



Coimisiún na Scrúduithe Stáit
State Examinations Commission

Junior Certificate Examination 2019

Mathematics

Paper 1
Ordinary Level

Friday 7 June
Afternoon 2:00 to 4:00

300 marks

Examination Number				

Centre Stamp				

Running Total	

For Examiner					
Q.	Ex.	Adv. Ex.	Q.	Ex.	Adv. Ex.
1			11		
2			12		
3			13		
4					
5					
6					
7					
8					
9					
10			Total		

Grade

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 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.

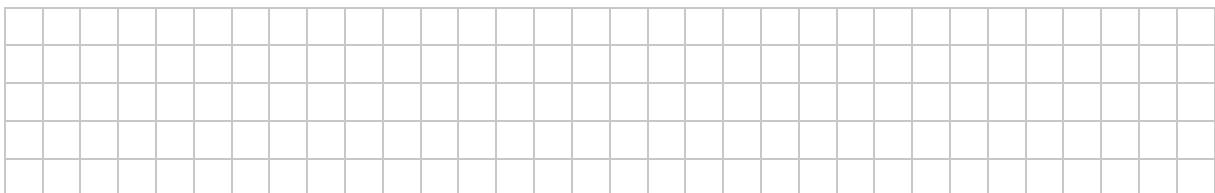
Write the make and model of your calculator(s) here:

Question 1**(Suggested maximum time: 10 minutes)**

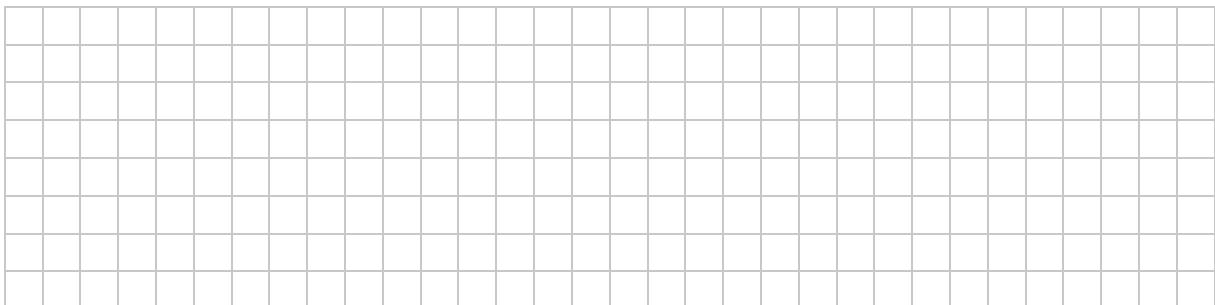
Tickets for a concert cost €70, €80, and €100.

- (a) Rafael bought three tickets. The total cost was €240.
What tickets could Rafael have bought?

The tickets could have cost € , € , and € .



- (b) A booking fee of 8% is added to the €240.
Find the total price after the booking fee is added.



In total, 60 000 tickets were sold for the concert, as follows:

20 000 tickets at €70 each
25 000 tickets at €80 each
15 000 tickets at €100 each.

- (c) Work out the **total** cost of all of the 60 000 tickets that were sold.



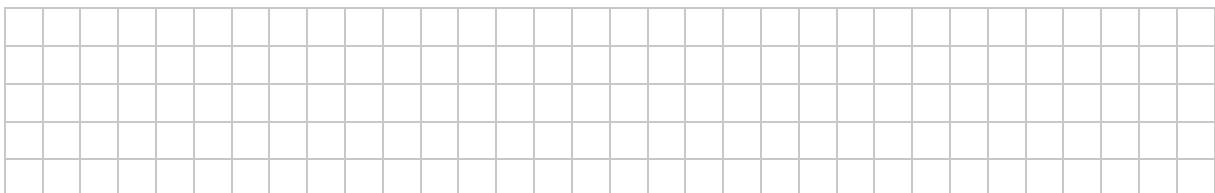
Question 2**(Suggested maximum time: 10 minutes)**

- (a)** Michael runs a weekly lottery.

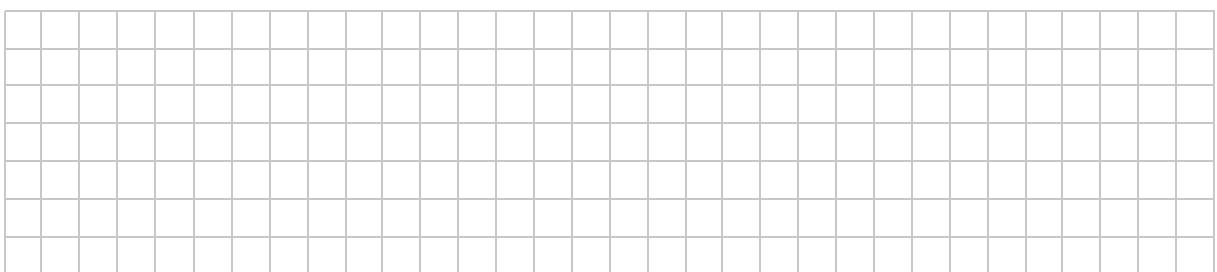
The cost of running each lottery is €80, including the prizes.

He gets roughly €400 from selling tickets for each lottery.

- (i)** Work out the **profit** that Michael makes from each lottery.



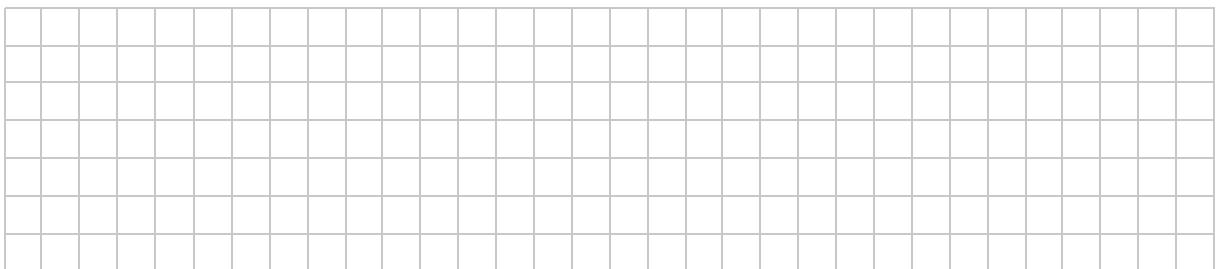
- (ii)** Work out the **least** number of lotteries that Michael must run to make over €1000 in profit. Show your working out.



- (b)** Siobhán and Ava win a lotto jackpot.

They divide it so that Siobhán gets €25 000 and Ava gets €45 000.

Write the ratio $25\,000 : 45\,000$ in its simplest form.

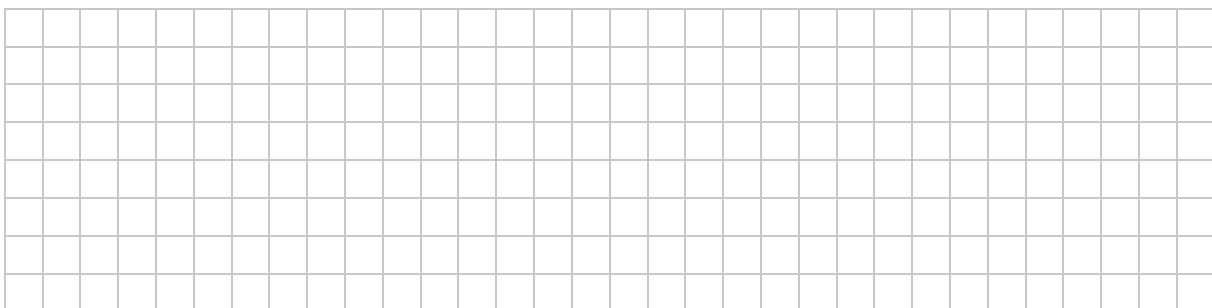


- (c) The jackpots for an American and an Irish lotto were as follows:

Irish jackpot	American jackpot
€4·8 million	\$5·3 million

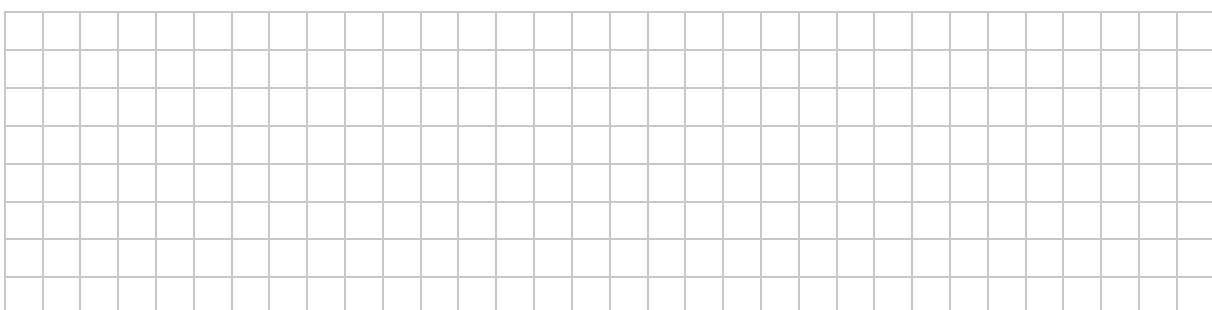
- (i) The exchange rate at the time was $\text{€}1 = \$1\cdot15$.

Show that the Irish jackpot was worth more than the American one.



- (ii) Give an example of an exchange rate that would make the American jackpot worth more than the Irish one.

$$\text{€}1 = \$ \boxed{}$$



Question 3

(Suggested maximum time: 5 minutes)

- (a) Alex's gross pay is €29 000 per year. She pays income tax at a rate of 20%.

(i) Find 20% of €29 000.

Alex has a tax credit of €3400.

(ii) Work out Alex's net pay per year.

- (b)** Alex bought a motorbike in 2017. Its value at that time was €14 000. After one year its value was €12 600.

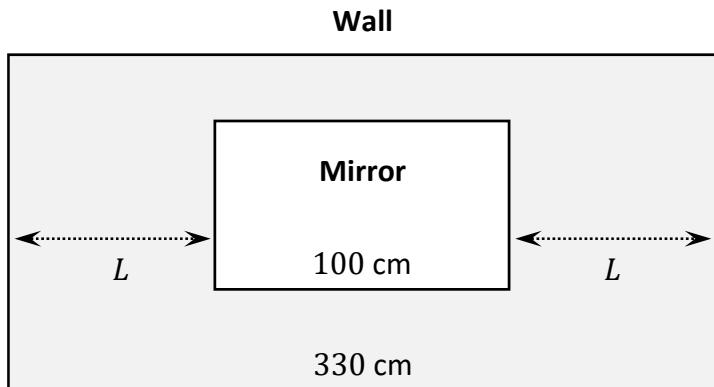
Write €12 600 as a **percentage** of €14 000.

Question 4

(Suggested maximum time: 5 minutes)

Damien is putting a mirror on a wall. The wall is 330 cm wide and the mirror is 100 cm wide. Damien wants to put the mirror in the middle of the wall, as shown.

Work out the value of L , the distance from the mirror to each end of the wall.



Question 5

(Suggested maximum time: 5 minutes)

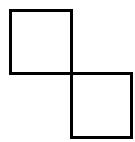
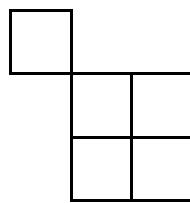
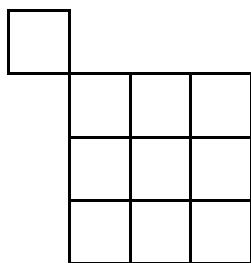
Solve the equation:

$$\frac{2x + 3}{5} = 7$$

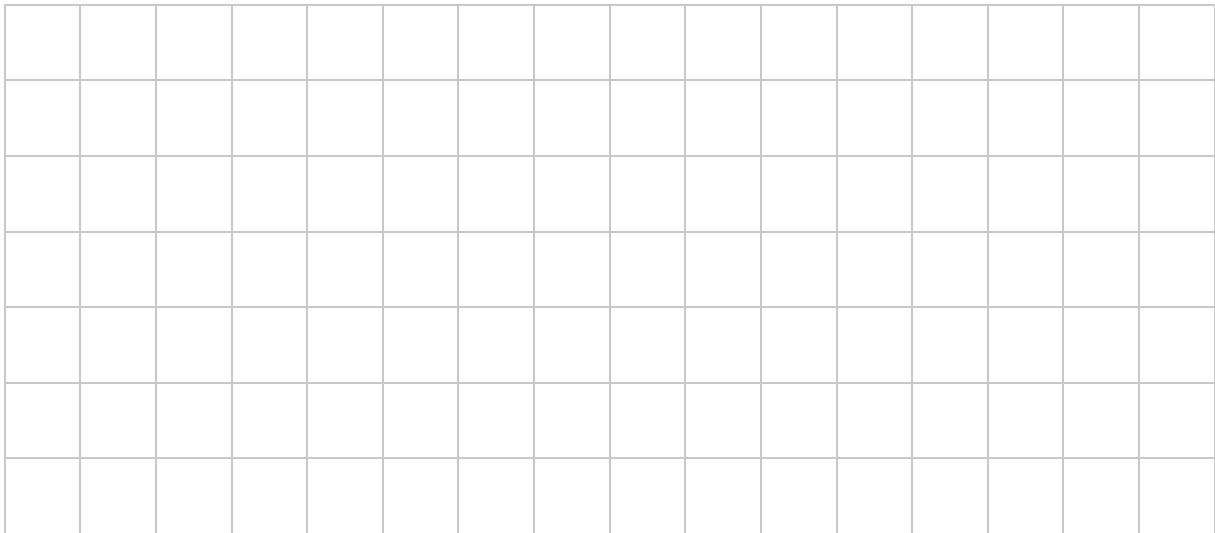
Question 6

(Suggested maximum time: 10 minutes)

The first three patterns in a sequence are shown.

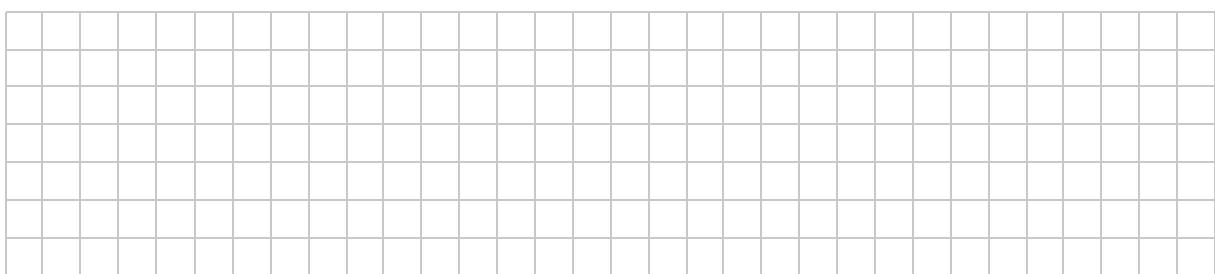
**Pattern 1****Pattern 2****Pattern 3**

- (a) Draw Pattern 4 in the sequence.



- (b) Fill in the table to show the number of small squares in each of the first four patterns.

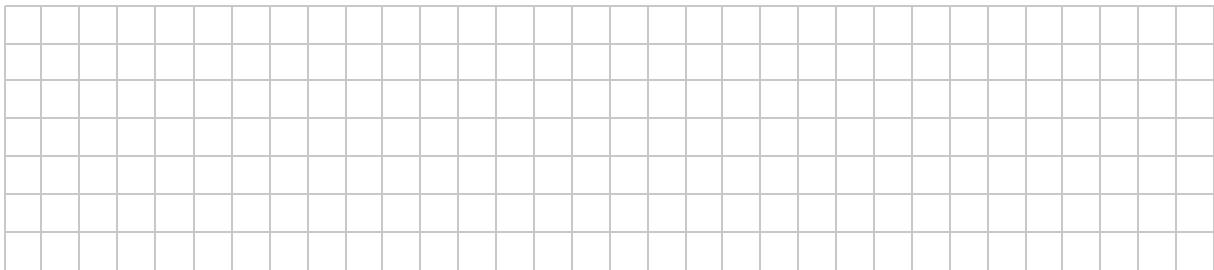
Pattern	Number of small squares
1	
2	5
3	
4	



- (c) The number of small squares in Pattern n is:

$$n^2 + 1$$

Use this to work out the number of small squares in Pattern 20.



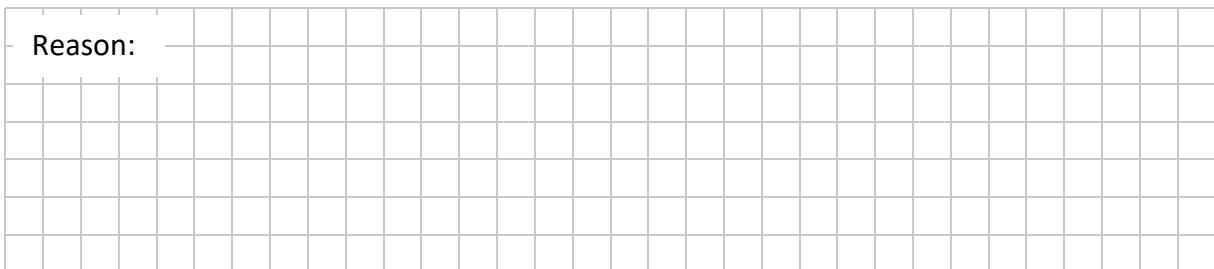
- (d) What kind of sequence is made by the number of small squares in each pattern?
Tick (\checkmark) one box only. Give a reason for your answer.

linear

quadratic

exponential

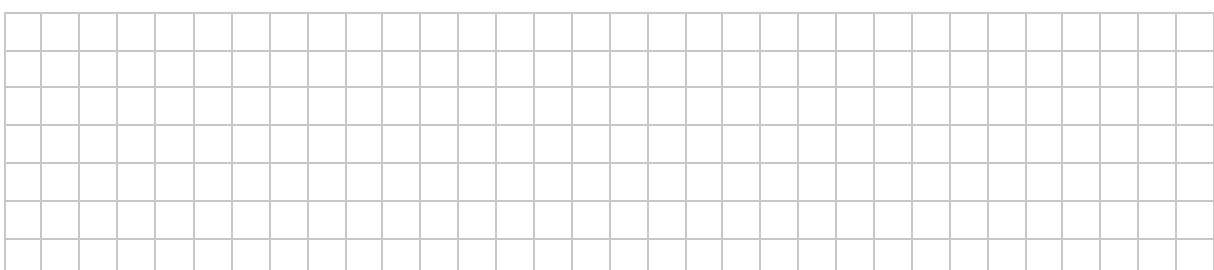
Reason:



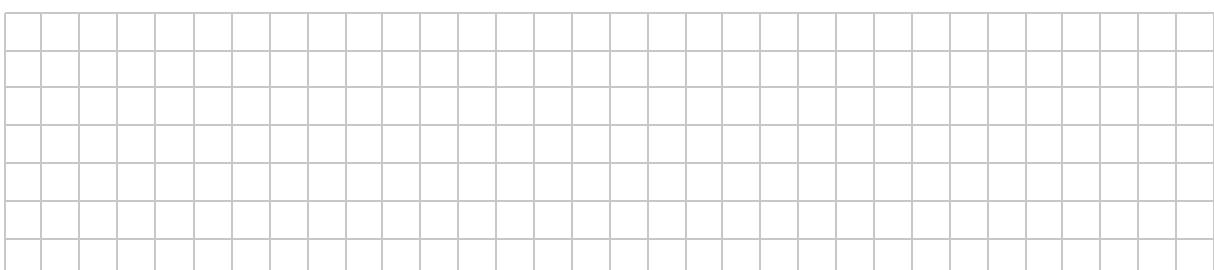
Question 7

(Suggested maximum time: 5 minutes)

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



- (b) Factorise $x^2 - 64$.



Question 8

(Suggested maximum time: 15 minutes)

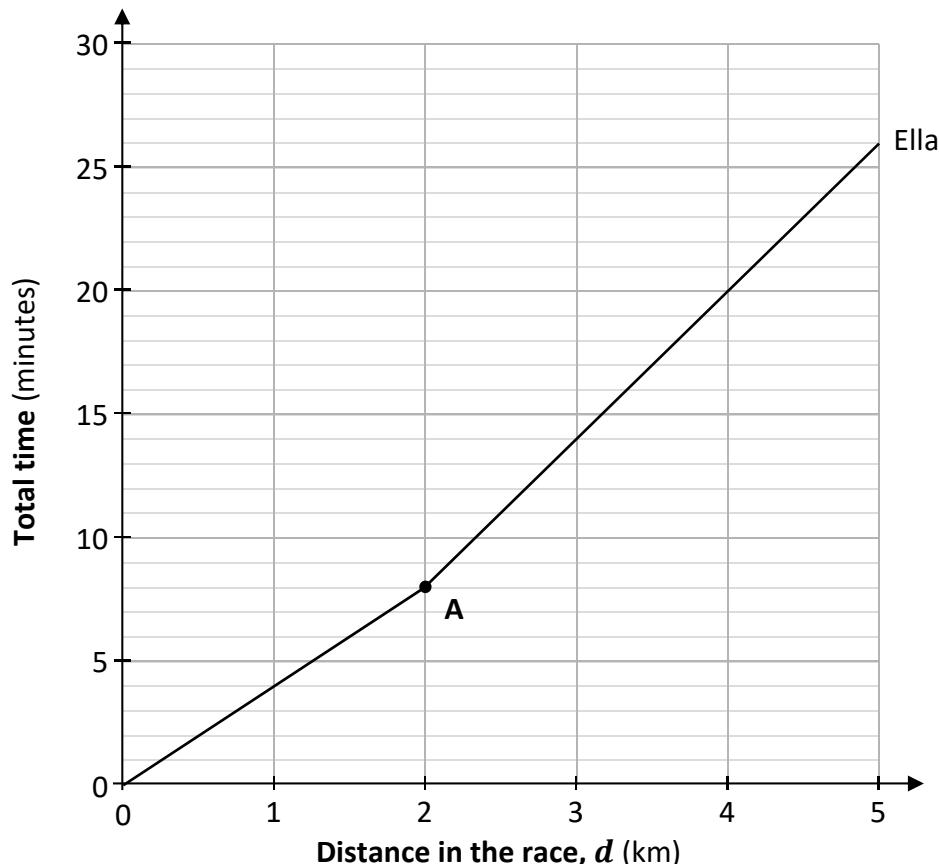
Poppy and Ella ran a 5 km race. The table below shows the total time that it took Poppy and Ella to run each of the given distances in the race. It took Ella 26 minutes to run the whole 5 km.

Distance in the race (km)	Total time taken for Ella (minutes)	Total time taken for Poppy (minutes)
1	4	5
2		10
3		17
4		24
5	26	30

The graph below shows the time that it took Ella to run d km during the race.

One of the points is marked **A**. Distance is on the horizontal axis.

- (a) Using the graph, fill in the three missing values for **Ella** in the **table above**.
- (b) Using the figures in the table, draw a graph on the diagram below to show the time it took **Poppy** to run d km during the race, for $0 \leq d \leq 5$ and $d \in \mathbb{R}$.



- (c) Who finished first, Ella or Poppy? Tick (✓) one box only. Give a reason for your answer.

Ella

1

Poppy

1

Reason:

- (d) Tick (\checkmark) the correct box to show what happened to Ella's speed after 2 km, which is marked A on the graph. Tick one box only. Justify your answer.

Ella's speed increased

1

Ella's speed decreased

1

Ella's speed
stayed the same

1

Justification:

- (e) It took Poppy 30 minutes to run the 5 km.
Work out Poppy's **average speed** for the race, in km per hour.

Question 9

(Suggested maximum time: 10 minutes)

A school team orders t-shirts and half zips.

Jill, Mike, Ted, and Gary order **t-shirts** (T).

Jill and Alice order **half zips** (Z).

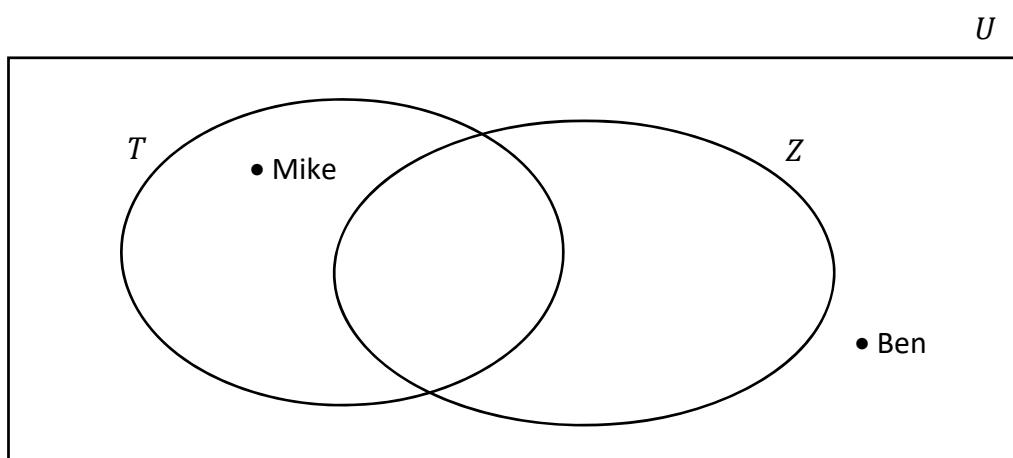
Ben and Zena **don't order either**.

- (a) Complete the Venn diagram below to show this information, where:

U is the whole team (the universal set)

T is the set of people ordering t-shirts

Z is the set of people ordering half zips.



- (b) In total, how many students are on the team?

Answer:

- (c) Write each term from the following list into the correct space in the table below, to match each description to the correct term in set notation. Z' is the complement of Z .

$Z \setminus T$

$T \cap Z$

Z'

	Description	Set notation
1	The students who order both t-shirts and half zips	
2	The students who order half zips but not t-shirts	
3	The students who do not order half zips	

Source of the images: www.adidas.ie. Altered.

Question 10

(Suggested maximum time: 5 minutes)

- (a) (i) The weight of an elephant is 5400 kg.
Write the weight of the elephant in grams.

$$5400 \text{ kg} = \boxed{} \text{ grams}$$

- (ii) The weight of a mouse is 19 grams. Write the correct figure from the following list into the sentence below. Show your working out.

300

3000

30 000

300 000

The weight of the elephant is roughly times the weight of the mouse.

- (b)** Fill in the table below to show each number in the form 10^n , where $n \in \mathbb{N}$.

Number	Number in the form 10^n
100	10^2
10 000	
$10^3 \times 10^9$	
10	

- (c) Write 5400 in the form $a \times 10^n$, where $1 \leq a < 10$ and $n \in \mathbb{N}$.

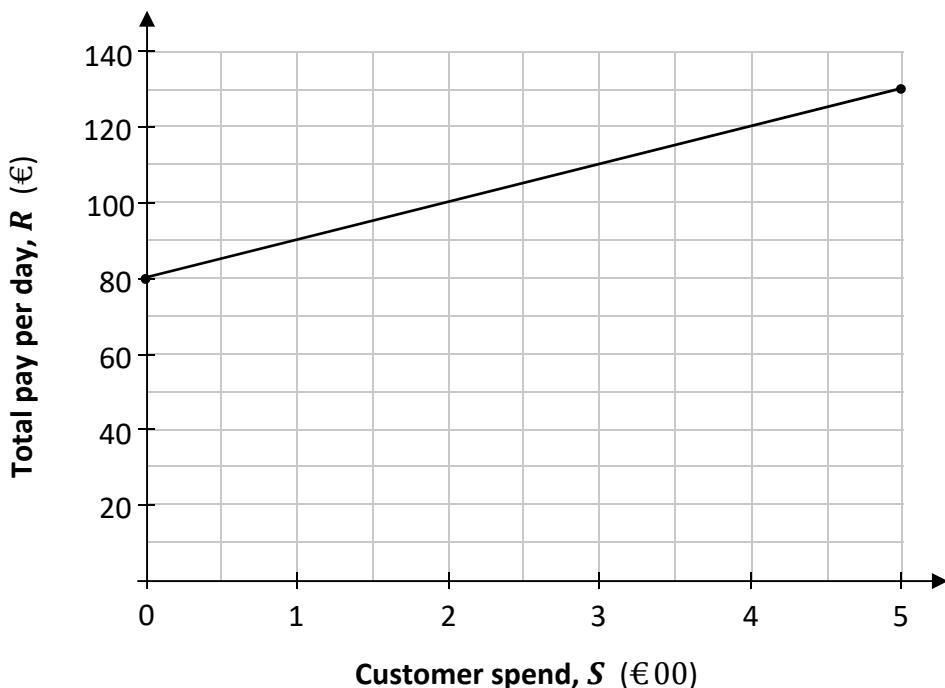
Question 11

(Suggested maximum time: 15 minutes)

Ruairí has a weekend job. His **total** pay per day is a **fixed rate plus tips**.

The tips are a percentage of the customer spend.

The graph below shows Ruairí's total pay per day, depending on the customer spend. R is his total pay per day (in euro) and S is the customer spend (in hundreds of euro).



- (a)** What is Ruairí's fixed rate per day
(his pay when the customer spend is €0)?

Answer:

- (b)** On one day, the customer spend was €500 (so $S = 5$).

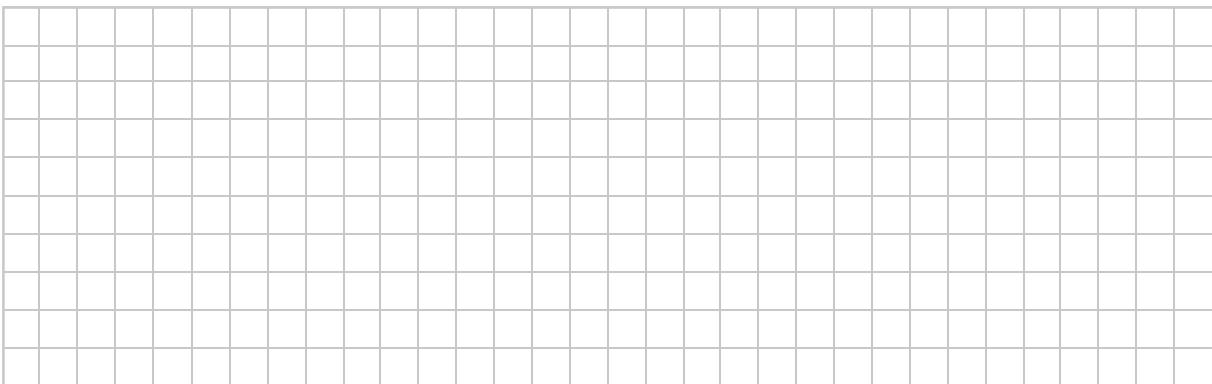
- (i) What was Ruairí's **total** pay on that day?

Answer:

- (ii) How much was Ruairí paid in tips on that day?

Answer:

- (c) The point (2.5, 105) is on the graph.
Explain what this means in the context of Ruairí's total pay **and** the customer spend.



- (d) Three equations are given below in terms of R and S .

Tick (\checkmark) the correct box to show which one corresponds to the graph of Ruairí's total pay.
Tick one box only. Justify your answer.

$$R = 80 - 10S$$

$$R = 130 + 10S$$

$$R = 80 + 10S$$

Justification:

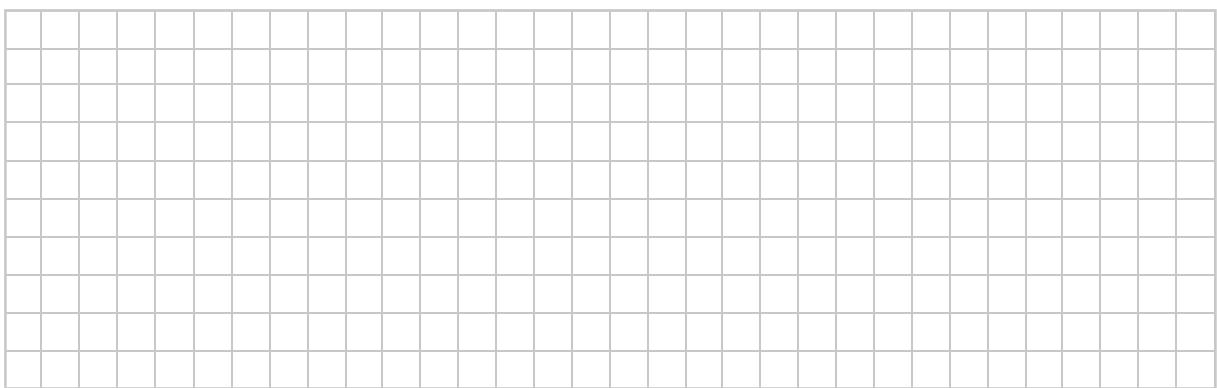
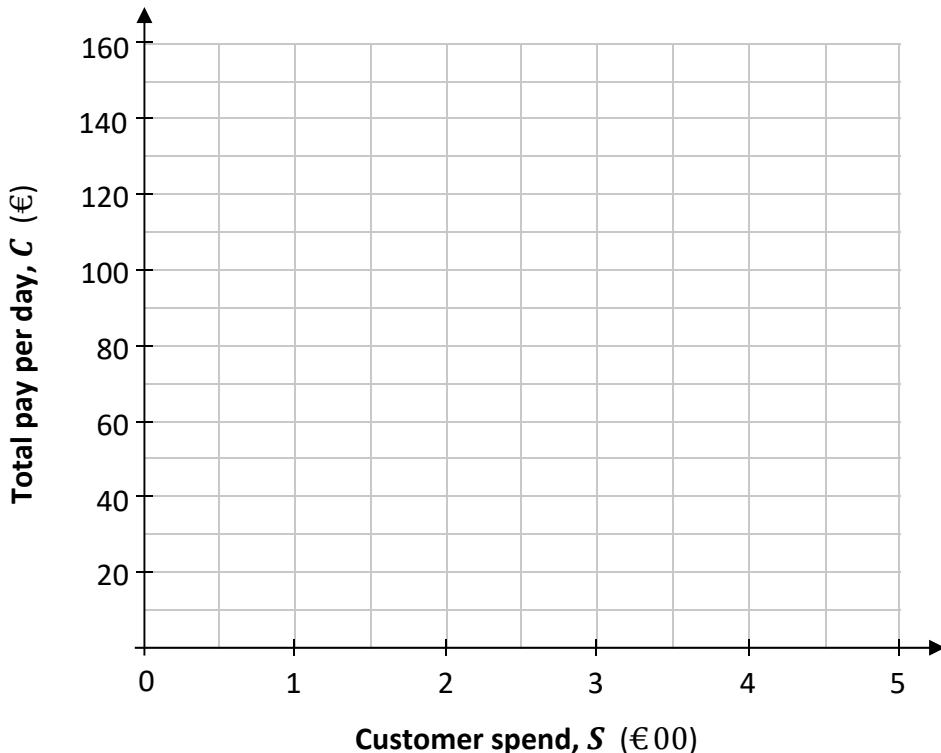
This question continues on the next page.

- (e) Cillian also has a weekend job. Cillian's total pay per day, C , is:

$$C = 60 + 20S$$

where S is the customer spend (in hundreds of euro).

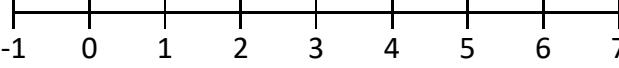
Draw the graph of Cillian's pay, C , on the axes below, for $0 \leq S \leq 5$ and $S \in \mathbb{R}$.



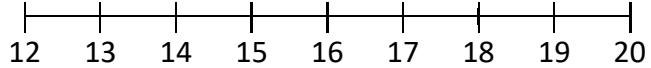
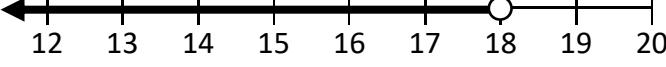
Question 12

(Suggested maximum time: 10 minutes)

- (a) The table below shows the graph of each of the given inequalities.
 Fill in the missing graph and the missing inequality, labelled A and B.
 $x \in \mathbb{N}$ in each case.

	Inequality ($x \in \mathbb{N}$)	Graph
1 (Example)	$x < 4$	
2	$x > 2$	A. 
3	B.	

- (b) Ailbhe writes two inequalities in A, and graphs each one.
 One inequality and one graph are shown in the table below.
- (i) Complete the table by filling in the missing inequality and graph, labelled G and H.
 $A \in \mathbb{R}$ in each case.

	Inequality ($A \in \mathbb{R}$)	Graph
1	$A \geq 13$	G. 
2	H.	

A teenage disco has the following rule about the age, A , of students:

Students must be 13 years of age or older, but less than 18.

- (ii) To represent this rule, should Ailbhe take the union, the intersection, or the complement of the two sets in part (b)(i)? Tick (✓) one box only.

union

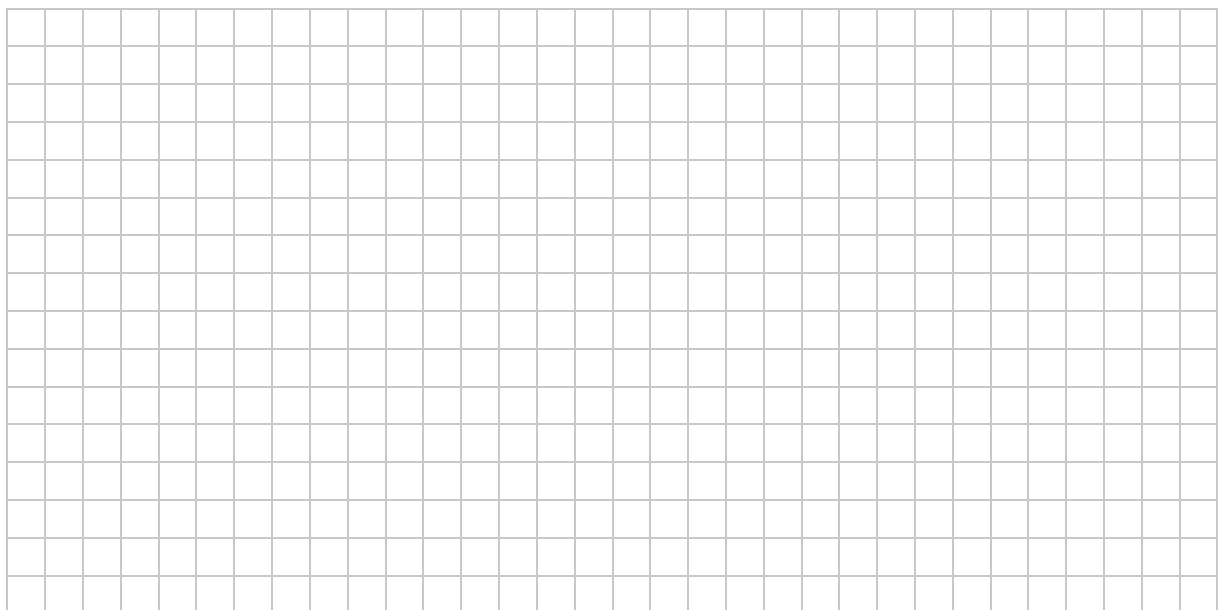
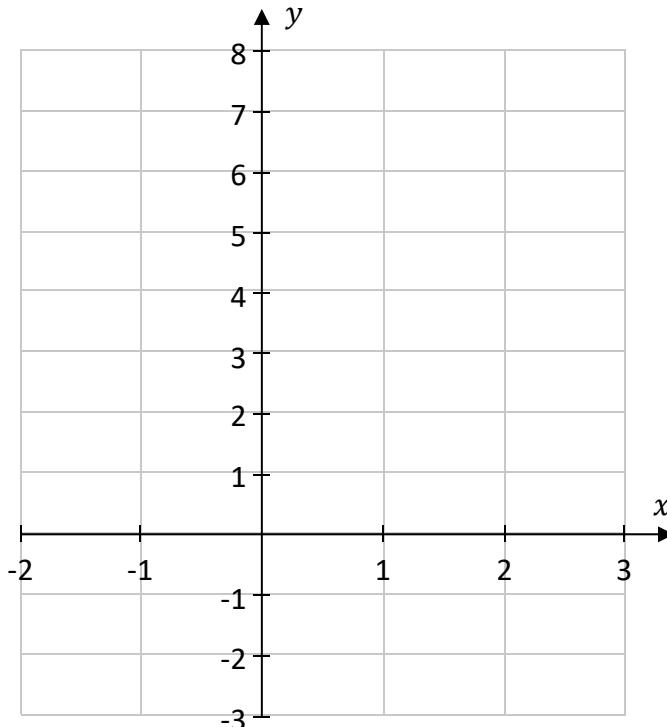
intersection

complement

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

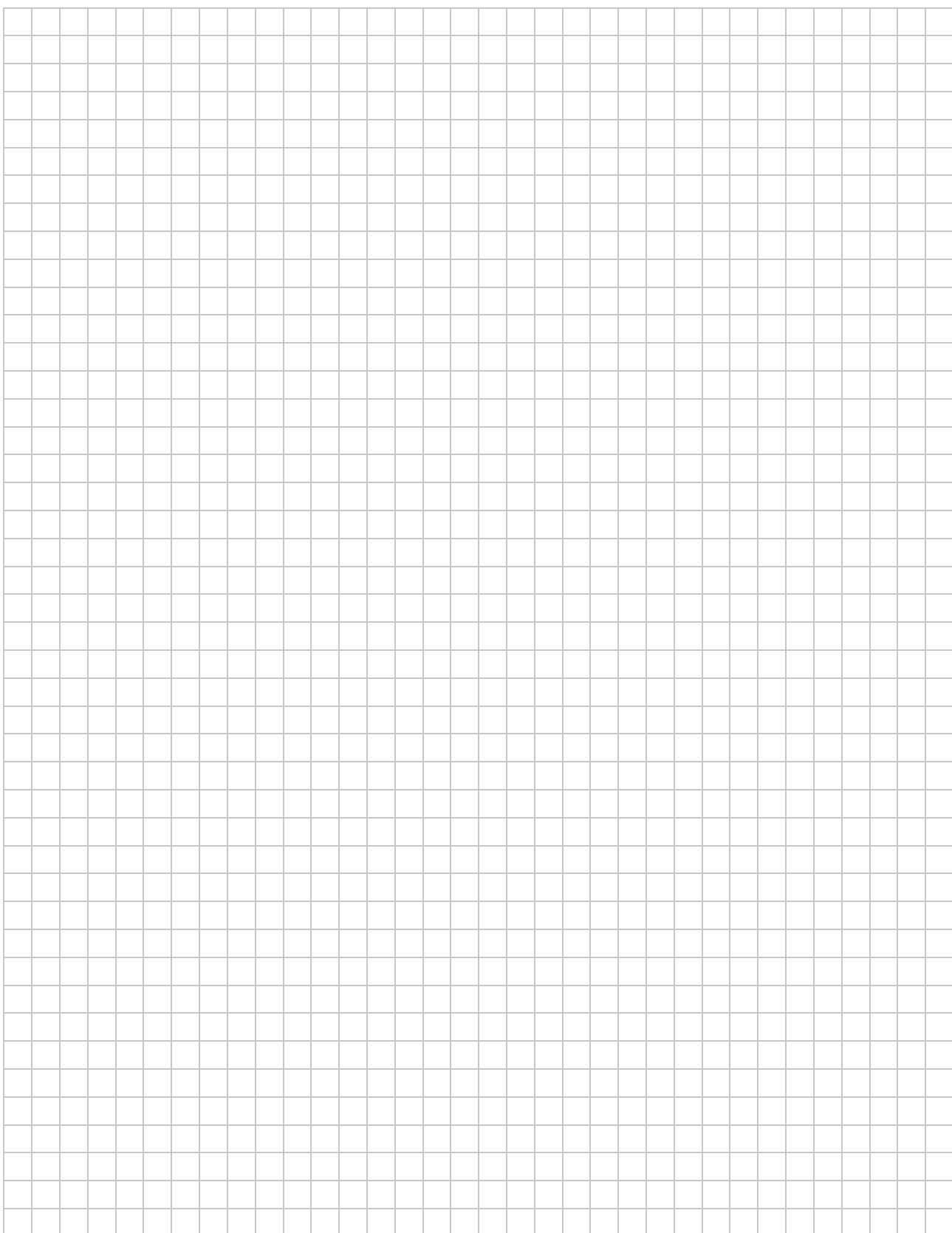
Draw the graph of the function

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

on the axes below, for $-2 \leq x \leq 3, x \in \mathbb{R}$.

Page for extra work.

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





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