



Coimisiún na Scrúduithe Stáit
State Examinations Commission

Junior Cycle Final Examination 2023

Mathematics

Ordinary Level

Friday 9 June Afternoon 1:30 - 3:30

270 marks

Examination Number

<input type="text"/>				
----------------------	----------------------	----------------------	----------------------	----------------------

Day and Month of Birth

<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
----------------------	----------------------	----------------------	----------------------

For example, 3rd February is
entered as 0302

Centre Stamp

<input type="text"/>

Instructions

There are 14 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 answers in the spaces provided in this booklet. You may lose marks if you do not do so. You may ask the superintendent for more paper. 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.

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) Find the value of each of the following.

(i) $372 + 119$

(ii) $3 \cdot 4 \times 7$

$$(iii) \quad 4^2 \times (8 - 5)$$

- (b)** Martin bought the following items in his local shop.

Fill in the table below to find the total cost of his shopping.

Items	Cost (in €)
3 litres of milk at €1·27 a litre	
4 scones at €1·10 each	
500 grams of ham at €12 per kg	
Total Cost	

Question 2

(Suggested maximum time: 5 minutes)

Ruth has 2 bags of marbles and 4 loose marbles, as shown.

Liam has 1 bag of marbles and 10 loose marbles, as shown.

There are the same number of marbles in each bag.

Ruth's Marbles	Liam's Marbles
 Two red drawstring bags filled with marbles. To the right of the bags are four green marbles arranged in a horizontal row.	 One red drawstring bag filled with marbles. To the right of the bag is a pyramid of marbles. The base layer has 3 marbles, the second layer has 2 marbles, and the top layer has 1 marble, making a total of 6 marbles.

Ruth and Liam each have the **same total** number of marbles.

Work out how many marbles are in each bag.

Question 3

(Suggested maximum time: 5 minutes)

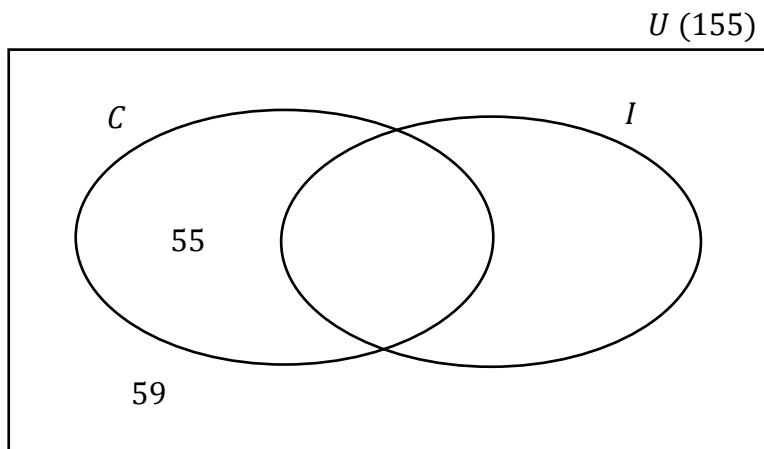
In a survey of a group of 155 students on take-away food:

75 said they like Chinese food (C)

41 said they like Indian food (*I*)

20 said they like both.

- (a) Complete the Venn diagram below to show this information.



- (b) How many students in the group like Chinese food **only**?

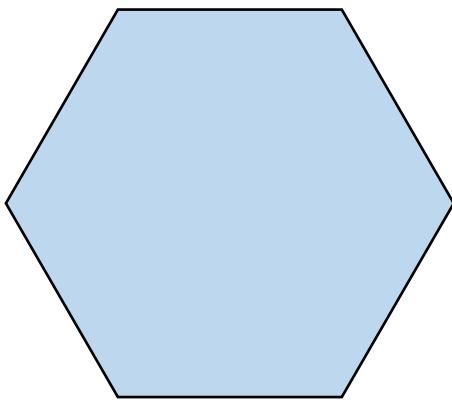
- (c) Explain what the following statement means, in the context of this survey, where C' is the complement of the set C :

$$\#(C') = 80$$

Question 4

(Suggested maximum time: 10 minutes)

The hexagon below is a scaled diagram of a classroom in a school.
All sides are equal in length.



- (a) By measuring, find the **length** of the **side** of the hexagon.
Give your answer correct to the nearest cm.

Length = cm

- (b) Find the length of the **perimeter** of the hexagon. Give your answer in cm.

The diagram is to a scale of $1 \text{ cm} = 2 \text{ m}$.

- (c) Find the **actual perimeter** of the classroom. Give your answer in metres.

- (d) There are 560 students in the school. 75% of the students go to a camogie match. Work out the number of students who go to the match.

A large rectangular grid consisting of 20 columns and 10 rows of small squares, intended for students to show their working for part (d).

In 2019, there were 80 students in first year in the school.

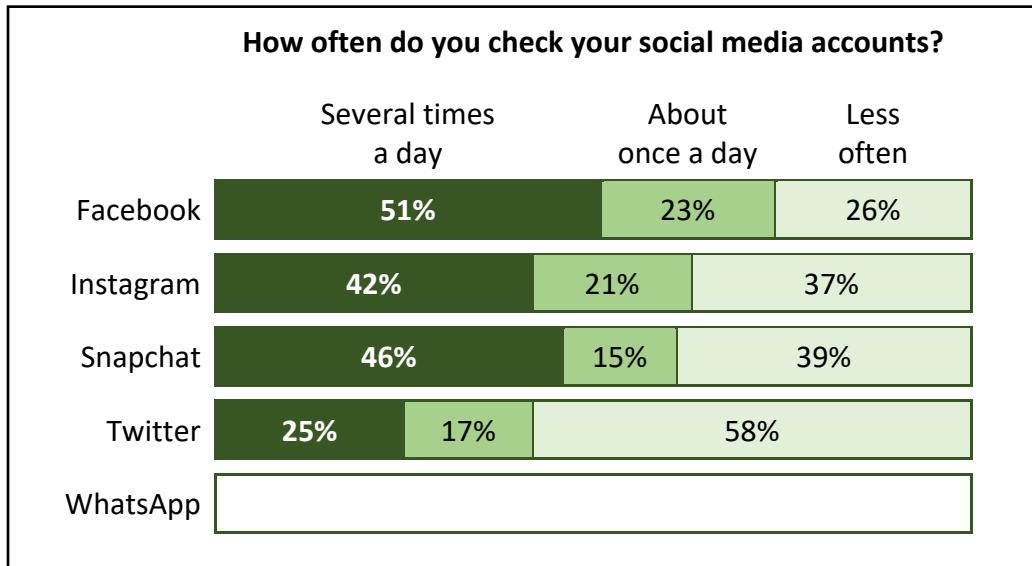
In 2020, there were 90 students in first year.

- (e) Write this **increase** as a **percentage** of the number of students in first year in 2019.

A large rectangular grid consisting of 20 columns and 10 rows of small squares, intended for students to show their working for part (e).

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

The diagram below shows the results of a survey of how often a group of adults checked their social media accounts, each day. The results for WhatsApp are not shown.



- (a)** Use the diagram to answer the following two questions.

In each case, tick (✓) the correct box only.

- (i)** The percentage who checked their *Instagram* account about once a day was:

15%

21%

37%

51%

- (ii)** The account that exactly $\frac{1}{4}$ of users checked several times a day was:

Facebook

Instagram

Snapchat

Twitter

- (b)** The results for WhatsApp are in the table below.

Use the values in the table to complete the diagram above.

It may be useful to use a ruler. You don't need to shade the diagram.

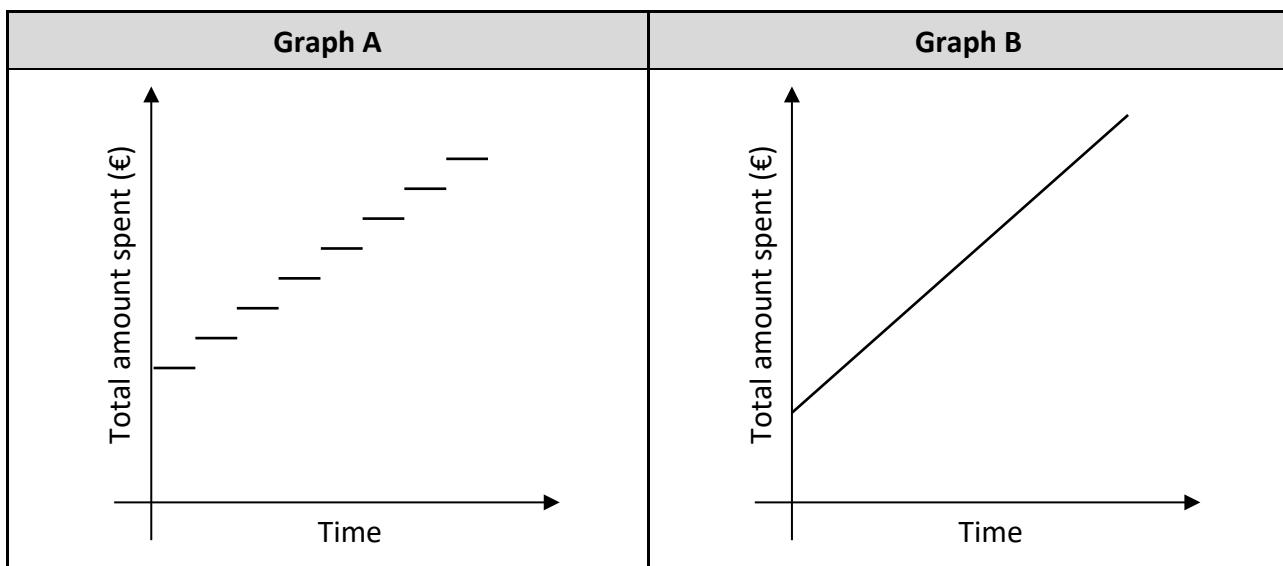
Results for WhatsApp	
Several times a day:	60%
About once a day:	20%
Less often:	20%

(c) Eoin has a mobile phone.

He paid €80 when he bought the phone, at the start of June.

He paid €25 at the start of each month after that.

Which of the graphs below, A or B, is better at showing the way Eoin paid for his phone over the first 8 months? Give a reason for your answer.



Answer:

(Tick (\checkmark) one box only)

Graph A

Graph B

Reason:

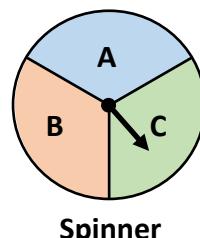
Question 6

(Suggested maximum time: 10 minutes)

Maria is playing a game. She rolls the die and spins the spinner shown.



Die



Spinner

- (a) Complete the table below to show all of the possible outcomes. Three are already done for you. For example, **6C** means that Maria got a **6** on the die and a **C** on the spinner.

		Spinner		
		A	B	C
Die	1		1 B	
	2			
	3	3 A		
	4			
	5			
	6			6 C

- (b)** How many different possible outcomes are there, in **total**?

- (c) List all of the outcomes that have an **even number** and B.

- (d) Each outcome in the table is equally likely.

What is the **probability** that Maria will get an **even number and B?**

Answer =

Question 7

(Suggested maximum time: 5 minutes)

Laurie is asked to write down a function, and an example to show how her function works. Laurie writes the following:

My function, f , takes a word as an input, and the output is the number of letters in the word.

For example, $f(\text{banana}) = 6$.

Using Laurie's function:

- (a) find the value of $f(\text{ned})$

$$f(\text{ned}) =$$

- (b)** write in an input that gives an output of 5.

$$f(\boxed{}) = 5$$

- (c) work out the value of:

$$f(Tomás) - 3 \times f(Ava) + 2 \times [f(Jakub)]^2$$

Question 8**(Suggested maximum time: 10 minutes)**

The students in a class used clinometers and metre sticks to find the height of their school. Each student measured the angle of elevation from a given point to the roof of the school. These angles are shown in the table below.

63°	63°	63°	62°
61°	60°	58°	57°
57°	56°	56°	55°

- (a) Work out the **median** of the angles measured by the students.

- (b) Keith finds the **mean** of the angles.

Mairéad finds the **mode** of the angles.

Should their answers be the same, or different? Give a reason for your answer.

Answer:

the same

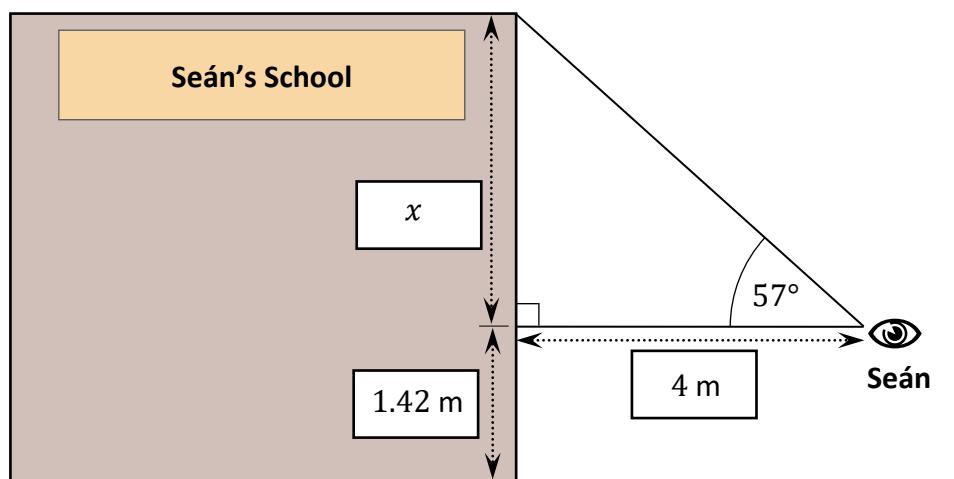
different

(Tick (\checkmark) **one** box only)

Reason:

Seán's value for the angle of elevation was 57° . Seán's clinometer was at a height of 1.42 m. He was standing 4 m from the school wall at this time.

Seán drew the diagram below to show this information.



- (c) Use the right-angled triangle in the diagram to write $\tan 57^\circ$ as a fraction, in terms of x .

$$\tan 57^\circ =$$

- (d) Use your calculator to find the value of $\tan 57^\circ$. Give your answer correct to 2 decimal places.

$$\tan 57^\circ =$$

- (e) Using his measurements, Seán works out that x is roughly 6.16 m.
Use this value to find Seán's estimate of the total height of the school, in metres.

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

The weight of each baby in a group was measured every 3 months, for the first 12 months of life. Some of the results are shown in **Table 1** below.

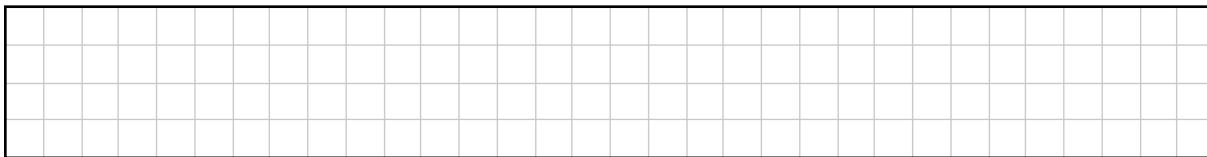
Table 1

Age of the babies (months)	0	3	6	9
Mean weight of the babies (kg)	3		7	

The points $A(0, 3)$ and $B(6, 7)$ are shown on the co-ordinate diagram below.



- (a) Draw the line AB on the co-ordinate diagram.



- (b) Complete the following sentence:

"The point B represents the mean weight of the babies after months."

Assume that the mean weight of the babies in the group increased in a **linear pattern** over the first 18 months of life.

- (c) Use the line *AB* to estimate the mean weight of the babies after 3 months and after 9 months. Write these values into **Table 1**. Show your work on the diagram.

- (d) The **slope** of the line AB is $\frac{2}{3}$. Explain what this slope means in the context of this question.

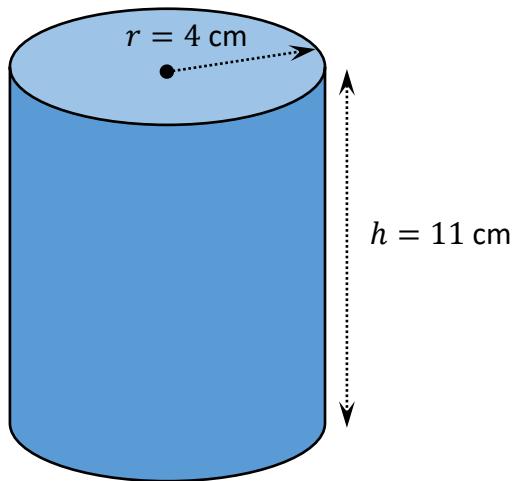
- (e) The line AB has equation:

$$y = \frac{2}{3}x + 3$$

Use this to estimate the mean weight of the babies after 18 months.
Show your working out.

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

Martina buys a carton of yoghurt. The carton is roughly in the shape of a cylinder. It has the dimensions shown in the diagram below.



- (a) Work out the **volume** of the carton in cm^3 .
Give your answer in terms of π .

$$V = \pi r^2 h$$

- (b) The carton contains fruit and yoghurt and weighs 450 g.
The ratio of fruit to yoghurt is 4 : 21.

Work out how many grams of **fruit** are in the carton.

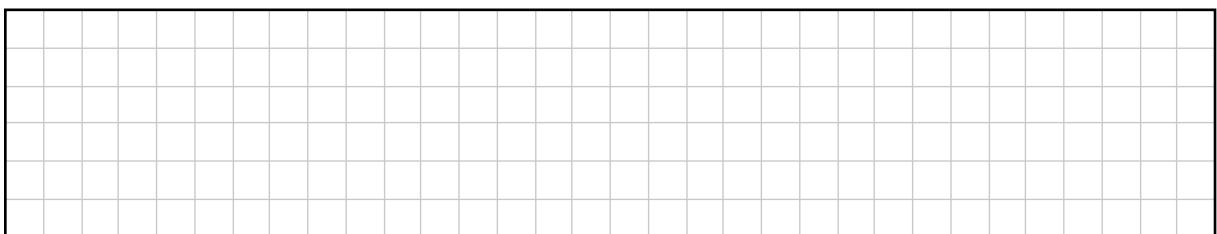
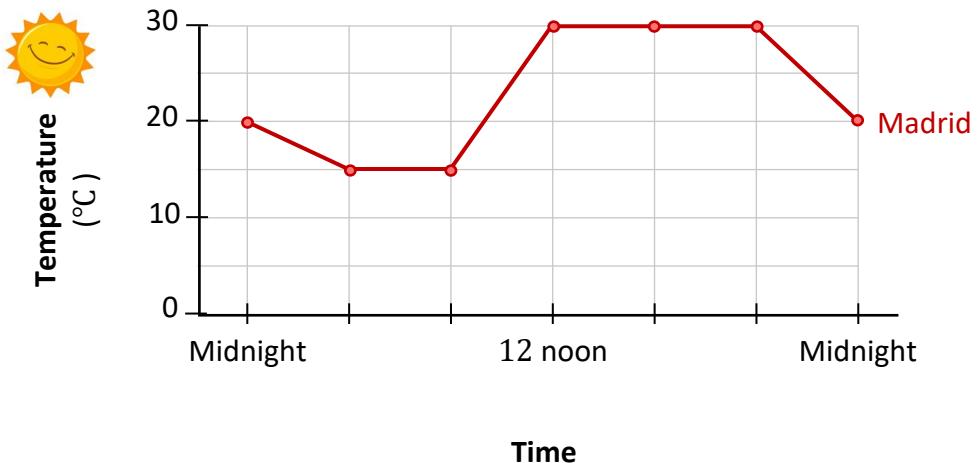
Question 11**(Suggested maximum time: 5 minutes)**

The graph below shows the approximate temperature in Madrid throughout one day (in °C).

The temperature in Ennis was exactly **half** that in Madrid throughout this day.

On the diagram below, **draw** a graph of the temperature in Ennis throughout this day.

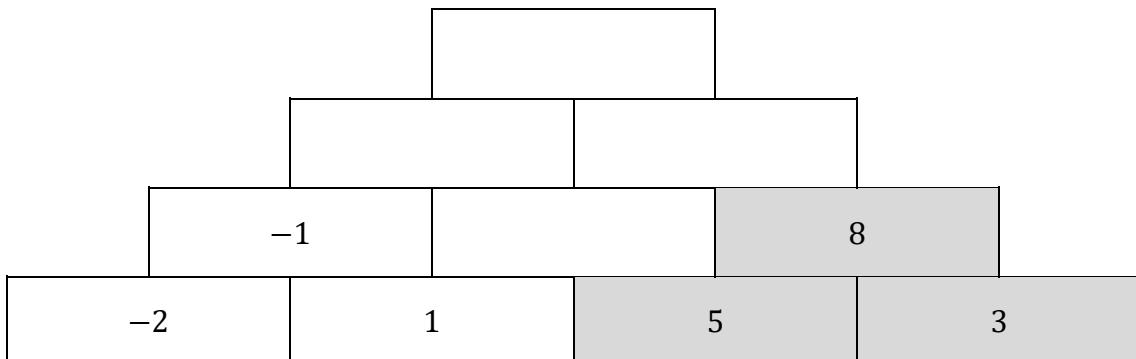
Use the same axes and scales.



Question 12

(Suggested maximum time: 10 minutes)

Pawel makes the “adding wall” below.



Each box in the bottom row is filled in.

To fill in any other box, you add the two numbers in the boxes that are directly below it.

For example, in the shaded boxes:

$$\boxed{5} + \boxed{3} = \boxed{8}$$

- (a) Fill in all the boxes in Pawel’s adding wall above.

Pawel also makes the “algebra adding wall” below, with the same rules.

- (b) Fill in all the boxes in Pawel's algebra adding wall below, in terms of x .

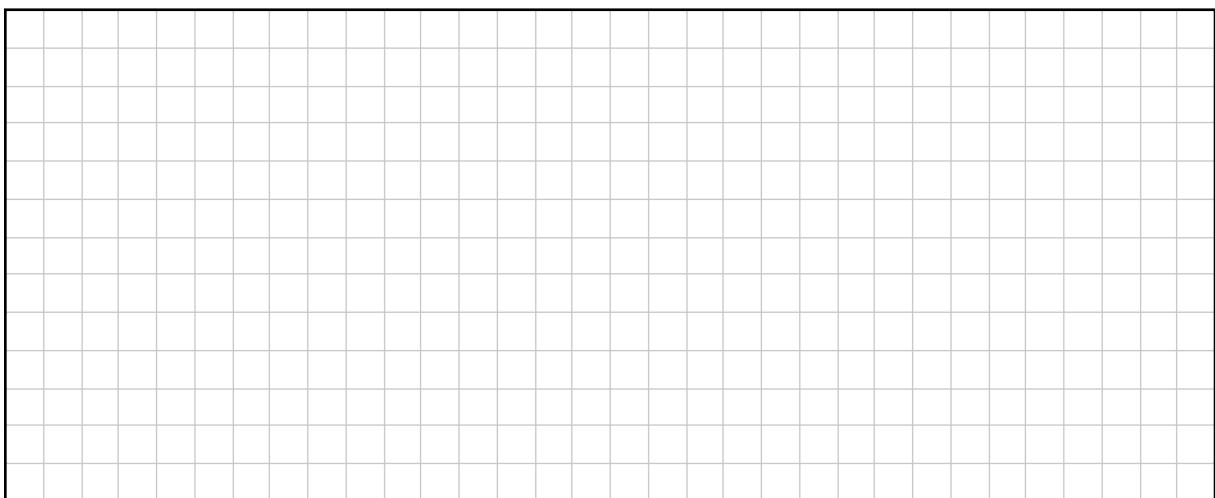
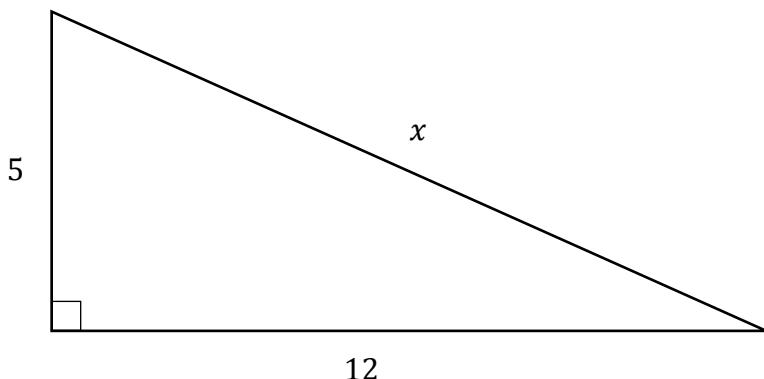
The diagram illustrates a sequence of four rectangles stacked vertically. The bottom rectangle is divided into four equal-width horizontal sections. The first section contains the expression $x - 4$, the second section contains the number 1, the third section contains the expression $x + 3$, and the fourth section contains the expression $2x + 4$. The sections containing $x - 4$, 1, and $x + 3$ are white, while the section containing $2x + 4$ is shaded gray.

- (c) There is one value of x that will make both adding walls exactly the same. Find this value of x .

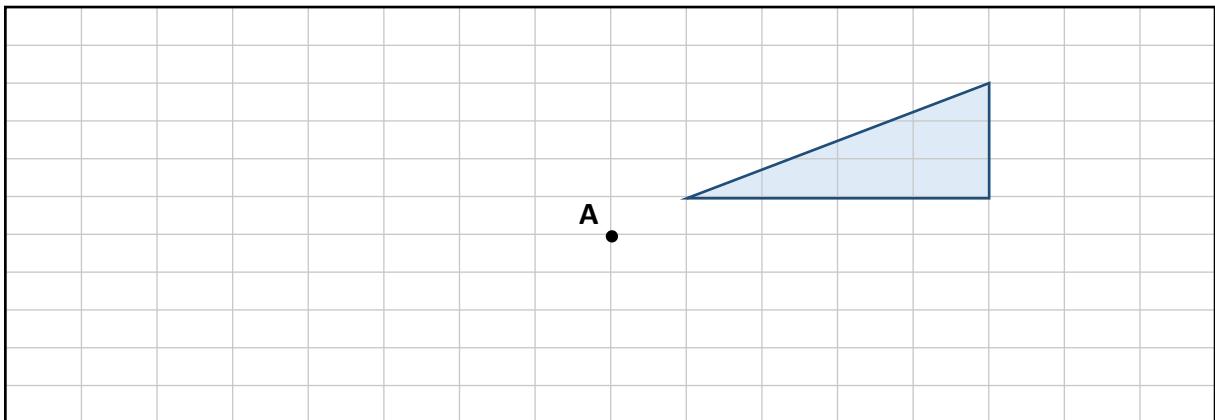
Question 13

(Suggested maximum time: 10 minutes)

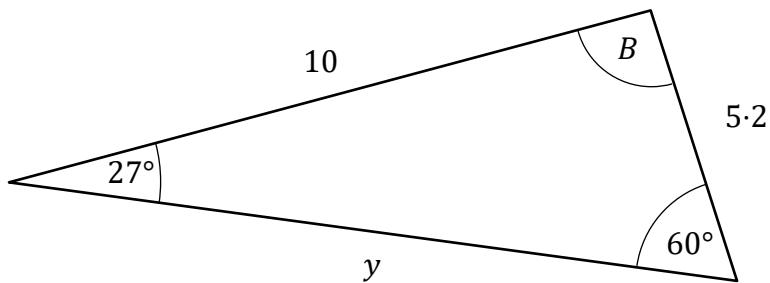
- (a) Use the theorem of **Pythagoras** to find the value of x in the right-angled triangle below.
Show all of your working out.



- (b) Draw the image of the following triangle under **central symmetry** in the point A.



- (c) (i) Work out the size of the angle B in the triangle below.



- (ii) Explain why the theorem of Pythagoras **cannot** be used to find the length of the side y in the triangle above.

Question 14**(Suggested maximum time: 5 minutes)**

- (a) The following are algebraic expressions.

$$2x$$

$$3x - 2$$

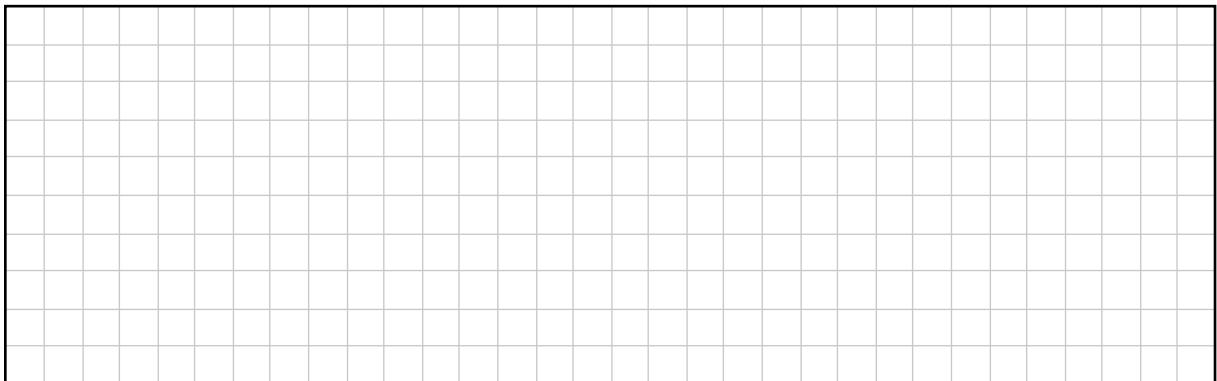
$$3x + 2$$

$$3(x + 2)$$

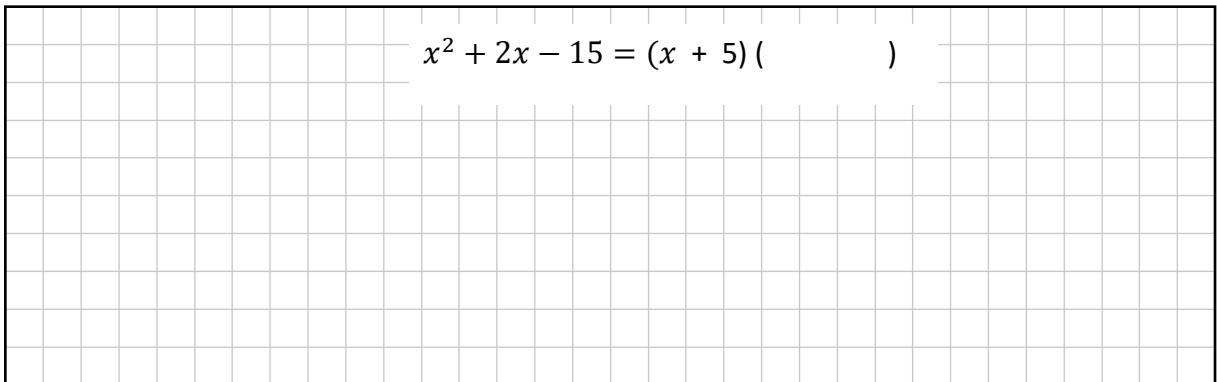
Complete the table below by writing the correct algebraic expression from the list above next to the corresponding statement. You do not need to use all of the algebraic expressions.

Statement	Algebraic Expression
Multiply x by 3, then subtract 2 from the result.	
Double x .	
Add 2 to x , then multiply the result by 3.	

- (b) Multiply out and simplify $(3x - 2)(2x - 3)$.

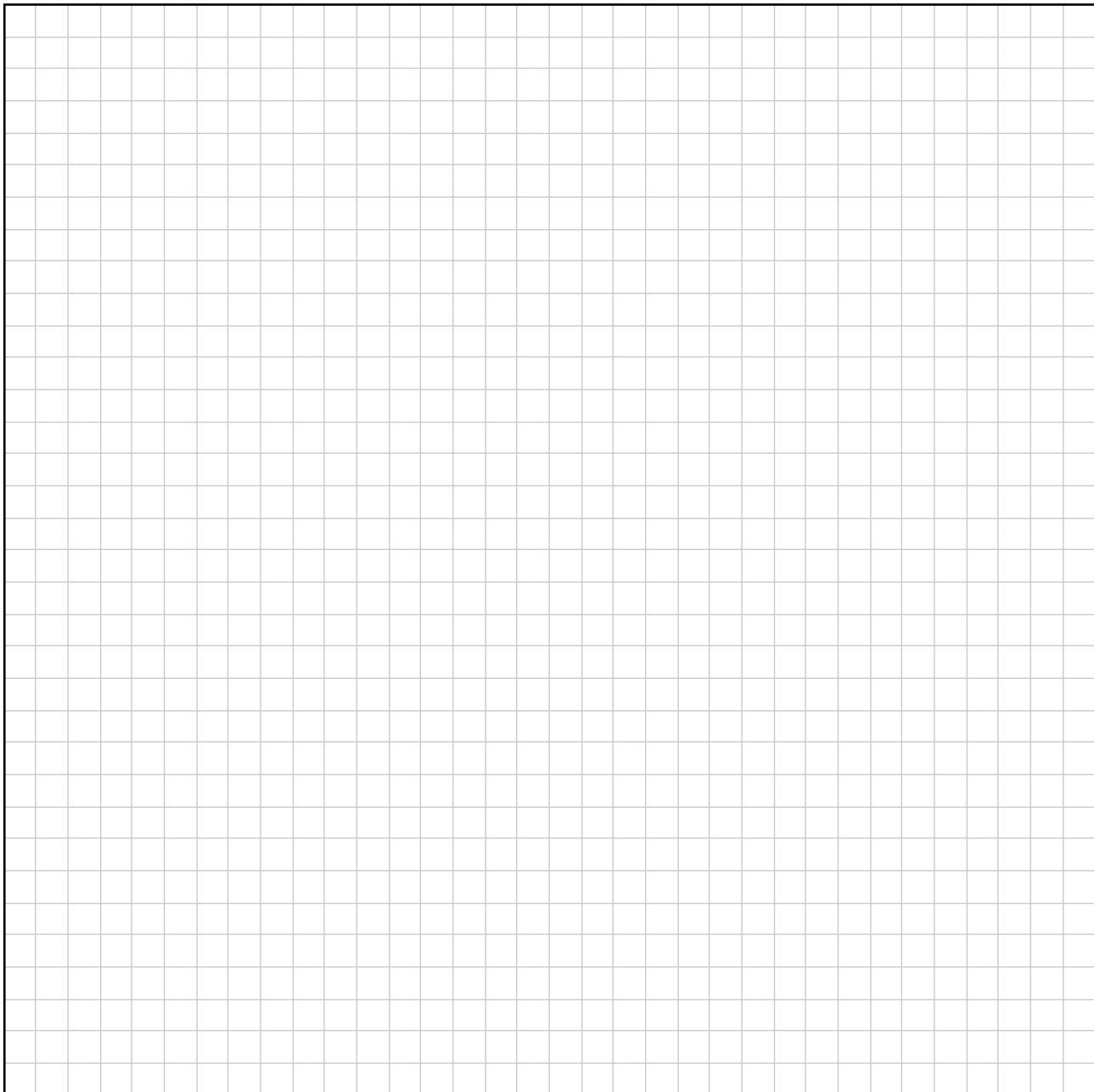


- (c) Factorise $x^2 + 2x - 15$.

$$x^2 + 2x - 15 = (x + 5)(\quad)$$


Page for extra work.

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



Acknowledgements

Images on page 4: www.vectorstock.com, www.masterfile.com. Altered.

Image on page 10: www.commons.wikimedia.org. Altered.

Image on page 16: www.supervalu.ie. Altered.

Image on page 17: www.shutterstock.com. Altered.

Do not write on this page

Copyright notice

This examination paper may contain text or images for which the State Examinations Commission is not the copyright owner, and which may have been adapted, for the purpose of assessment, without the authors' prior consent. This examination paper has been prepared in accordance with *Section 53(5) of the Copyright and Related Rights Act, 2000*. Any subsequent use for a purpose other than the intended purpose is not authorised. The Commission does not accept liability for any infringement of third-party rights arising from unauthorised distribution or use of this examination paper.

Junior Cycle Final Examination – Ordinary Level

Mathematics

Friday 9 June

Afternoon 1:30 - 3:30