

## Question 1

### Question 1

(Suggested maximum time: 5 minutes)

Xena's car has a screen which shows the temperature in degrees Celsius, correct to the nearest whole number.

When Xena was going to work one day, the temperature on the screen was 18 °C.



- (a) Write down **three** possible values that the **actual** temperature could have been when Xena was going to work.

,  ,

Let  $t$  represent the **actual** temperature at a given time.

- (b) Fill in the missing values in the inequality in  $t$  below to show the range of possible values of  $t$  when Xena was going to work.

$\leq t <$

- (c) If you were to graph the **actual** temperature,  $t$ , over the course of a day, would it be more appropriate to graph  $t \in \mathbb{N}$ ,  $t \in \mathbb{Z}$ , or  $t \in \mathbb{R}$ ? Give a reason for your answer.

Answer:

$t \in \mathbb{N}$

$t \in \mathbb{Z}$

$t \in \mathbb{R}$

(Tick (✓) **one** box only)

Reason:

Grid area for writing the reason.

## Question 2

### Question 9

(Suggested maximum time: 5 minutes)

- (a) Multiply out and simplify  $4x(5x + 4) - 3(x - 2)$ .

- (b) Factorise fully  $9 - 25y^2$ .

- (c) Write  $\frac{5^7 \times 25^3}{\sqrt{5}}$  in the form  $5^p$ , where  $p \in \mathbb{Q}$ .

Question 3

Question 13

(Suggested maximum time: 10 minutes)

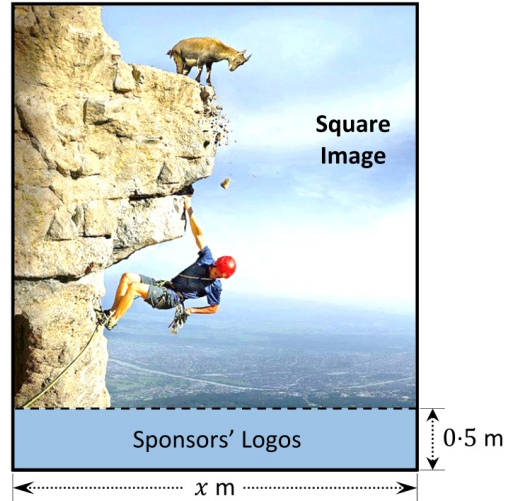
A company is making a large rectangular poster, as shown in the diagram on the right.

The top section will be a square image.

The bottom section will be a rectangle of height 0.5 m, which will have the sponsors' logos.

The width of the poster is  $x$  m, as shown.

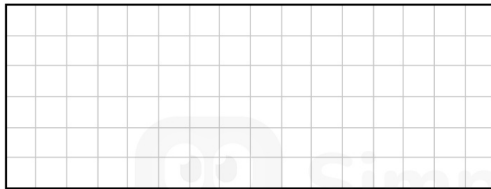
Rectangular Poster



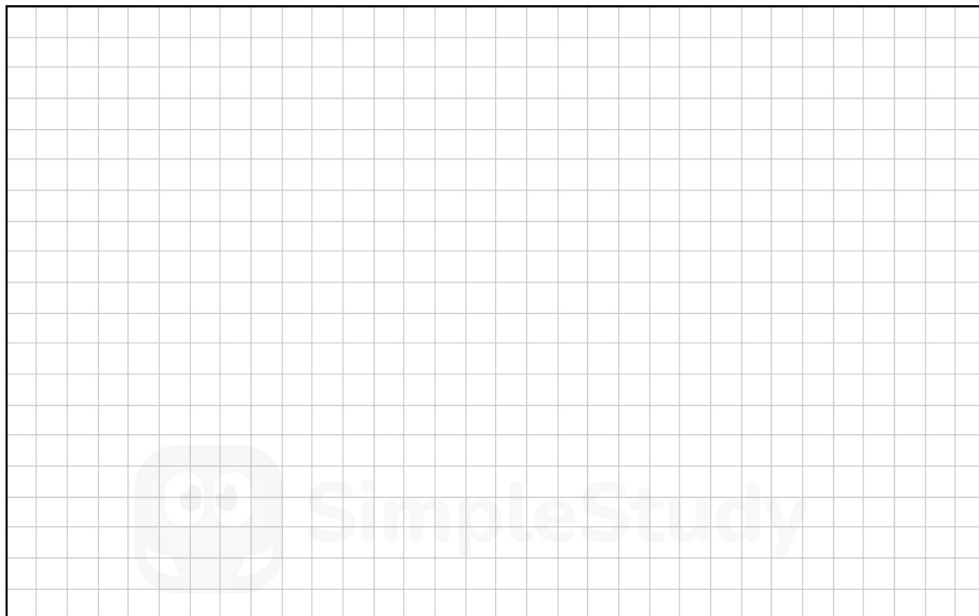
- (a) Write the **total height** of the poster, in terms of  $x$ .

Total height =  m

- (b) The **total area** of the poster is  $50 \text{ m}^2$ . Show that  $2x^2 + x - 100 = 0$ .



- (c) Solve the equation  $2x^2 + x - 100 = 0$  to find the value of  $x$ , the width of the poster. Give your answer in **metres**, correct to the nearest **centimetre**.



Question 4

Question 12

(Suggested maximum time: 10 minutes)

(a) Factorise  $a^2 - 16n^2$ .

(b) One of the factors of  $8x^2 + 45x - 18$  is  $x + 6$ .

(i) Factorise  $8x^2 + 45x - 18$ .

(ii) Write down one quadratic expression in  $x$ , other than  $8x^2 + 45x - 18$ , that has  $x + 6$  as a factor.

Give your answer in the form  $ax^2 + bx + c$ , where  $a, b, c \in \mathbb{R}$ .

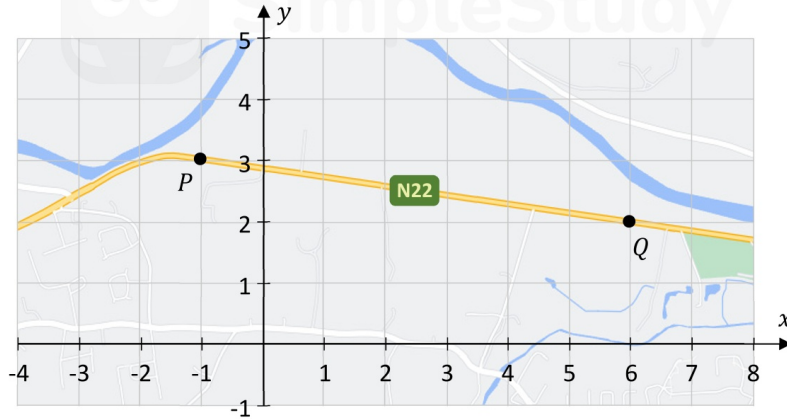
Answer:

## Question 5

### Question 3

(Suggested maximum time: 10 minutes)

The co-ordinate diagram below shows part of the N22 road in County Cork. Two points on the road,  $P$  and  $Q$ , are marked on the diagram.



- (a) The point  $Q$  has co-ordinates  $(6, 2)$ .  
Write down the co-ordinates of the point  $P$ .

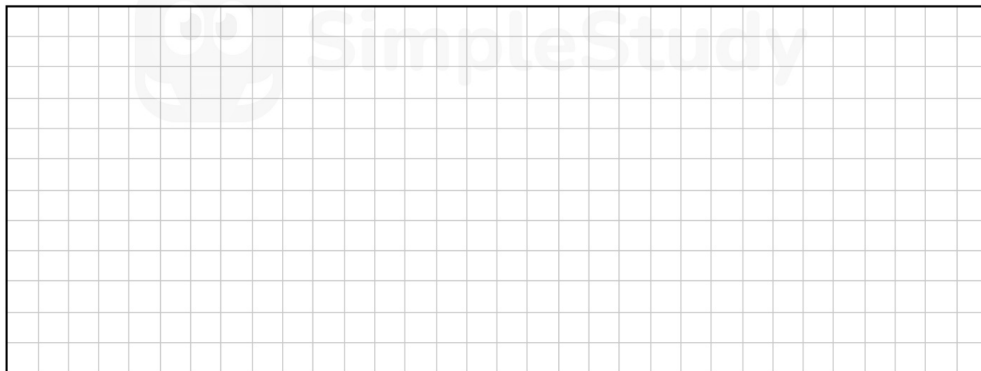
$$P = \left( \quad , \quad \right)$$

- (b) The equation of the line  $PQ$  is:

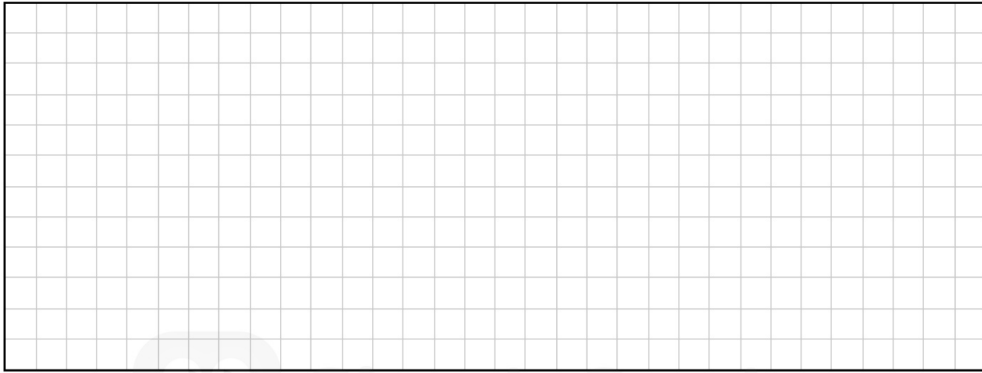
$$x + 7y = 20$$

Using this, or otherwise, find the co-ordinates of the point where the line  $PQ$  crosses the  $y$ -axis.

$$\text{Answer} = \left( \quad , \quad \right)$$

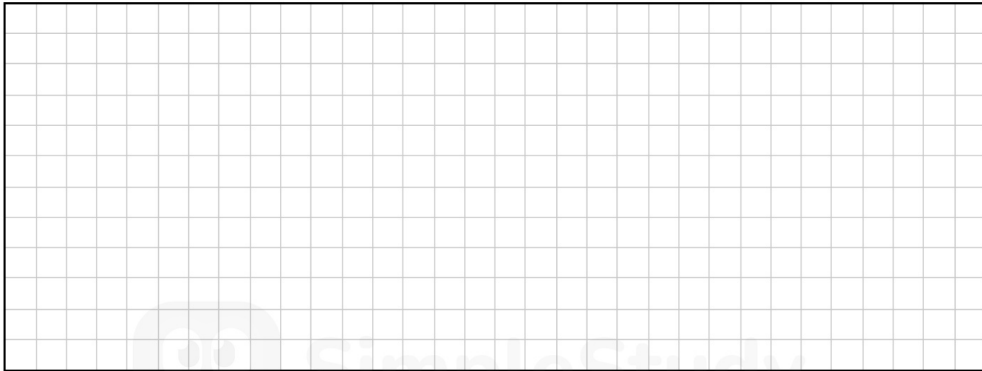


- (c) A new road is being built through the point  $Q(6, 2)$ .  
On the co-ordinate diagram, it will be a straight line segment which is **perpendicular** to  $PQ$ .  
Work out the equation of this new road.  
Give your answer in the form  $ax + by + c = 0$ , where  $a, b, c \in \mathbb{R}$ .



- (d) The distance  $|PQ|$  on the diagram is 7.1 cm, correct to 1 decimal place.  
5 mm on the diagram represents 100 m.

Use this to work out the **actual** distance from  $P$  to  $Q$ . Give your answer in km.



Question 6

Question 12

(Suggested maximum time: 10 minutes)

The diagram below shows a curved shape  $ABC$ .

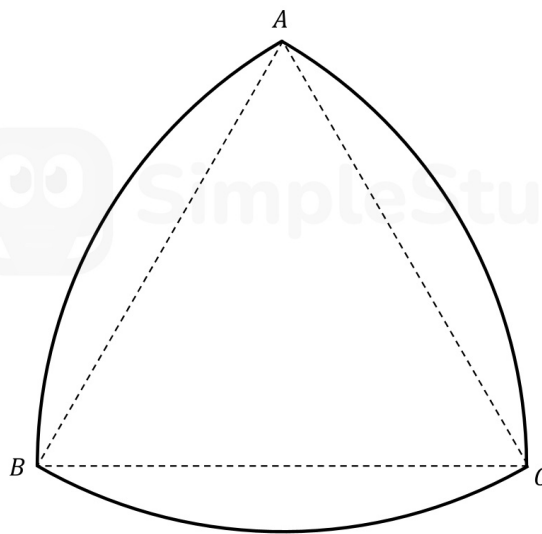
$C$  is the centre of the circular arc from  $A$  to  $B$ .

$A$  is the centre of the circular arc from  $B$  to  $C$ .

$B$  is the centre of the circular arc from  $C$  to  $A$ .

The dotted triangle  $ABC$  is an equilateral triangle.

- (a) Using only a compass and straight edge, **construct one** of the axes of symmetry of the curved shape  $ABC$ . Show all of your construction lines clearly.



- (b) (i) Write down the size of the angle  $\angle ACB$ .

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- (ii) The length of the straight-line segment  $[BC]$  is 40 cm.  
Find the length of the **circular** arc from  $B$  to  $C$ .  
Give your answer in cm, correct to 2 decimal places.

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## Question 7

### Question 8

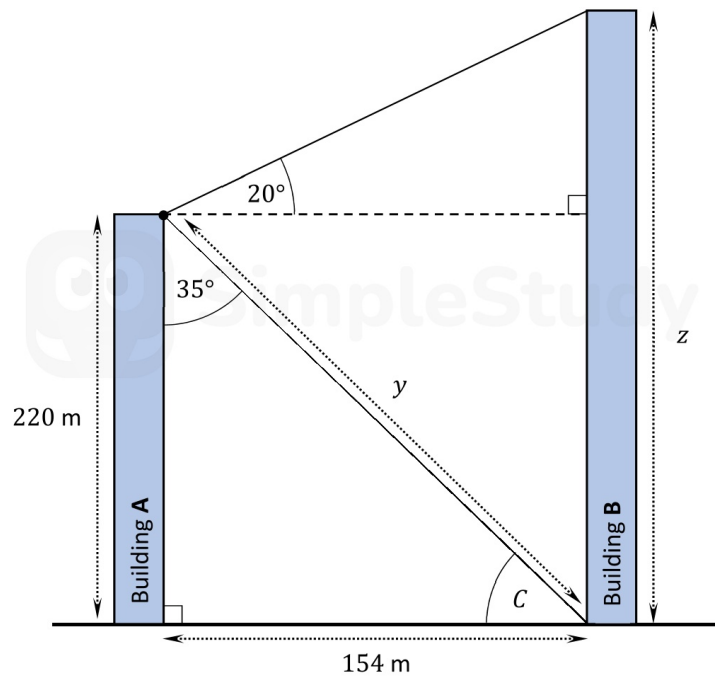
(Suggested maximum time: 10 minutes)

The diagram below shows two vertical buildings, **A** and **B** (diagram not to scale).

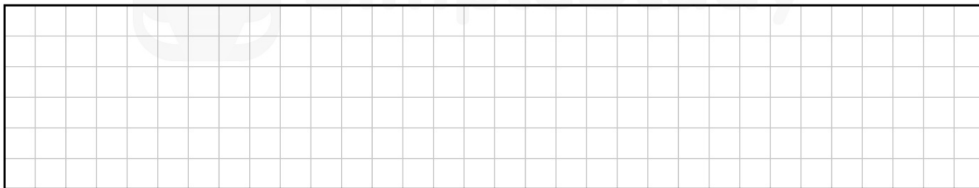
Mary stands at the top of Building **A**. She is 220 m above the ground.

She wants to work out the distances marked  $y$  and  $z$  in the diagram – that is, the distance from the top of Building **A** to the bottom of Building **B**, and the height of Building **B**, respectively.

Mary measures the two angles that are marked  $35^\circ$  and  $20^\circ$  in the diagram, to the bottom of Building **B** and the top of Building **B**, respectively. The broken line is horizontal.



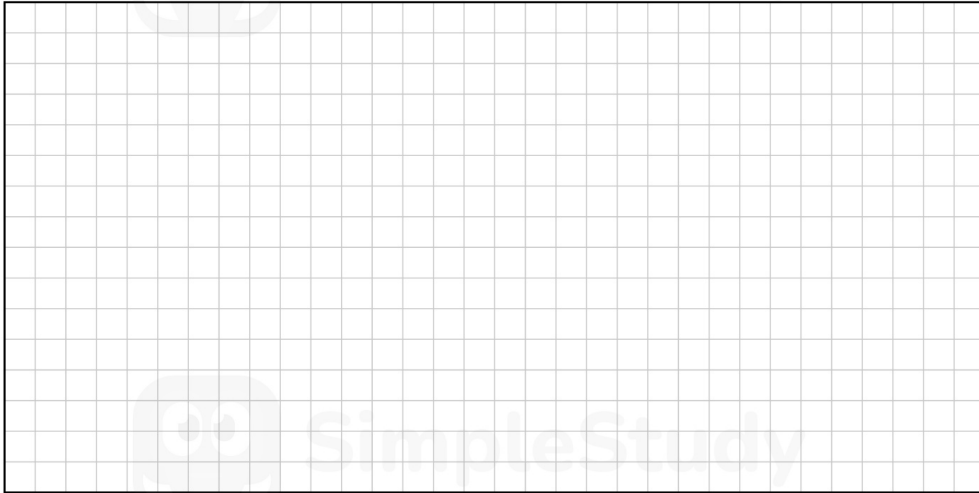
- (a) Work out the size of the angle  $C$ .



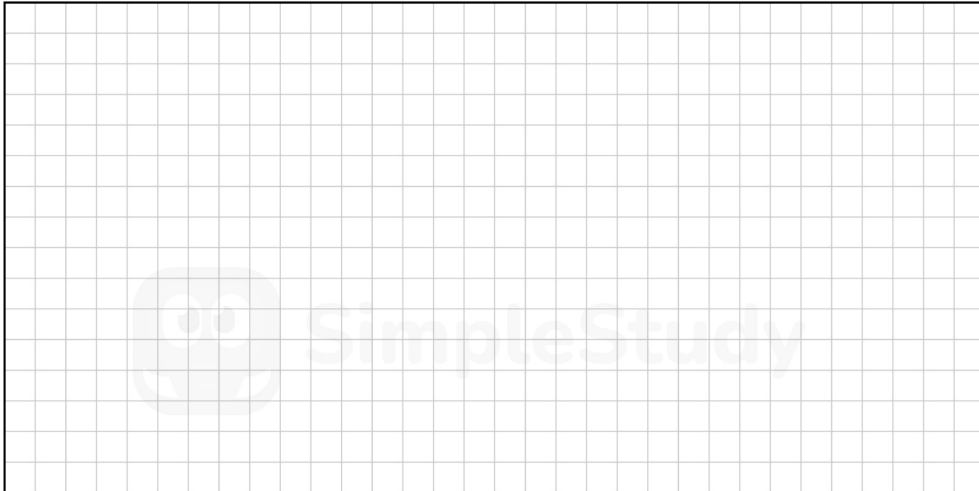
- (b) Mary works out that the horizontal distance between the two buildings is 154 m,

correct to the nearest metre, as shown.

Use the **Theorem of Pythagoras** to work out the distance marked  $y$  on the diagram.  
Give your answer correct to the nearest metre.



- (c) Use **trigonometry** to work out the value of  $z$ , the height of Building B.  
Give your answer correct to the nearest metre.



## Question 8

### Question 3

(Suggested maximum time: 10 minutes)

The students in a Transition Year mini-company make and sell candles.

They buy a solid rectangular block of wax measuring 35 cm by 45 cm by 16 cm.



- (a) Work out the **volume** of the block of wax.

- (b) The students are going to use this wax to make candles in the shape of cylinders.  
Each candle will have a radius of  $r$  cm and a height of 9 cm.  
Work out the **volume** of each candle, in terms of  $r$  and  $\pi$ .



- (c) The students make 100 candles from the block of wax.  
In making the candles, 10% of the wax in the block is wasted.  
Use this information to work out the value of  $r$ , the **radius** of each candle.  
Give your answer correct to 1 decimal place.



## Question 9

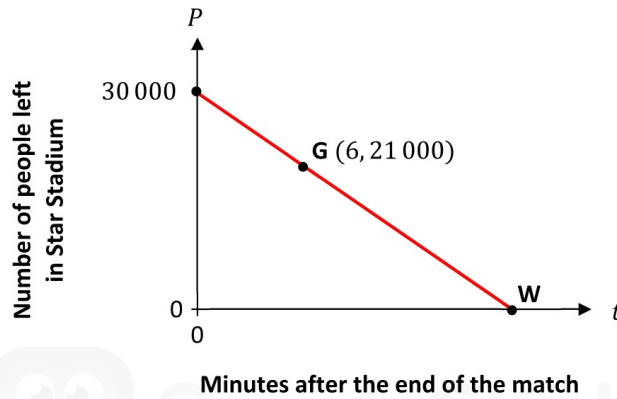
### Question 11

(Suggested maximum time: 5 minutes)

30 000 people went to a football match in Star Stadium.

After the match, the 30 000 people left the stadium at a constant rate.

The graph below shows  $P$ , the number of people still in the stadium  $t$  minutes after the end of the match. Two points are marked on the graph: **G** and **W**.



- (a) The point **G** has co-ordinates (6, 21 000).  
Explain what the 6 and the 21 000 mean, in terms of the number of people in the stadium.

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- (b) It took 20 minutes for all of the 30 000 people to leave the stadium.  
Use this fact to write down the co-ordinates of the point **W**, which is on the  $t$ -axis.

$$\mathbf{W} = ( \quad , \quad )$$

- (c) The equation of the graph can be written as:

$$P = 30\,000 - 1500t$$

- (i) How many people were in the stadium 12 minutes after the match had finished?

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- (ii) Explain what the 1500 in this equation means, in terms of the number of people in the stadium.

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## Question 10

### Question 5

(Suggested maximum time: 5 minutes)

- (a) The table below shows the outcome when the numbers  $a$  and  $b$  are multiplied together, for  $a, b \in \mathbb{N}$ .

Write “**odd**” or “**even**” in each box to complete each of the mathematical statements correctly. The first one is done for you.

	$a$	$\times$	$b$	$=$	$c$
<b>1.</b>	even	$\times$	even	$=$	even
<b>2.</b>	odd	$\times$	odd	$=$	
<b>3.</b>	odd	$\times$	even	$=$	

Ruairí rolls a regular, unbiased, six-sided die three times. He writes down the number on each roll of the die.

- (b) Complete the sample space below, showing the different possible combinations of odd numbers (**O**) and even numbers (**E**) that Ruairí could roll. Two possible outcomes have been filled in for you.



<b>E E E</b>	<b>E E O</b>		

- (c) Each outcome in the table is equally likely. Ruairí **multiplies** together the three numbers that he rolls. Find the **probability** that Ruairí will get an **even number** as his answer.

## Question 11

### Question 7

(Suggested maximum time: 10 minutes)

Joonas has an unlimited supply of €5 notes and €2 coins.

- (a) Fill in the table to show three different ways in which he can use these to make exactly €27. One way is already done.

	Number of €5 notes	Number of €2 coins	Total amount of money
Way 1	1	11	€27
Way 2			€27
Way 3			€27

- (b) Explain how he could use his supply of €5 notes and €2 coins to make every whole number value of money greater than €3 (i.e. to make € $n$  for every  $n \in \mathbb{N}$ , where  $n > 3$ ).

## Question 12

### Question 4

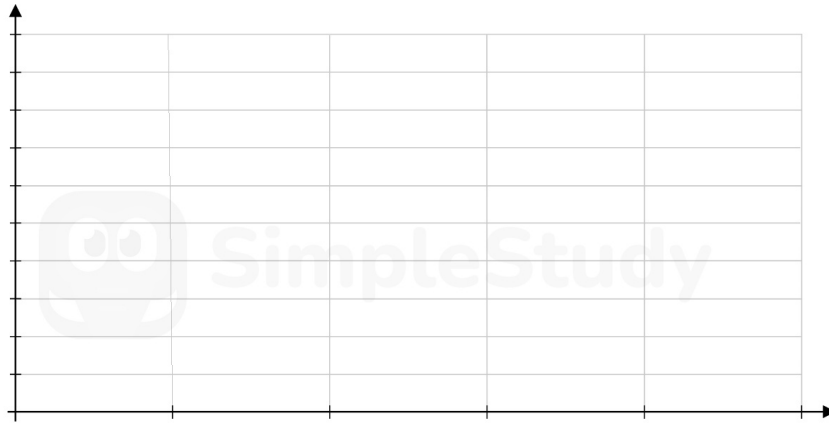
(Suggested maximum time: 10 minutes)

The ages of children in a crèche were recorded.  
The data are shown in the table below.

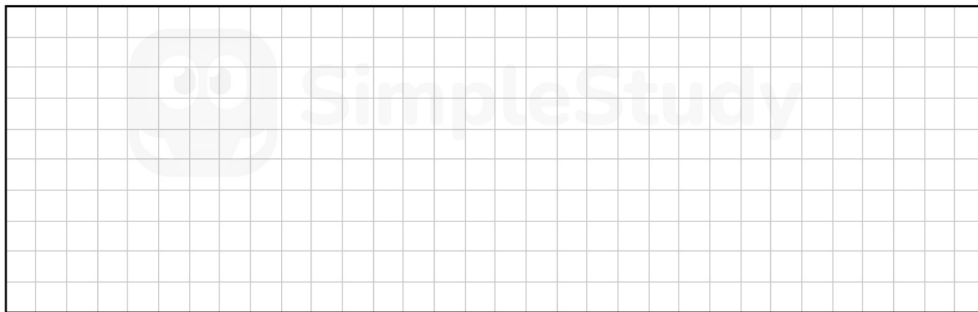
Age (years)	0 – 1	1 – 2	2 – 3	3 – 4	4 – 5
Number of children	6	10	19	3	5

[Note: 2 – 3 means “2 years or more, but less than 3 years”, etc.]

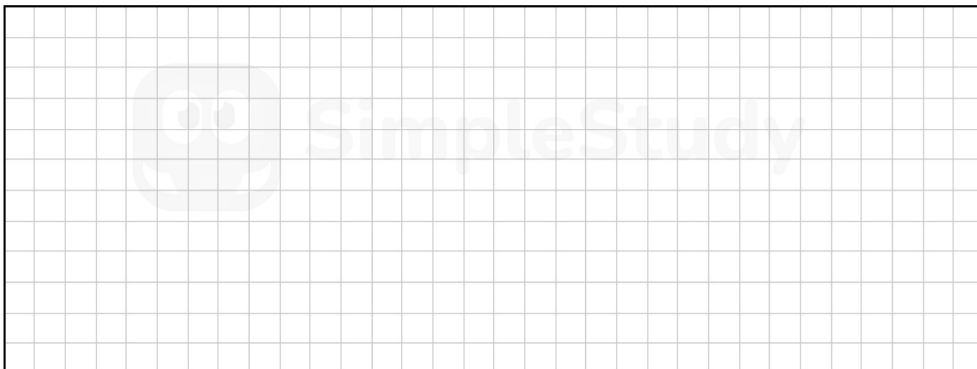
- (a) Represent the data on a **histogram**. Label the axes clearly.



- (b) Work out the **percentage** of children in the crèche who are aged 1 – 2 years.  
Give your answer correct to the nearest percent.



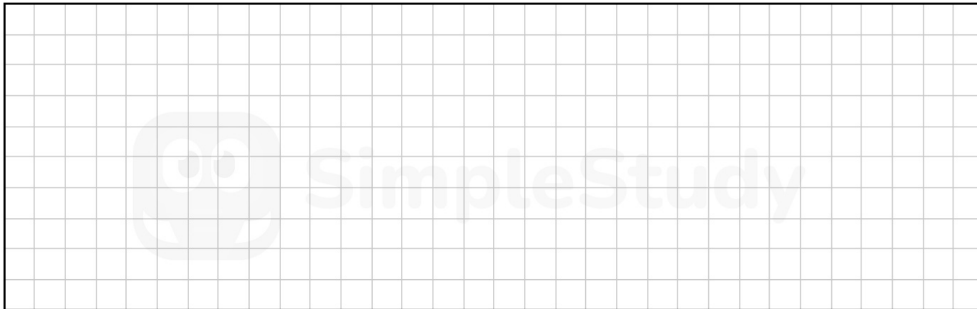
- (c) Use mid-interval values to estimate the **mean** age of the children in the crèche.  
Give your answer in years, correct to 1 decimal place.



- (d) The table below shows the **maximum** number of children that **one** staff member in the crèche can mind, depending on the age of the children. So, for example, one staff member can mind up to 3 children aged 0 – 1 years, **or** up to 5 children aged 1 – 2 years, and so on.

Age (years)	Maximum number of children that one staff member can mind
0 – 1	3
1 – 2	5
2 – 3	6
3 – 6	8

Work out the **least** number of staff members that are needed to mind all of the children in the crèche.

A large grid for working out the solution to the problem. The grid is 20 columns wide and 15 rows high. A faint watermark of a smiley face and the text 'SimpleStudy' is visible in the center of the grid.

### Question 13

#### Question 10

(Suggested maximum time: 10 minutes)

Michelle must pay Universal Social Charge (USC) on all of her gross income. The income bands and rates of USC that Michelle must pay are given in the table below.

Income Band	Rate of USC
Up to €12 012	1.5%
Next €5564	3.5%
Above €17 576	7%

Michelle pays USC at all three rates.

- (a) Find the amount of USC that she must pay at each of the first two rates (1.5% and 3.5%).

USC @ 1.5% = \_\_\_\_\_      USC @ 3.5% = \_\_\_\_\_

Michelle's gross income is  $x$ .

Michelle pays a total of 5% of her gross income in USC.

- (b) Write an expression, in terms of  $x$ , for the **total amount** of money that Michelle pays in USC.

- (c) Find the value of  $x$ , Michelle's gross income.



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