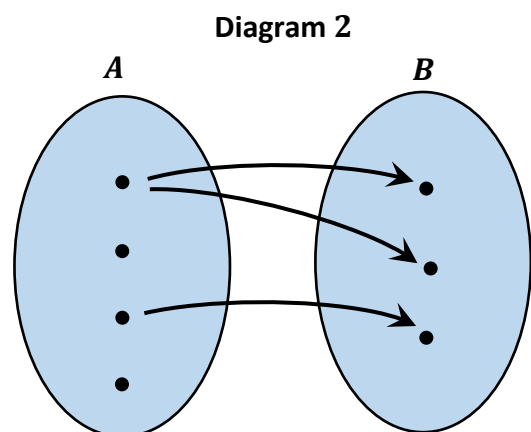
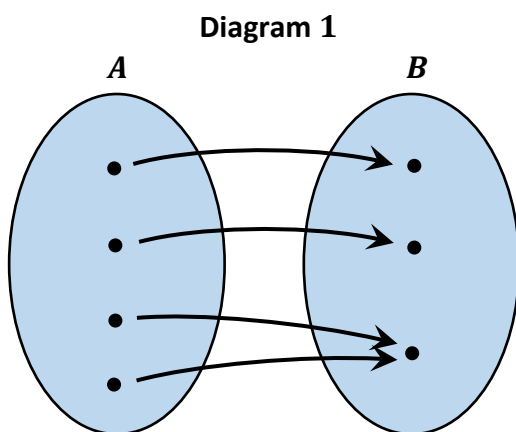
### Question 6

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

- (a) A mapping diagram of the function  $f(x) = 2x + 1$  is shown below. Fill in the three missing entries into the diagram below.



- (b)** Which of the following diagrams does **not** represent a function from set  $A$  to set  $B$ ? Give a reason for your answer.



Which is **not** a function?  
(Tick (✓) **one** box only)

Diagram 1



Diagram 2



Reason:

**Question 7** (Suggested maximum time: 10 minutes)

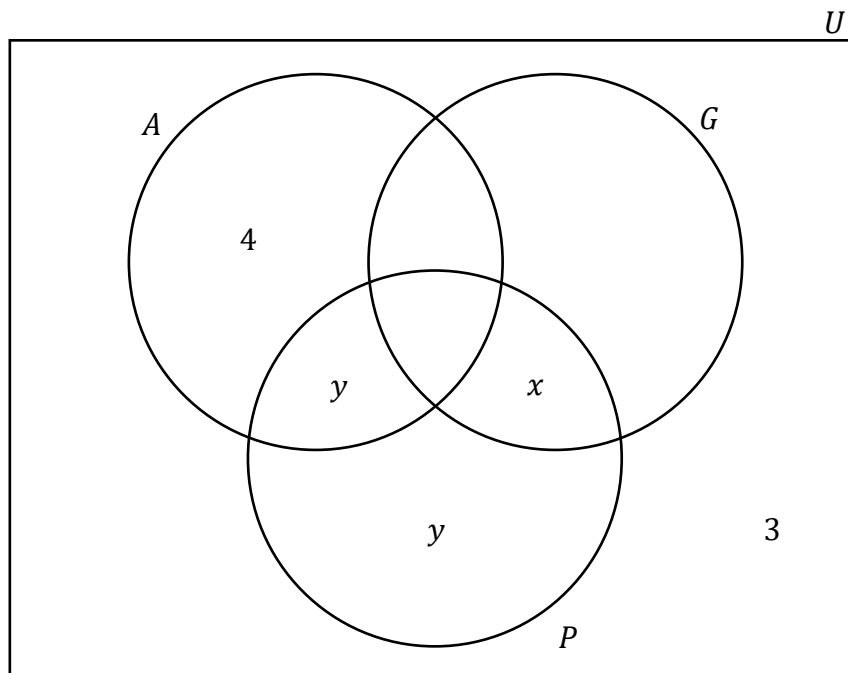
**Question 7** (Suggested maximum time: 10 minutes)

A group of students ( $U$ ) were given three maths problems to solve: an algebra problem ( $A$ ), a geometry problem ( $G$ ), and a probability problem ( $P$ ).

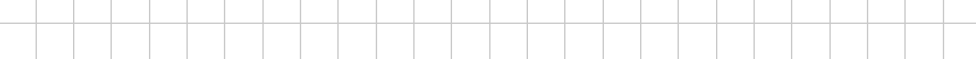
The Venn diagram below shows the number of students who solved some of the different types of problem. For example, 4 students solved the algebra problem ( $A$ ) only.

Some of the values are given in terms of  $x$  and  $y$ , where  $x, y \in \mathbb{N}$ .

Three values are missing.



- (a) (i) One of the regions of the Venn diagram has  $x$  students.  
Write a statement describing exactly which problems these students solved.



- (ii) Use the following information to fill in the three missing values in the Venn diagram:

- 2 students solved all three problems
- $2x$  students solved the geometry problem only
- 7 students solved both the algebra problem and the geometry problem.

[illegible]

- (b) (i)  $\#(A \cup G) = 29$  and  $\#P = 13$ .

Use this information to show that the following two equations are true:

$$3x + y = 18$$

$$x + 2y = 11$$

|                     |            |
|---------------------|------------|
| $\#(A \cup G) = 29$ | $\#P = 13$ |
|                     |            |

- (ii) Solve these simultaneous equations to find the value of  $x$  and the value of  $y$ .

|               |             |
|---------------|-------------|
| $3x + y = 18$ |             |
| $x + 2y = 11$ |             |
|               |             |
| $x =$ _____   | $y =$ _____ |

Question 8

(Suggested maximum time: 10 minutes)

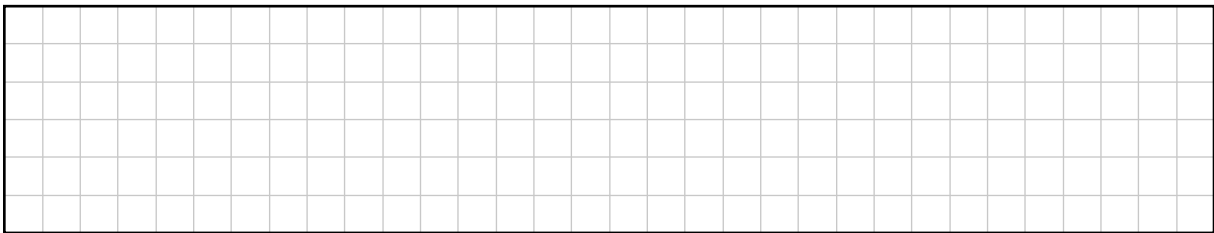
During an experiment, the number of bacteria in a sample can be modelled by the function:

$$b(t) = 10(2^t)$$

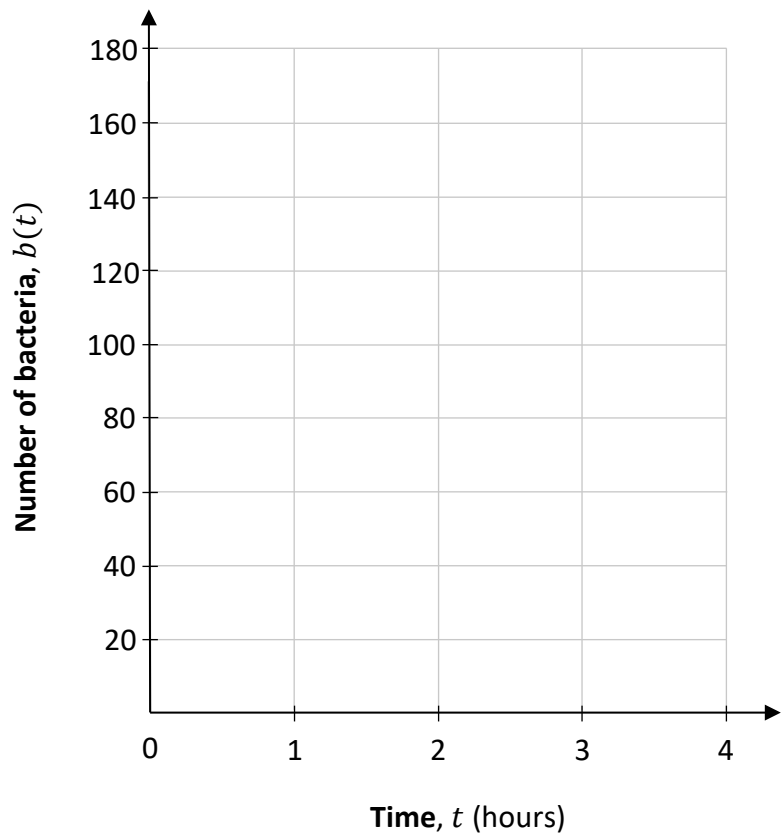
where  $b(t)$  is the number of bacteria  $t$  hours after the start of the experiment, with  $0 \leq t \leq 24, t \in \mathbb{R}$ .

- (a) (i) Complete the table below to show the number of bacteria for the first 4 hours of the experiment.

| Time, $t$ (hours)          | 0 | 1 | 2 | 3  | 4 |
|----------------------------|---|---|---|----|---|
| Number of bacteria, $b(t)$ |   |   |   | 80 |   |



- (ii) Hence, draw the graph of the function  $b(t)$  in the domain  $0 \leq t \leq 4, t \in \mathbb{R}$ .



(b) Use your graph to answer parts (b)(i) and (b)(ii).

- (i) Estimate the number of bacteria 2.5 hours after the start of the experiment.  
Show your work on the graph.

- (ii) Estimate how many hours it takes until there are 120 bacteria.  
Show your work on the graph.  
Give your answer correct to 1 decimal place.

- (c) What kind of pattern is made by the number of bacteria in the table on the previous page?  
Give a reason for your answer.

Answer:

(Tick (✓) **one** box only)

Linear

☐

Quadratic

☐

Exponential

☐

None of these

☐

Reason:

- (d) What is the number of bacteria 24 hours after the start of the experiment,  
according to the function  $b(t) = 10(2^t)$ ?

Give your answer in the form  $a \times 10^n$ , where  $1 \leq a < 10$  and  $n \in \mathbb{N}$ .

Write  $a$  correct to 3 significant figures.

**Question 9****(Suggested maximum time: 10 minutes)**

- (a)** Solve the equation  $2x^2 + 7x - 3 = 0$ .

Give each answer correct to 2 decimal places.

- (b)** Write the following expression as a single fraction in its simplest form:

$$\frac{3}{x+1} - \frac{4}{x}$$

(c)  $g(x)$  is the function  $g(x) = ax^2 + bx + c$ , where  $a$ ,  $b$ , and  $c$  are constants.

The graph of  $y = g(x)$  cuts the  $x$ -axis at the points  $(-3, 0)$  and  $(-2, 0)$ .

It also cuts the  $y$ -axis at the point  $(0, 12)$ .

Use this to find the value of  $a$ , the value of  $b$ , and the value of  $c$ .

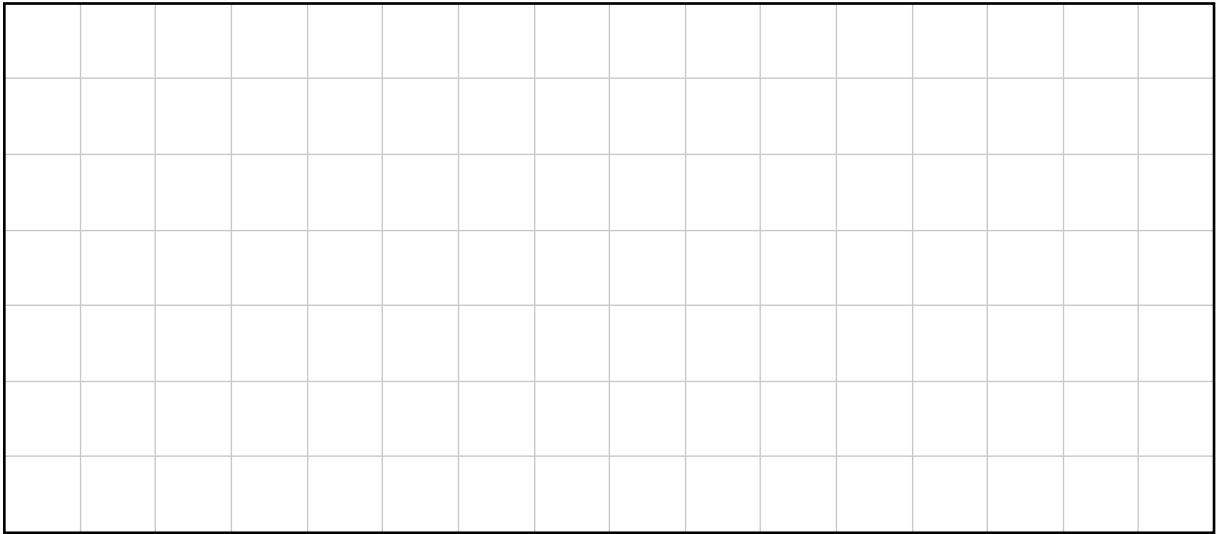
$a =$  \_\_\_\_\_  $b =$  \_\_\_\_\_  $c =$  \_\_\_\_\_

**Question 10**

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

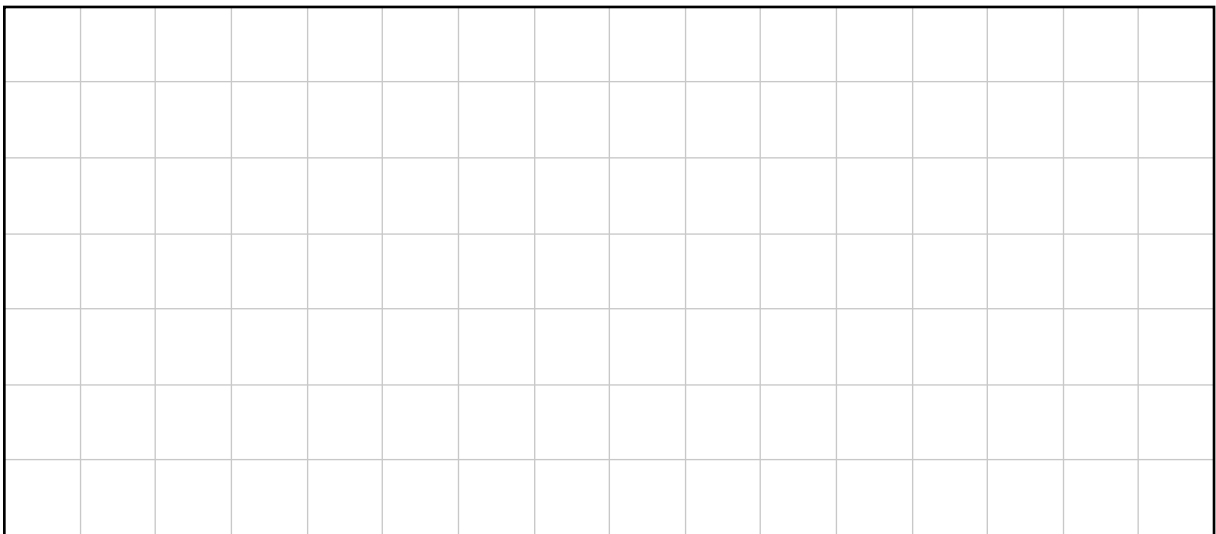
**(a)** In the two grids below, each of the small squares has sides of length 1 cm.

**(i)** On the grid below, **draw** a square that has a **perimeter** of 12 cm.



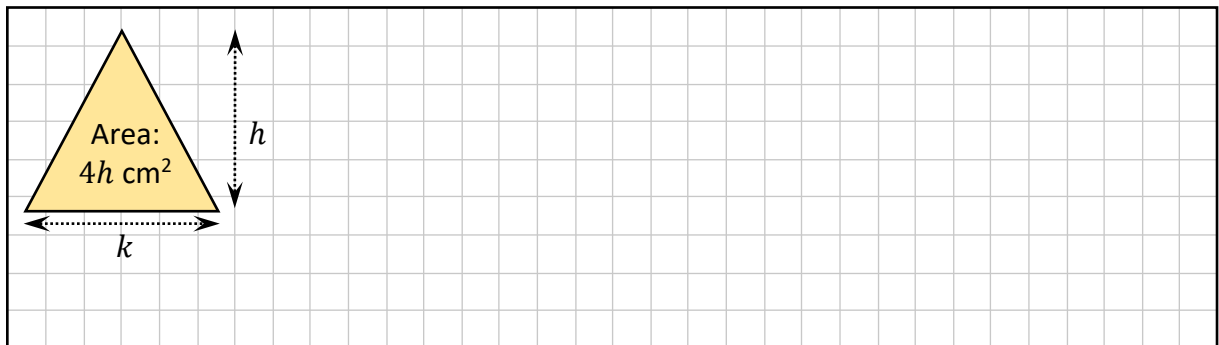
**(ii)** A rectangle has length  $l$  cm and width  $w$  cm, where  $l$  and  $w$  are whole numbers. The rectangle also has an **area** of  $10 \text{ cm}^2$ .

**Draw** one such rectangle on the grid below.

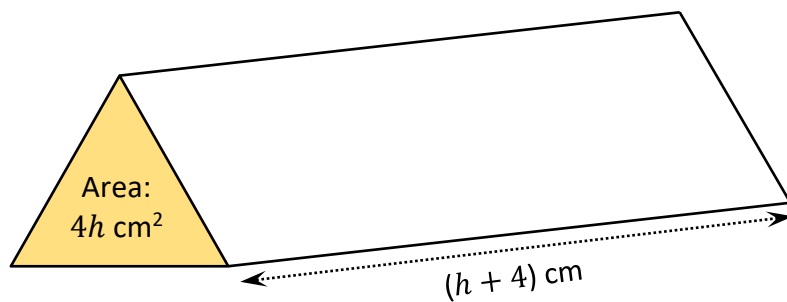


(b) A triangle has a base length of  $k$  cm and a perpendicular height of  $h$  cm.

- (i) The **area** of the triangle is  $4h \text{ cm}^2$ .  
Find the value of  $k$ .

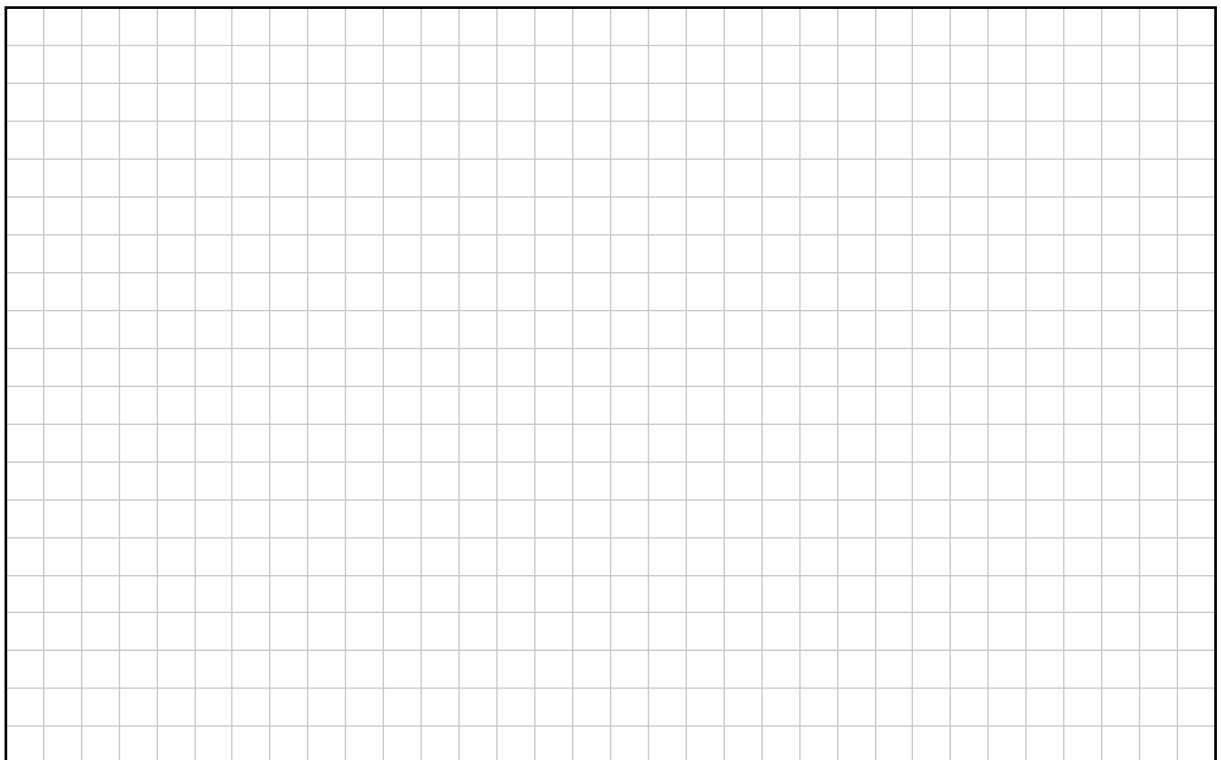


This triangle forms the ends of a triangular-based prism, as shown below.  
The length of the prism is  $(h + 4) \text{ cm}$ .



- (ii) The **volume** of the prism is  $240 \text{ cm}^3$ .

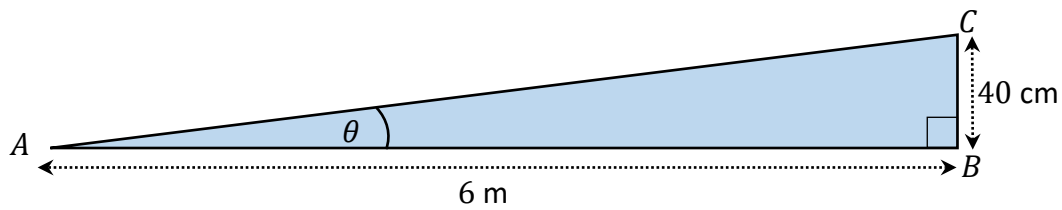
Work out the value of  $h$ , the perpendicular height of the triangle.



### Question 11

(Suggested maximum time: 10 minutes)

A school designs a new wheelchair ramp for their entrance, as shown in the diagram below. The ramp has a perpendicular height of 40 cm and a horizontal length of 6 m.



- (a) The slope of this ramp is  $\frac{|BC|}{|AB|}$ .

The recommended maximum slope for this type of a wheelchair ramp is  $\frac{1}{12}$ .

Does this wheelchair ramp meet this recommendation?

Use calculations to support your answer.

Answer:

(Tick (✓) **one** box only)

Yes

☐

No

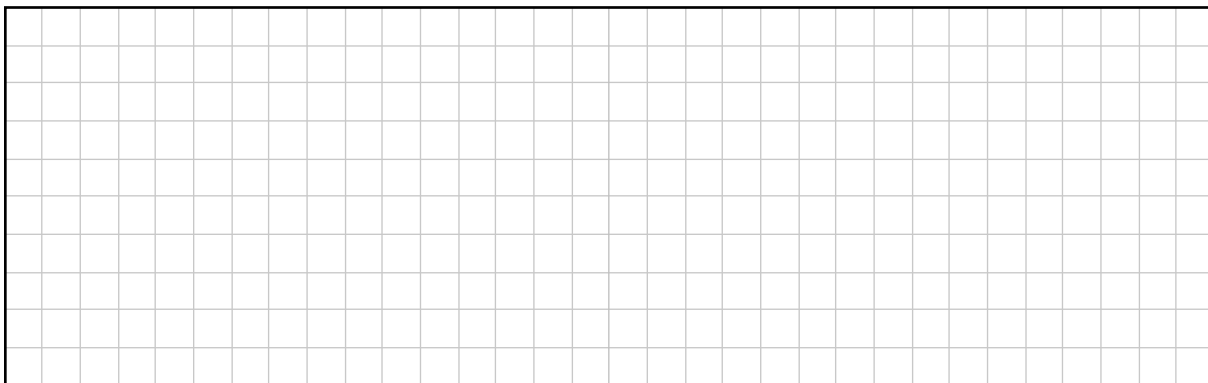
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Calculations:

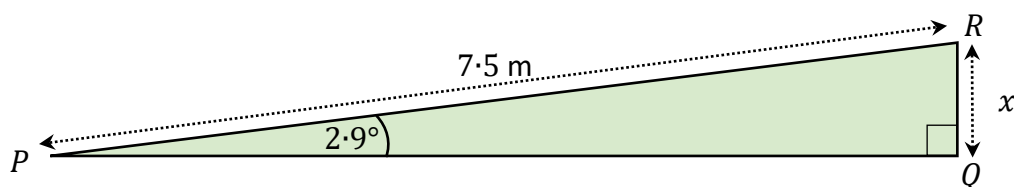
- (b) Find  $|AC|$ , the length of the incline of the ramp.

Give your answer in **cm**, correct to 1 decimal place.

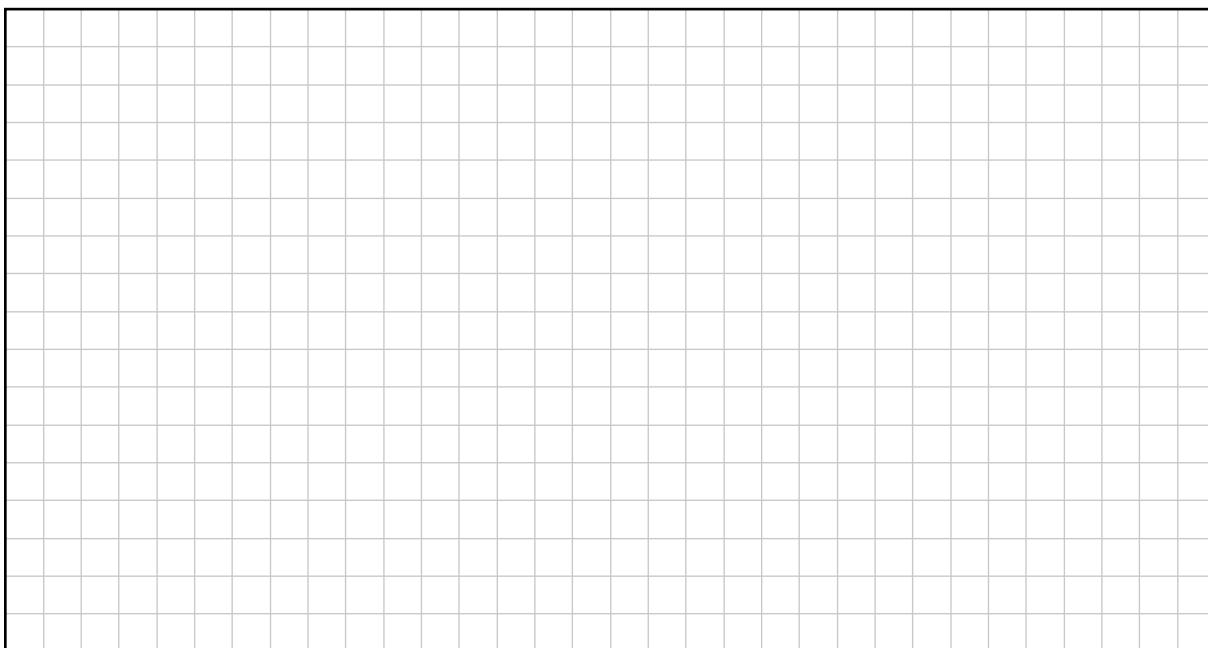
- (c) Use **trigonometry** to work out the size of the angle marked  $\theta$  in the diagram **on the previous page**.  
Give your answer in degrees, correct to 1 decimal place.



- (d) A different ramp in the school has the following design:



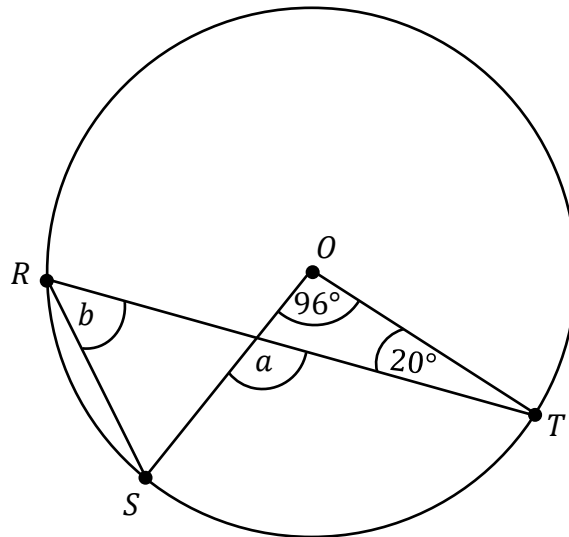
Work out the value of  $x$ , the perpendicular height of this ramp.  
Give your answer correct to the nearest cm.



**Question 12**

(Suggested maximum time: 10 minutes)

- (a) The diagram below shows a circle with centre  $O$ .  
 The three points  $R$ ,  $S$ , and  $T$  are on the circle.  
 The angles  $a$  and  $b$  are marked on the diagram.  
 $|\angle TOS| = 96^\circ$ .  
 $|\angle OTR| = 20^\circ$ .



Work out the size of the angle  $a$  and the size of the angle  $b$ .

|                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                        |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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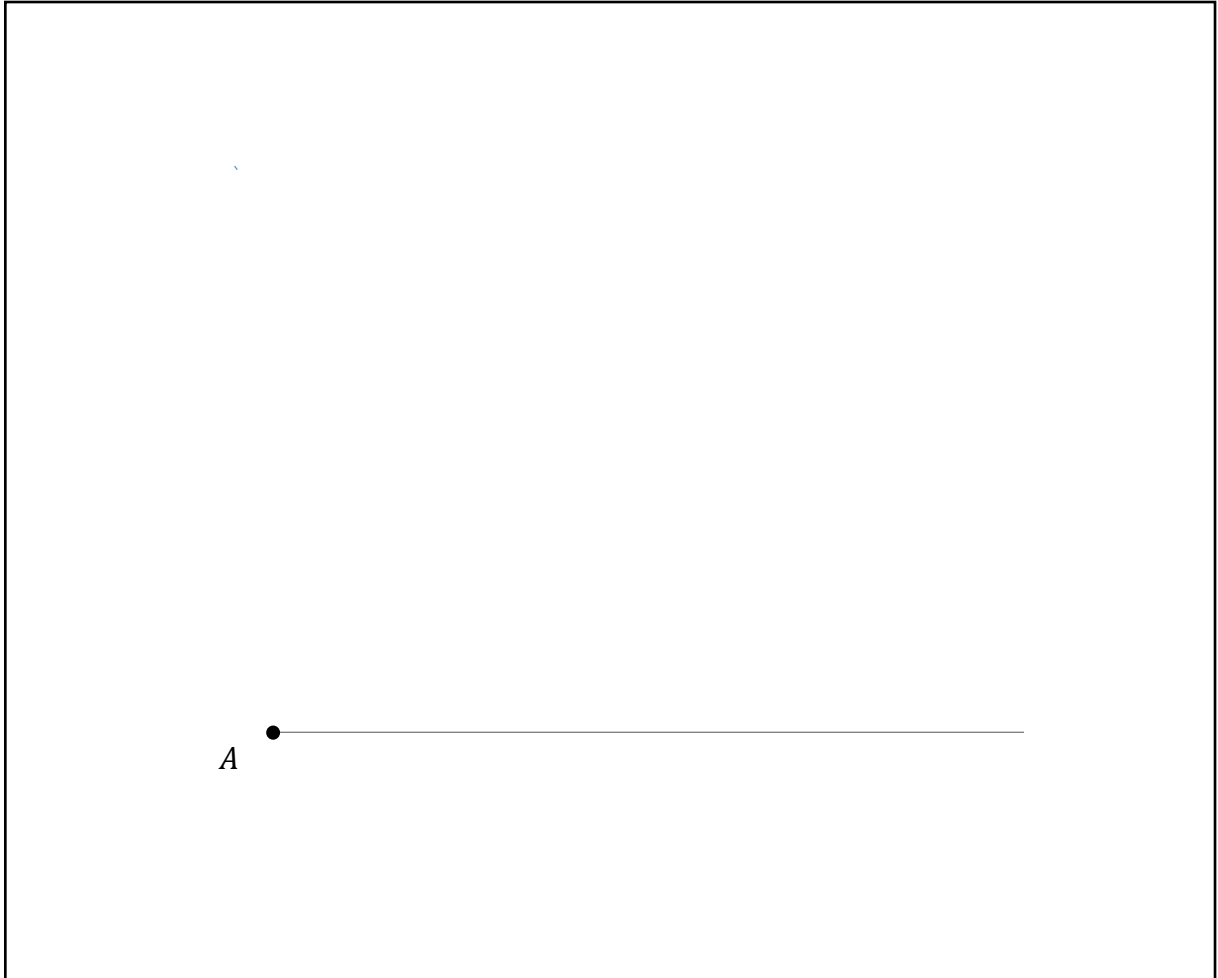
(b) In the triangle  $ABC$ :

|                       |                           |                           |
|-----------------------|---------------------------|---------------------------|
| $ AB  = 8 \text{ cm}$ | $ \angle CAB  = 70^\circ$ | $ \angle ABC  = 50^\circ$ |
|-----------------------|---------------------------|---------------------------|

**Construct** the triangle  $ABC$  in the box below. The point  $A$  is given.

**Label** the points  $B$  and  $C$  on your diagram.

Show all of your construction lines clearly.

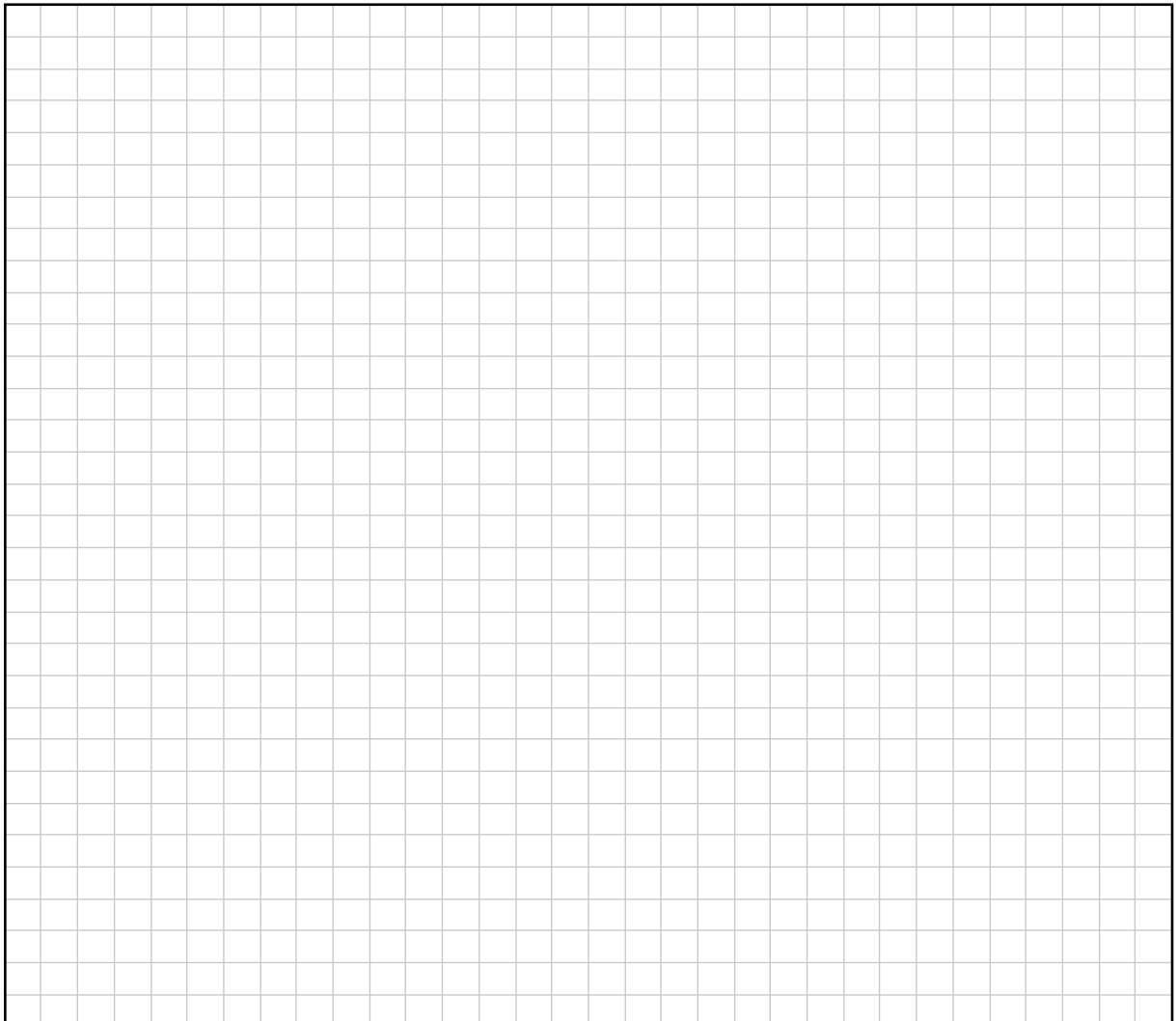
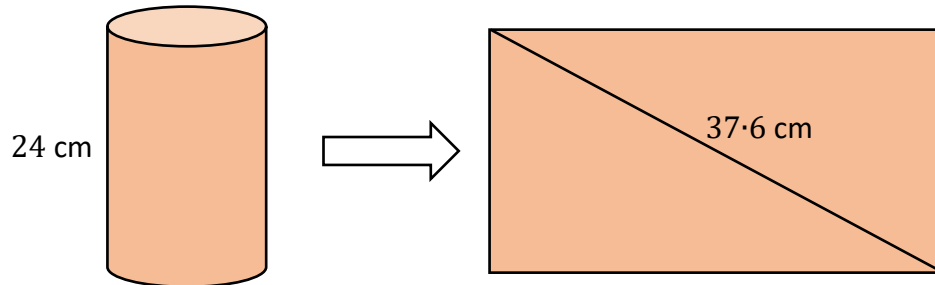


**Question 13****(Suggested maximum time: 5 minutes)**

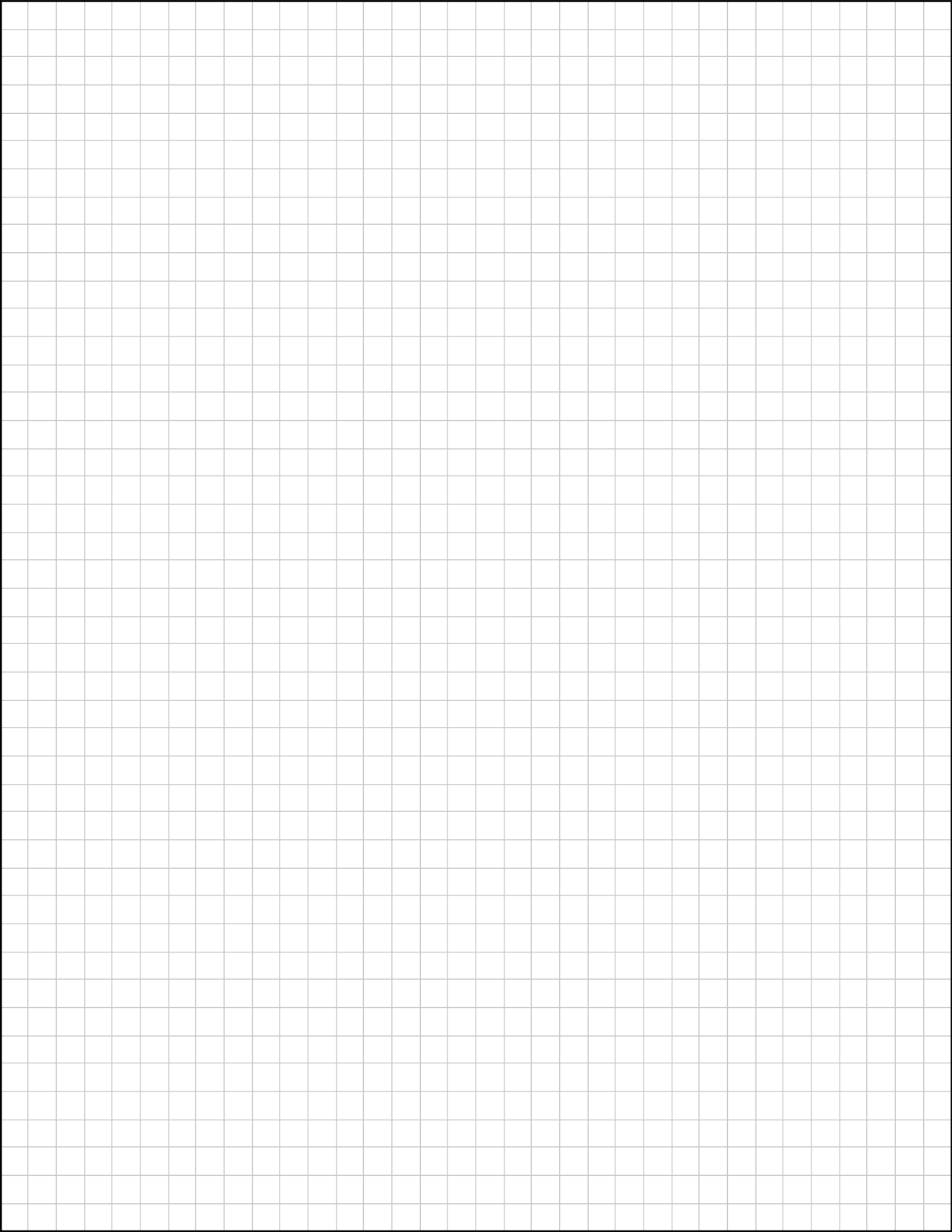
A cylinder has a height of 24 cm and a radius of  $r$  cm, where  $r \in \mathbb{R}$ .

The net of the curved surface of the cylinder is a rectangle, with a diagonal of length 37.6 cm.

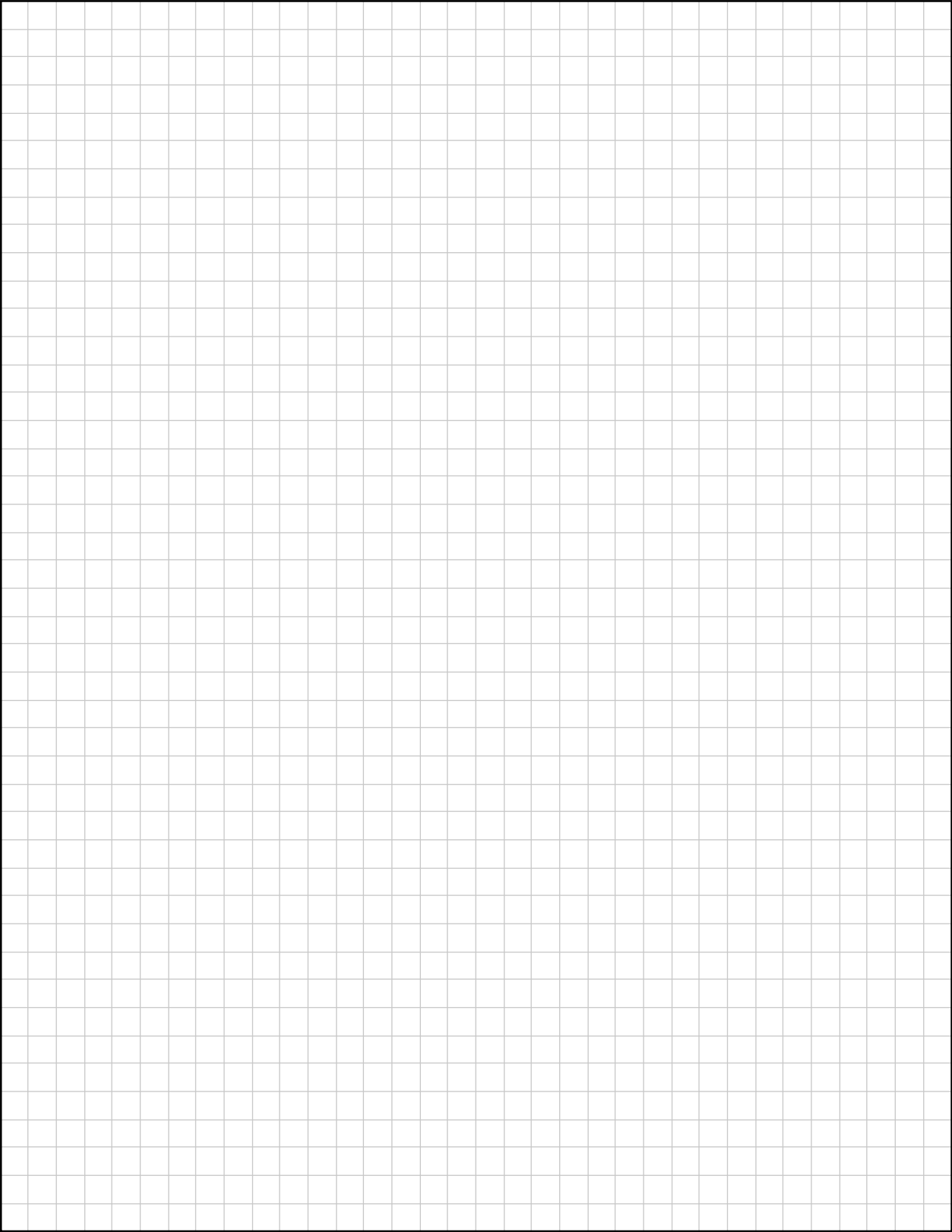
Use this to find the value of  $r$ , correct to 1 decimal place.



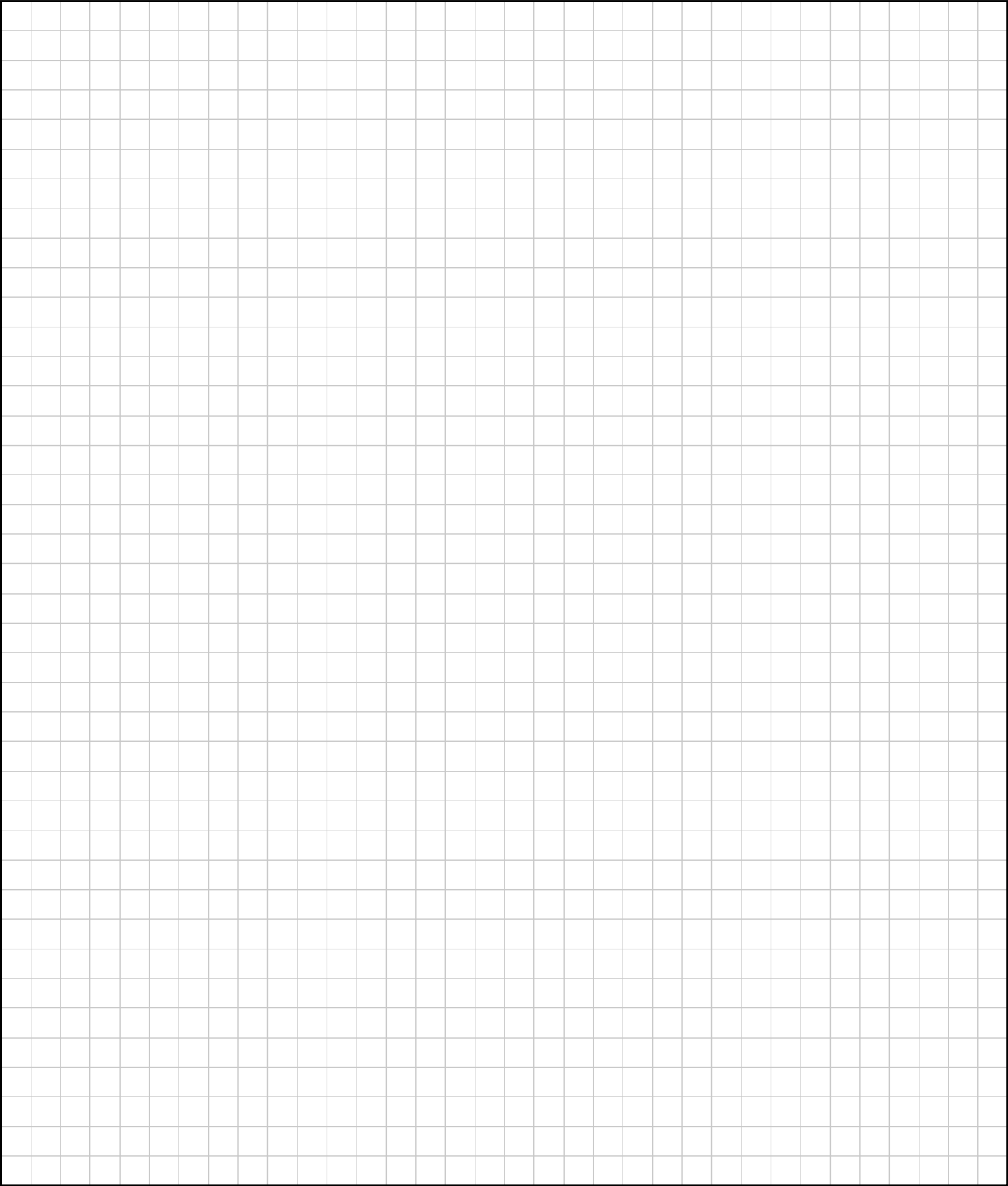
Page for extra work.  
Label any extra work clearly with the question number and part.



Page for extra work.  
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Junior Cycle Final Examination – Higher Level

**Mathematics**

Friday 5 June

Afternoon 1:30 - 3:30