

Question 1 (7 marks)

Label the graphs by dragging the matching equation to the correct place.



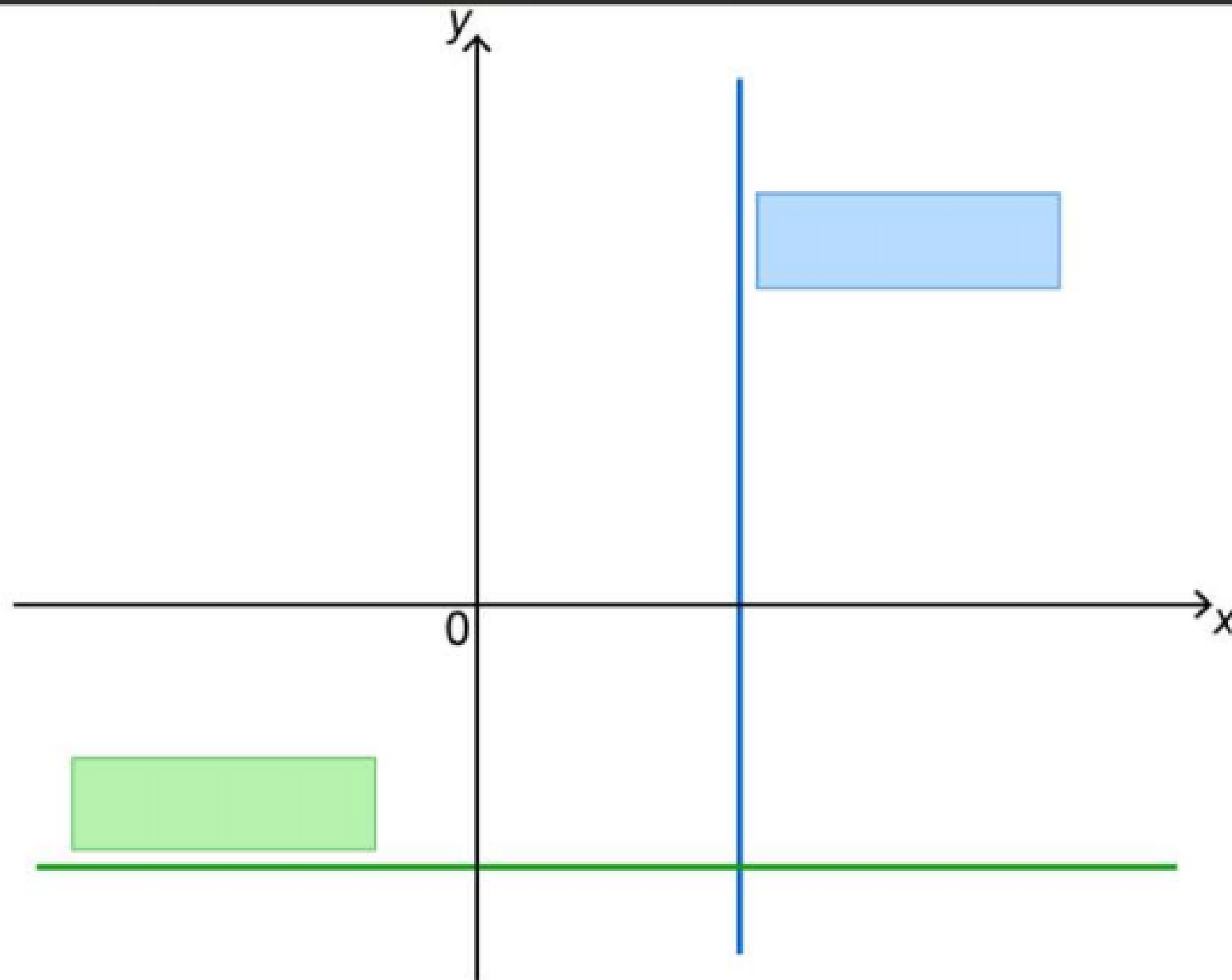
Draggable equations:

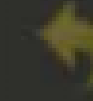
$$x = 3$$

$$x = -3$$

$$y = 3$$

$$y = -3$$





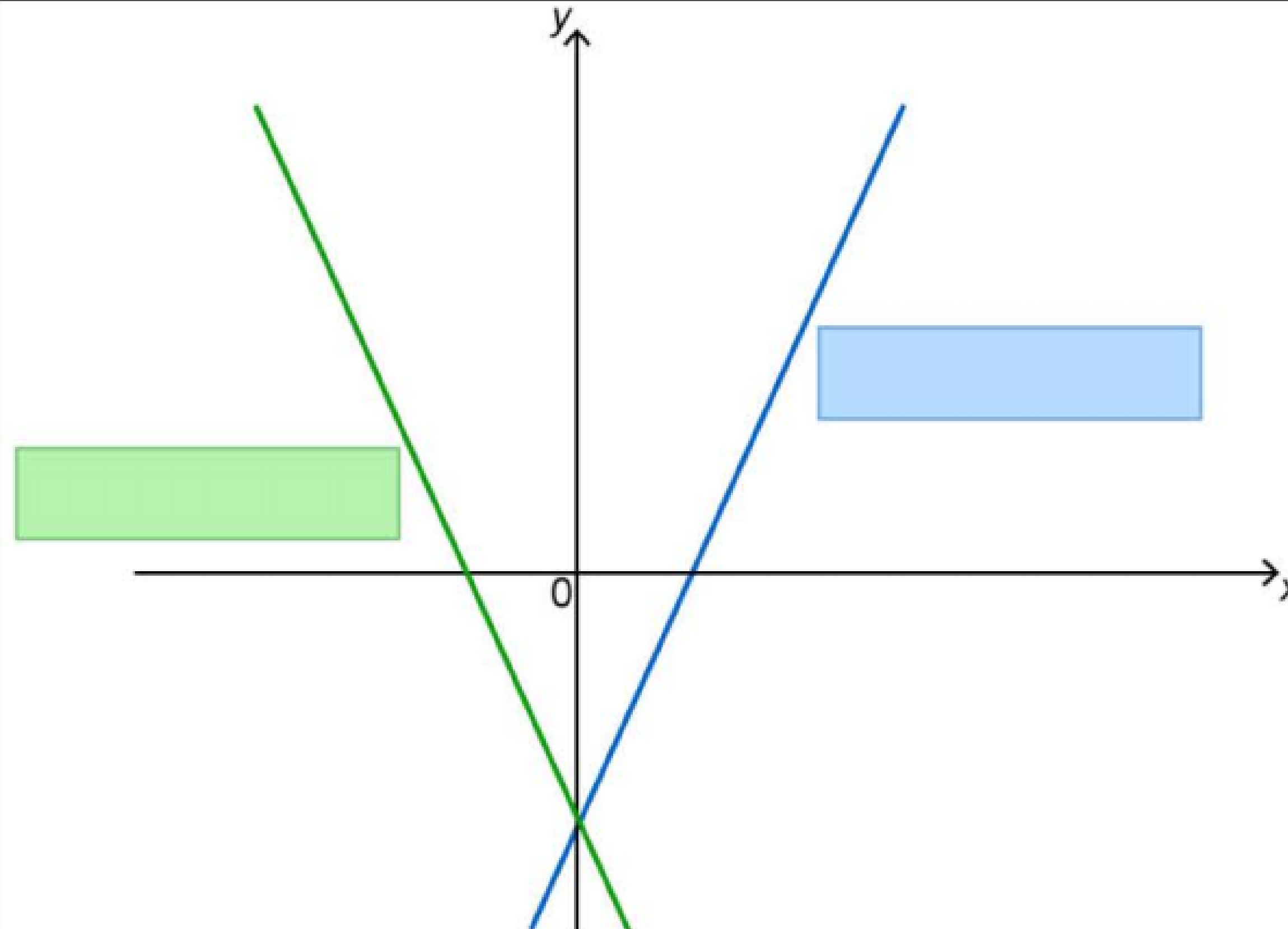
Draggable equations:

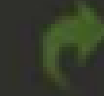
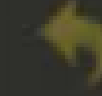
$$y = 2x + 3$$

$$y = 2x - 3$$

$$y = -2x + 3$$

$$y = -2x - 3$$





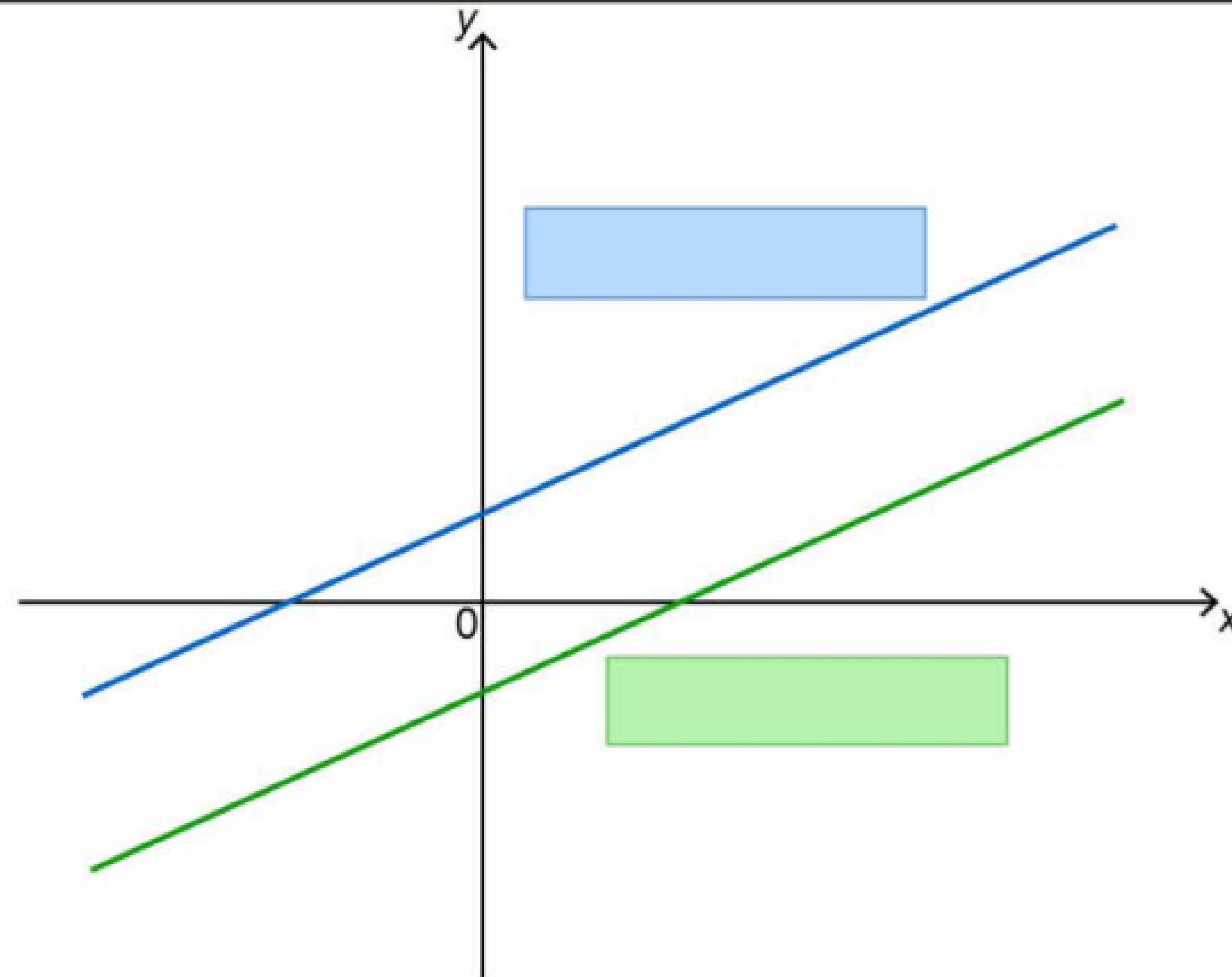
Draggable equations:

$$x + 2y = 3$$

$$x + 2y = -3$$

$$x - 2y = 3$$

$$x - 2y = -3$$





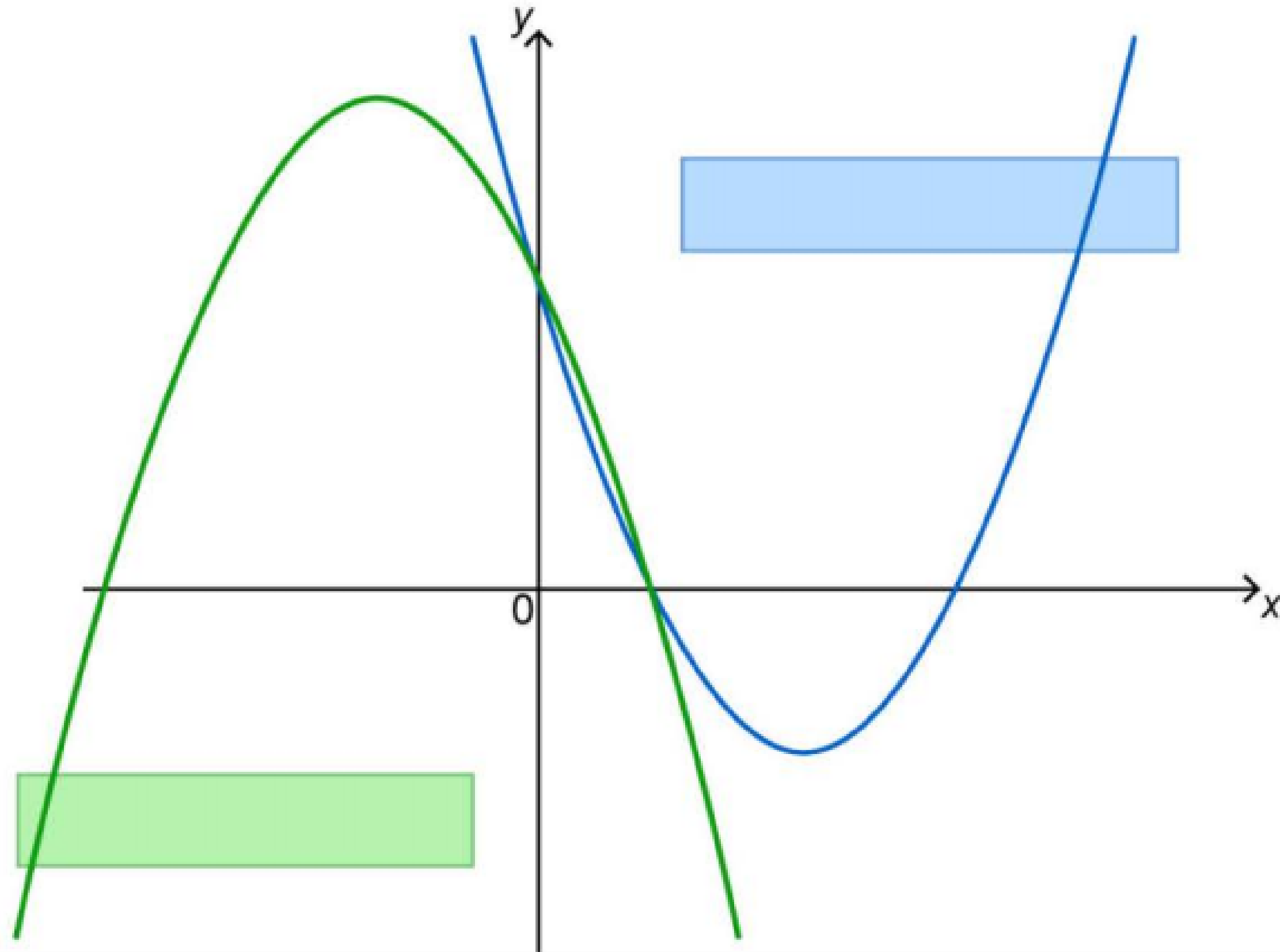
Draggable equations:

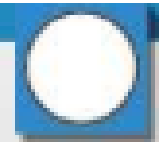
$$y = (x + 1)(x + 3)$$

$$y = (x - 1)(x - 3)$$

$$y = (1 - x)(x + 3)$$

$$y = (x + 1)(3 - x)$$









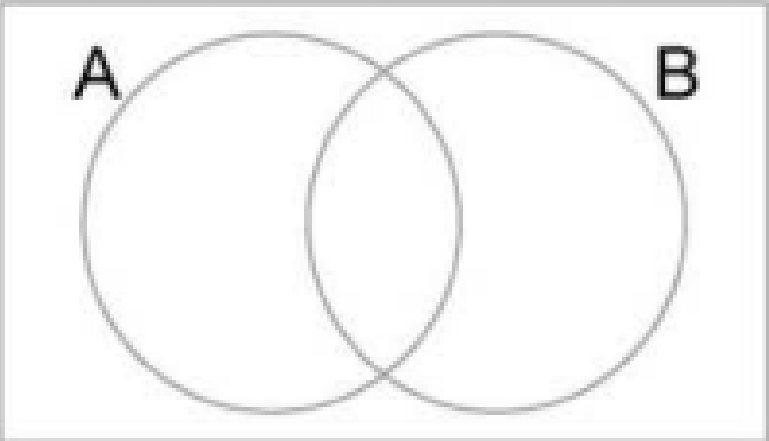
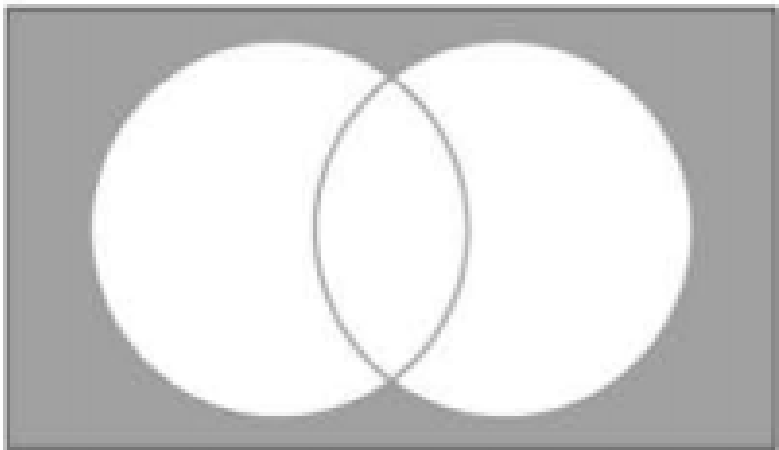
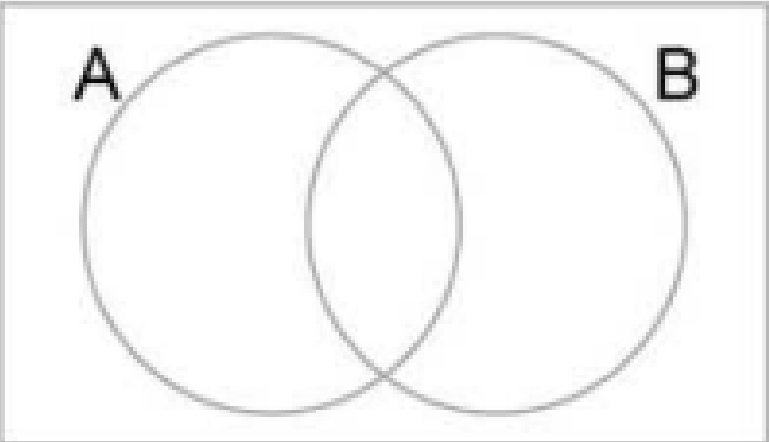
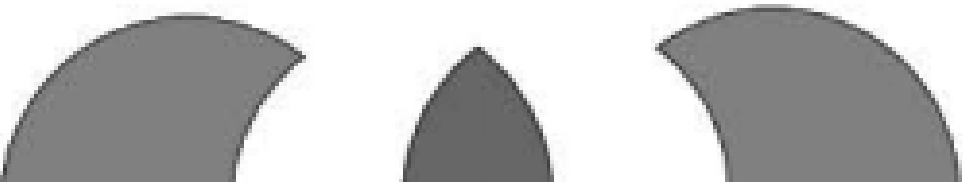
Question 2 (9 marks)



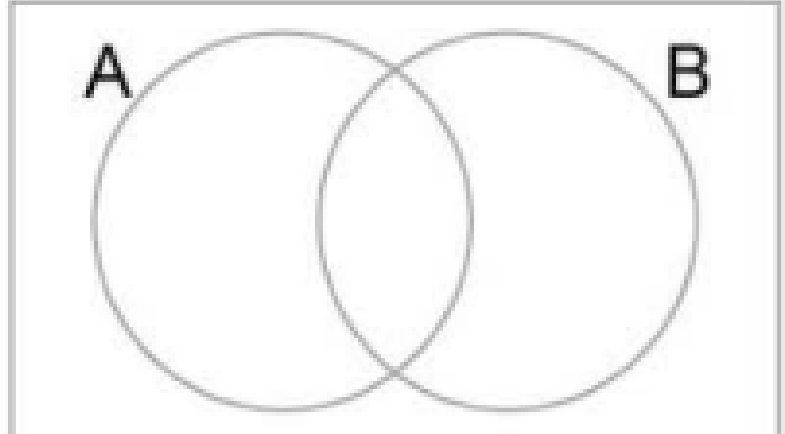
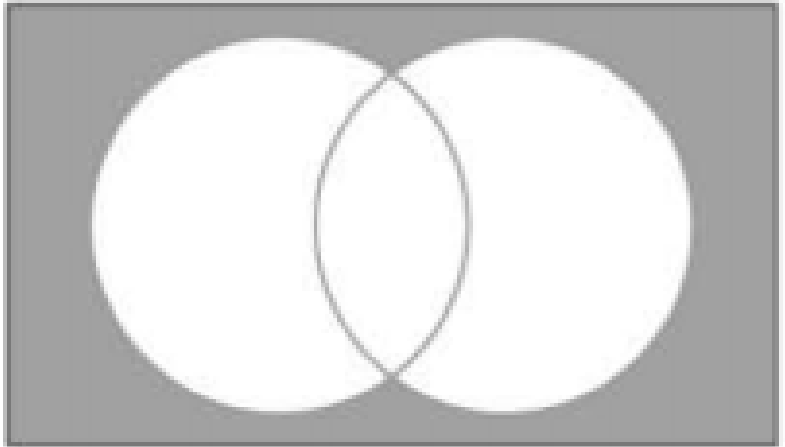
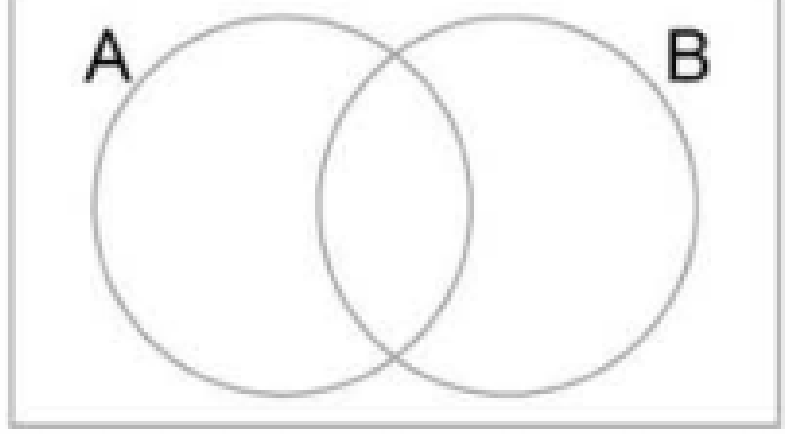
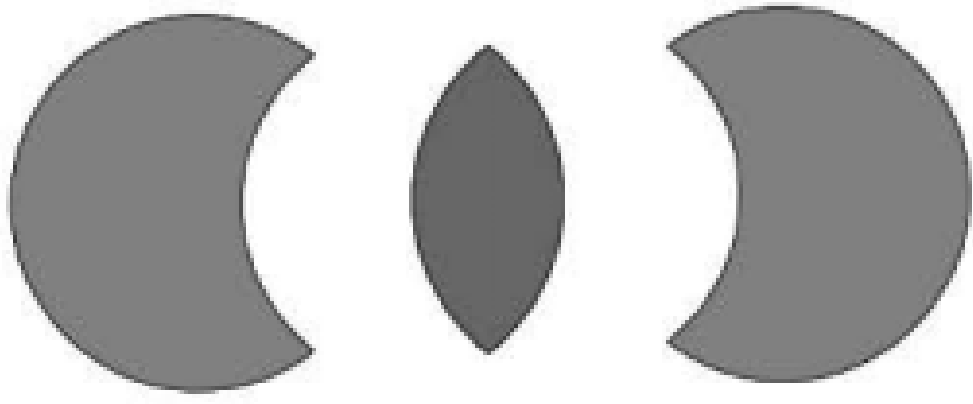
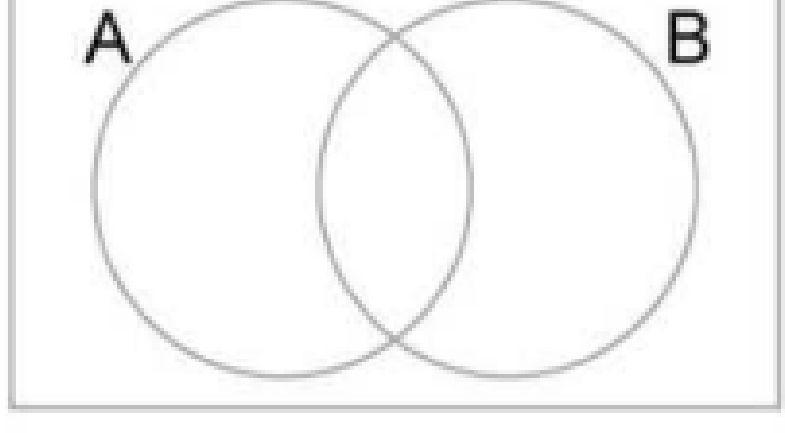
Question 2a (3 marks)

The two sets, A and B, are intersecting as seen in the Venn diagram below.

Select the shading(s) that represent the sets in the Venn diagrams below.

		   
Set	Venn diagram	Draggable shading
(i) $A'$		
(ii) $A' \cap B$		

Select the shading(s) that represent the sets in the Venn diagrams below.

Set	Venn diagram	Draggable shading
(i) $A'$		
(ii) $A' \cap B$		
(iii) $A' \cup B$		

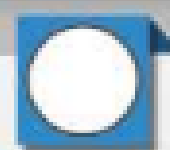
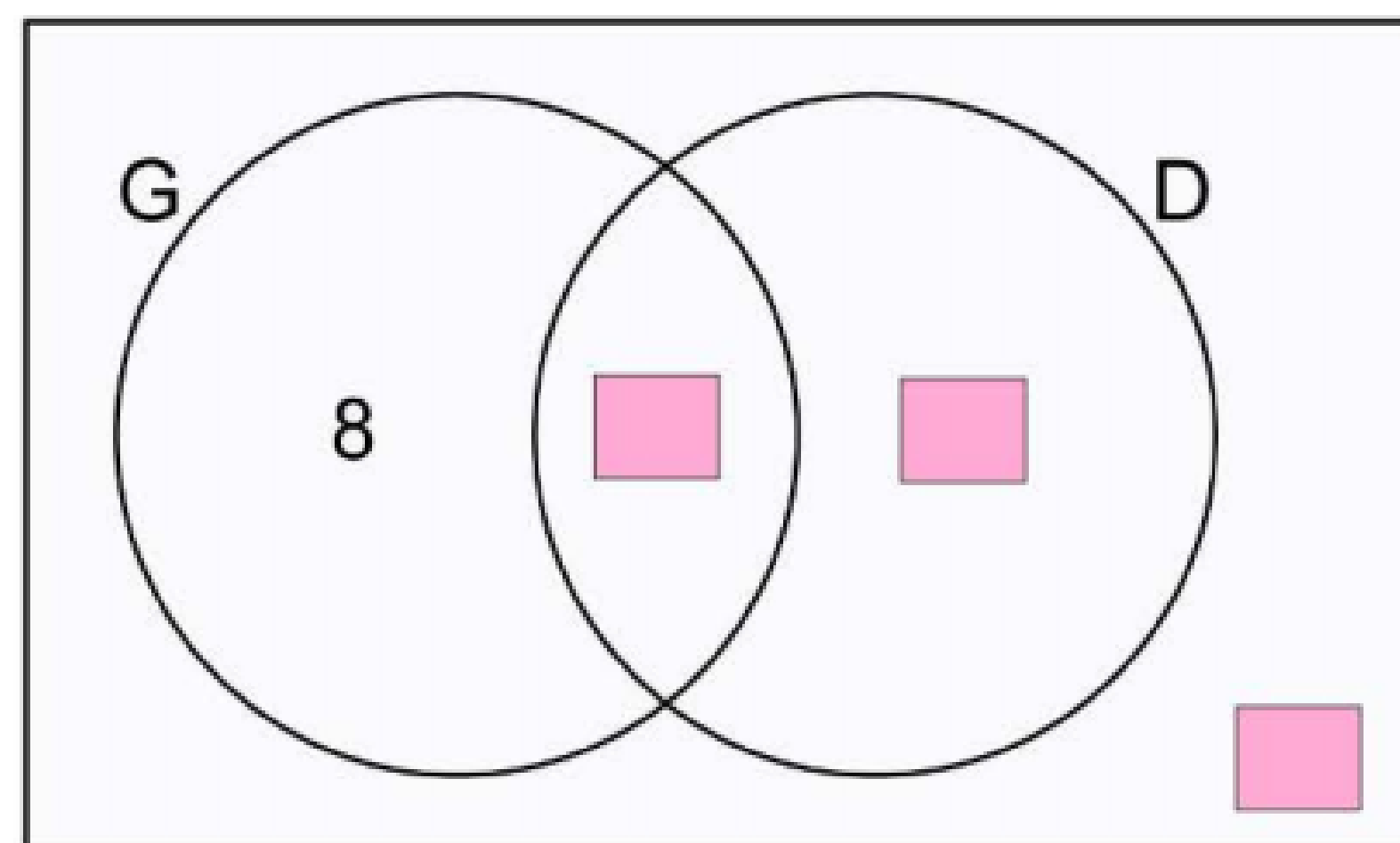


### Question 2b (2 marks)

There are 24 students in a class. Of these students:

- 15 play the guitar (G)
- 12 play the drums (D)
- 4 play neither.

**Determine** the missing values in the Venn diagram below.

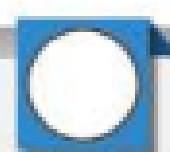


### Question 2c (1 mark)

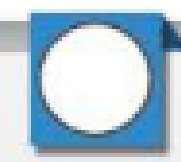
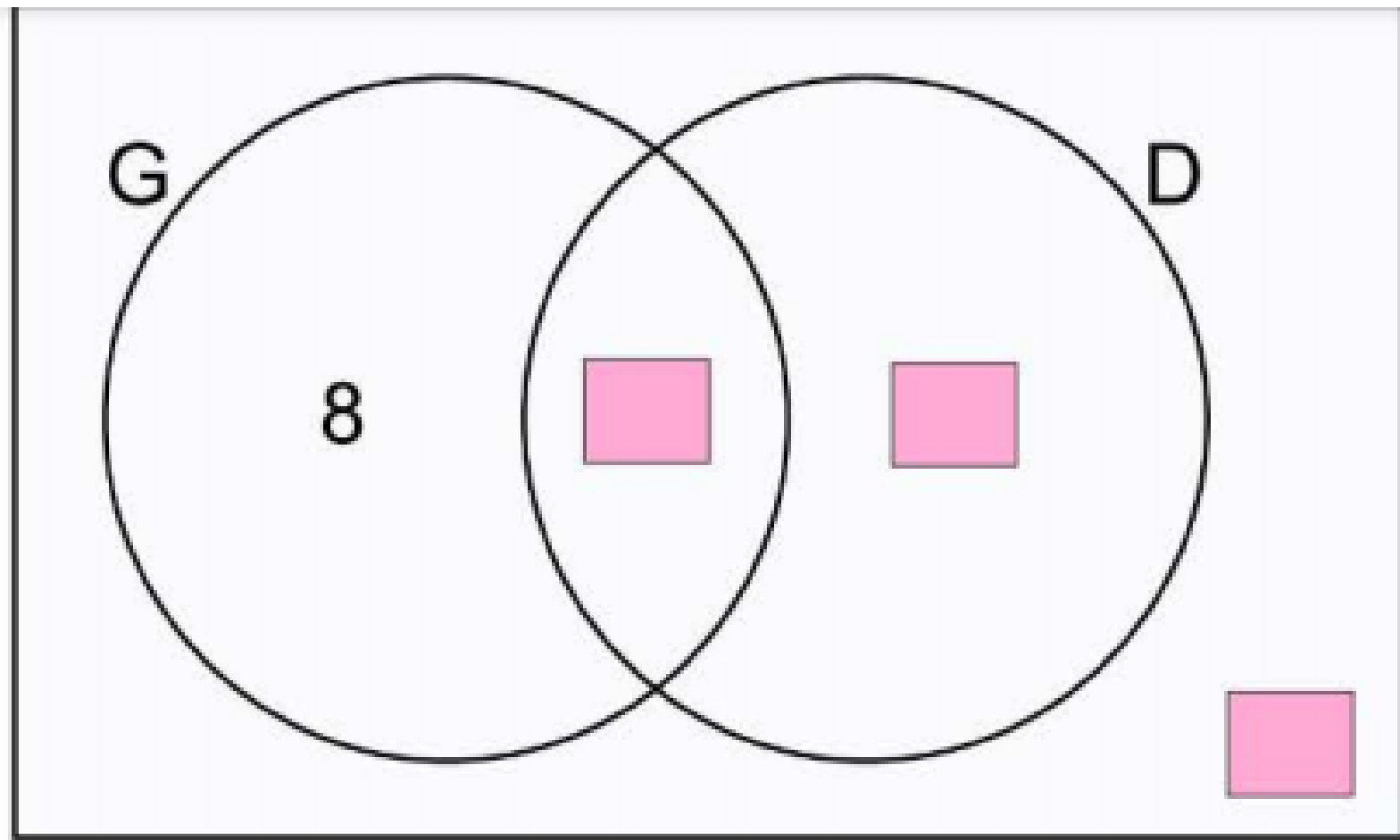
A student is selected at random.

**Determine** the probability that this student plays only one musical instrument.

Rich text editor toolbar with buttons for Bold (B), Italic (I), Undo, Redo, Underline (U), Subscript ( $x_2$ ), Superscript ( $x^2$ ), Bulleted List, Numbered List, Omega ( $\Omega$ ), and Sum ( $\Sigma$ ). Below the toolbar is a text input area with a "Styles" dropdown menu and a "Send" icon.



### Question 2d (3 marks)



### Question 2d (3 marks)



Three students are selected at random.  
**Determine** the probability that the three students do not play any musical instruments.

**B**

*I*



U

$x_0$

$x^2$

$\therefore$

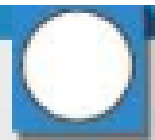
$\therefore$

$\Omega$

$\Sigma$

Styles





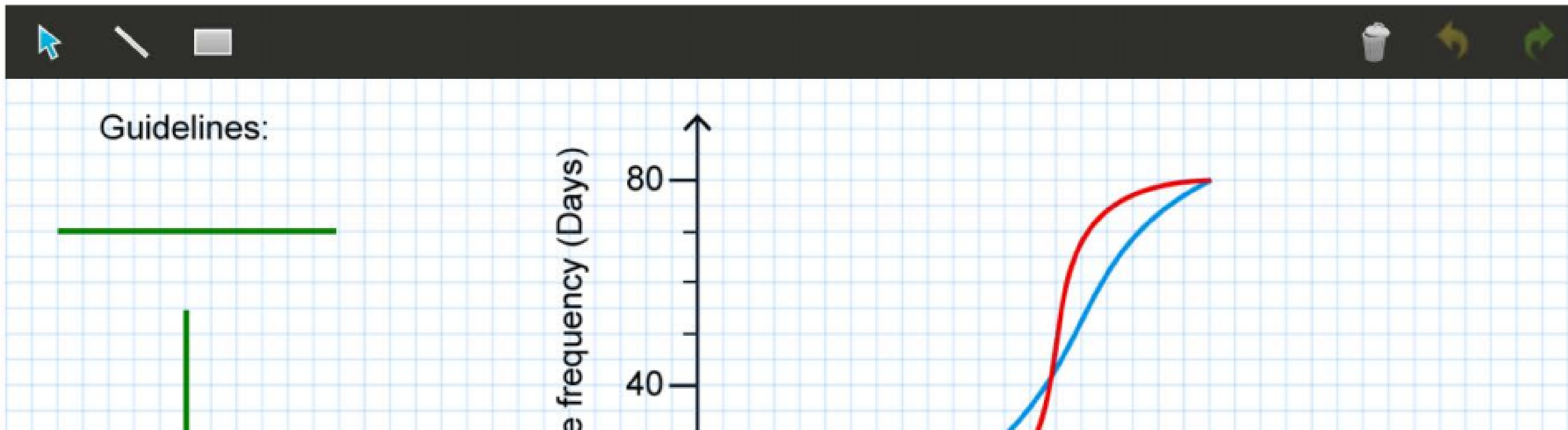
### Question 3 (4 marks)

Aaron is comparing the rainfall for the first 80 days in 2021 and in 2022. The graph below shows two cumulative frequency curves for the rainfall in 2021 and in 2022.

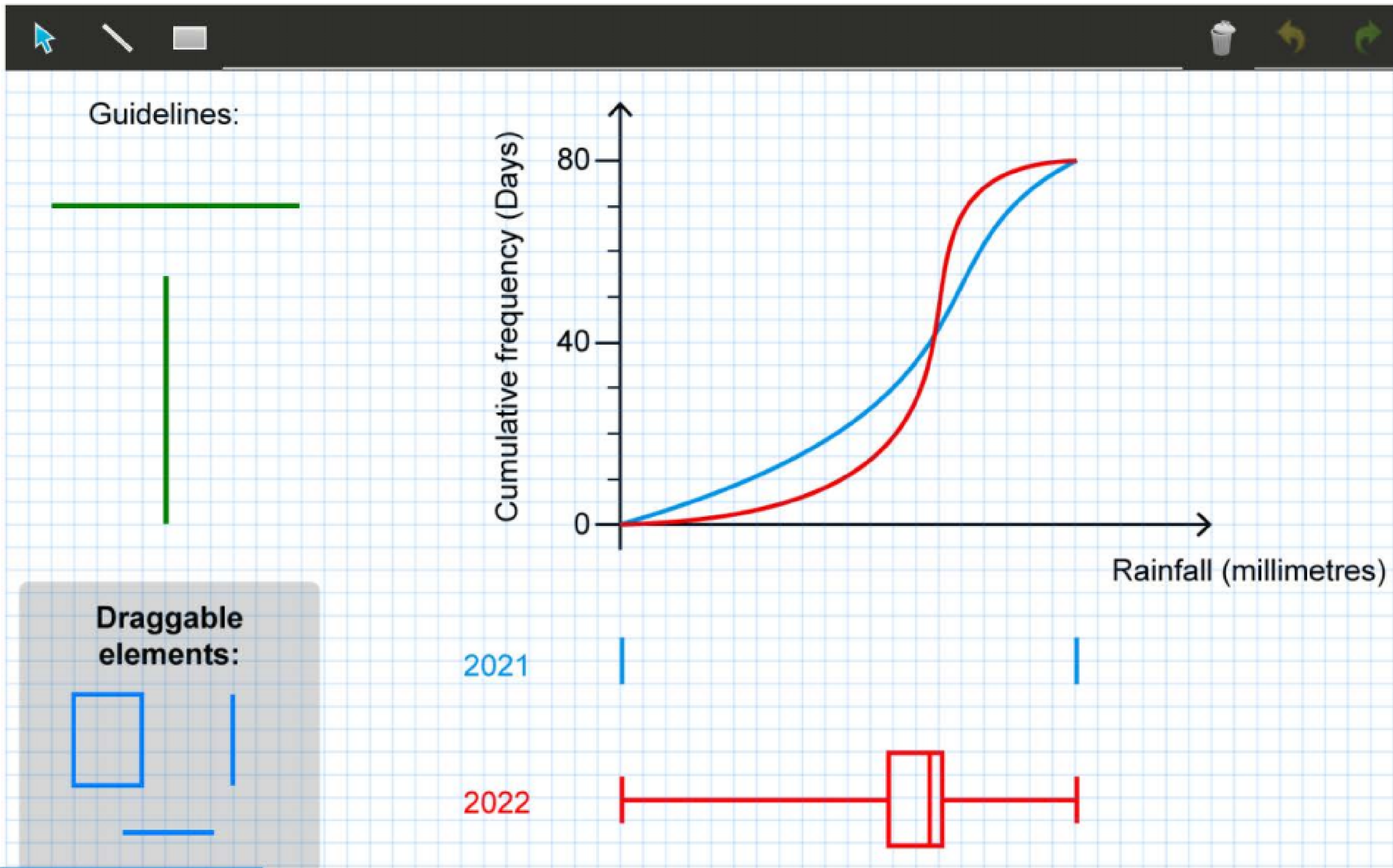


### Question 3a (2 marks)

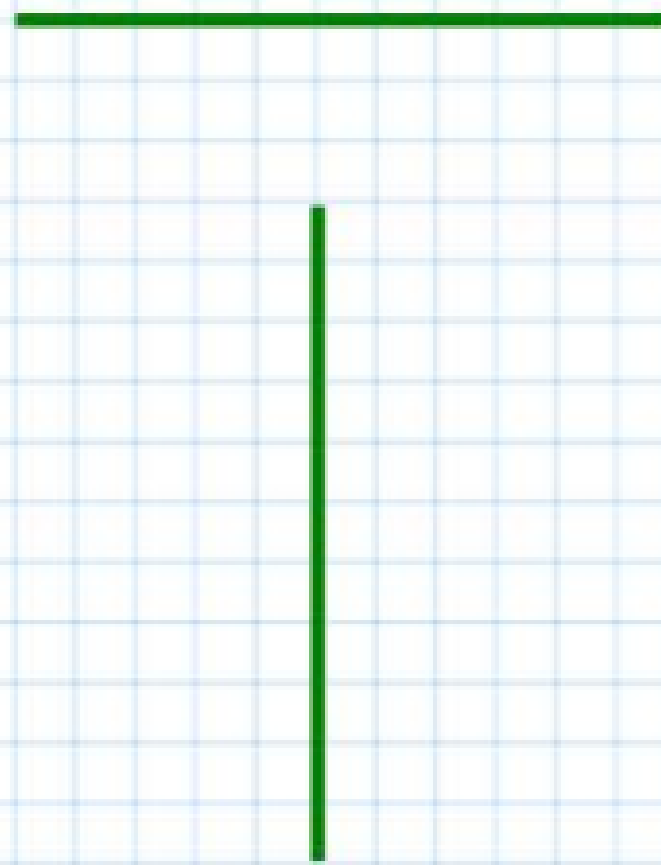
On the canvas below, **draw** the box-and-whisker plot for 2021.



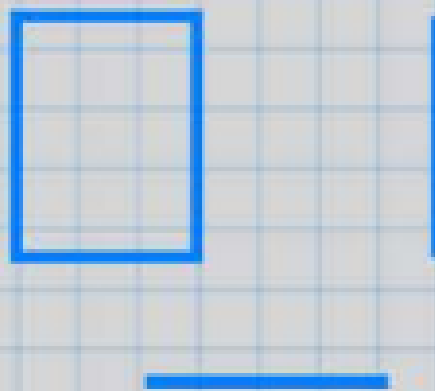
On the canvas below, **draw** the box-and-whisker plot for 2021.



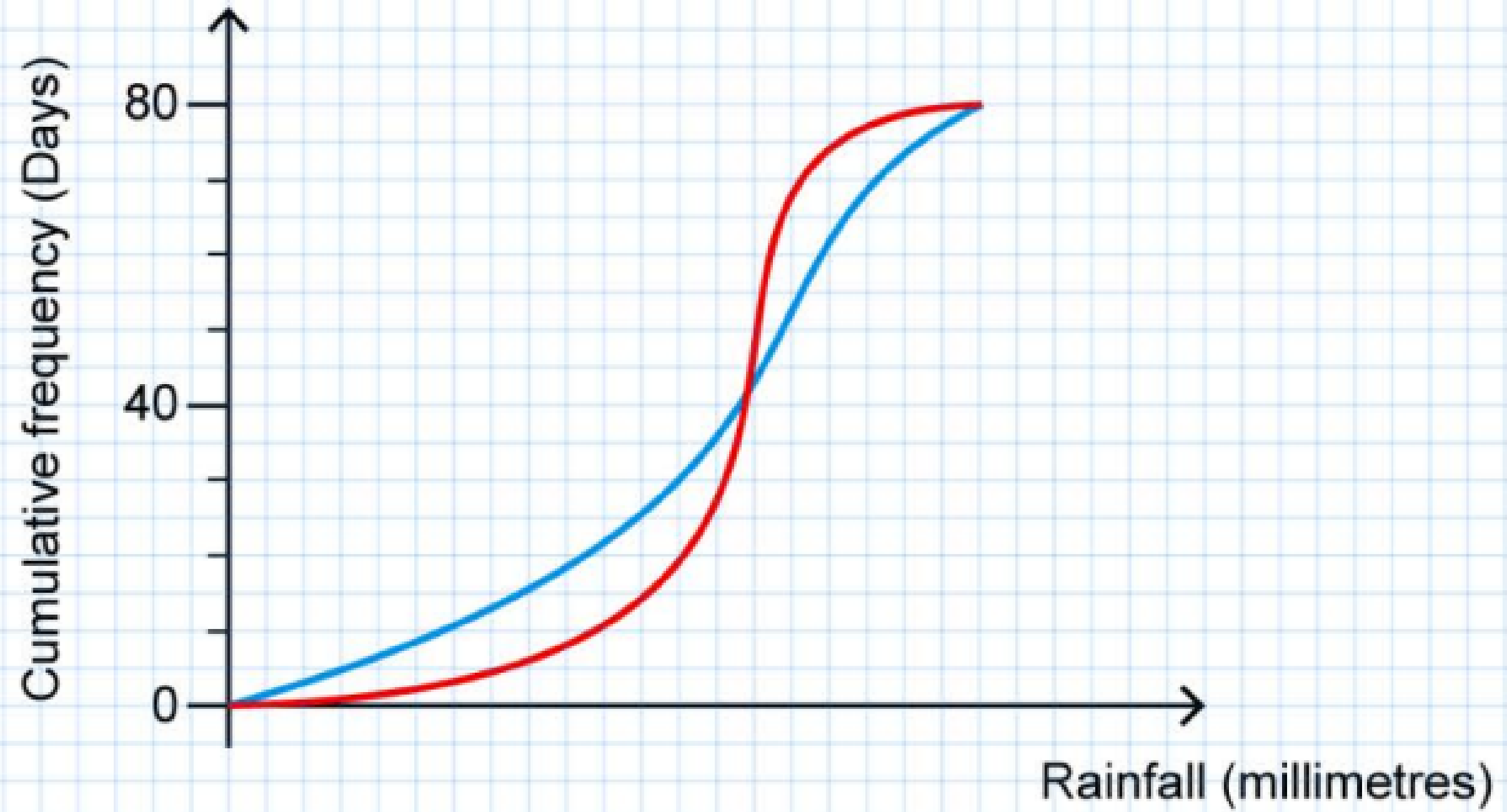
Guidelines:



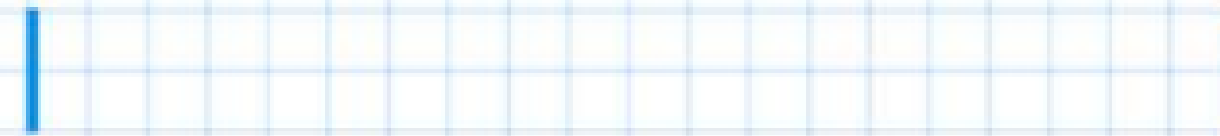
Draggable elements:



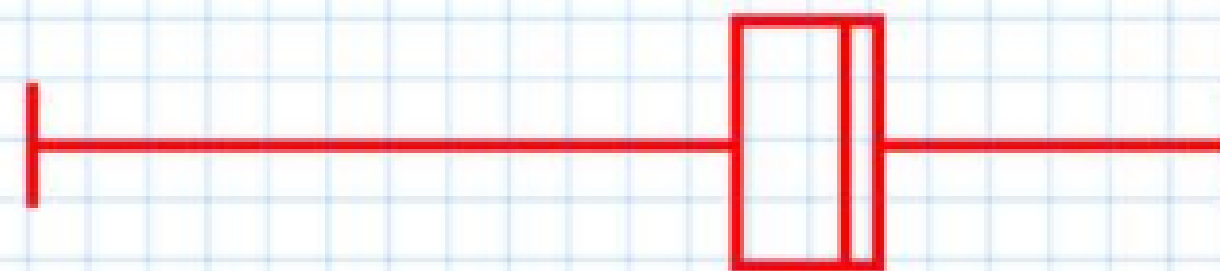
The draggable elements can be resized



2021



2022



Box-and-whisker plots for rainfall

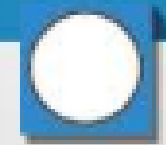


Question 3b (2 marks)

**Compare** the median and the interquartile range for the two distributions.

**B** *I* | ← → U  $x_2$   $x^2$   $\frac{1}{2}$   $\frac{3}{4}$   $\Omega$   $\Sigma$  Styles -

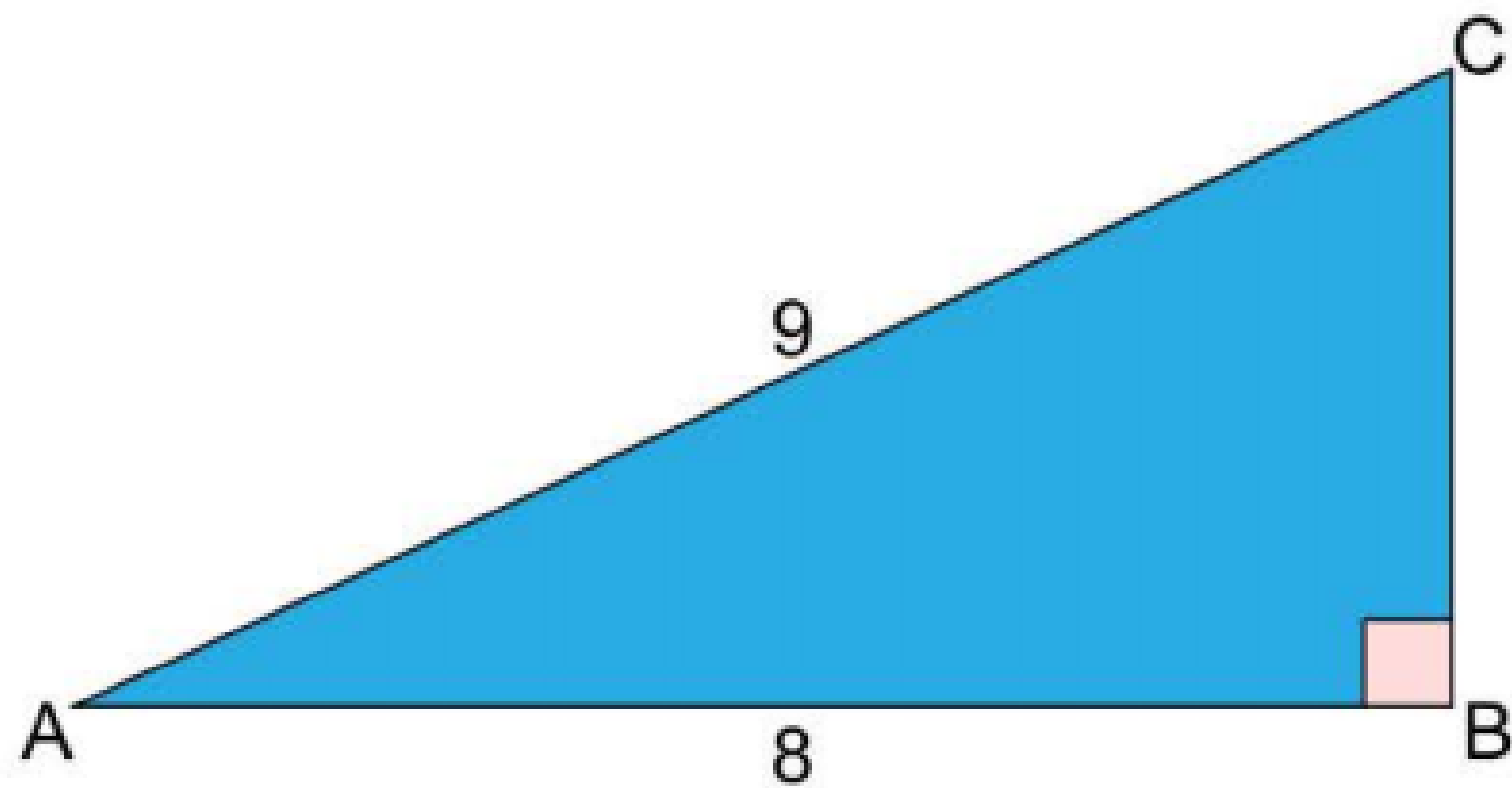




### Question 4 (9 marks)

The diagram shows the right-angled triangle ABC.

Diagram not to scale



### Question 4a (2 marks)

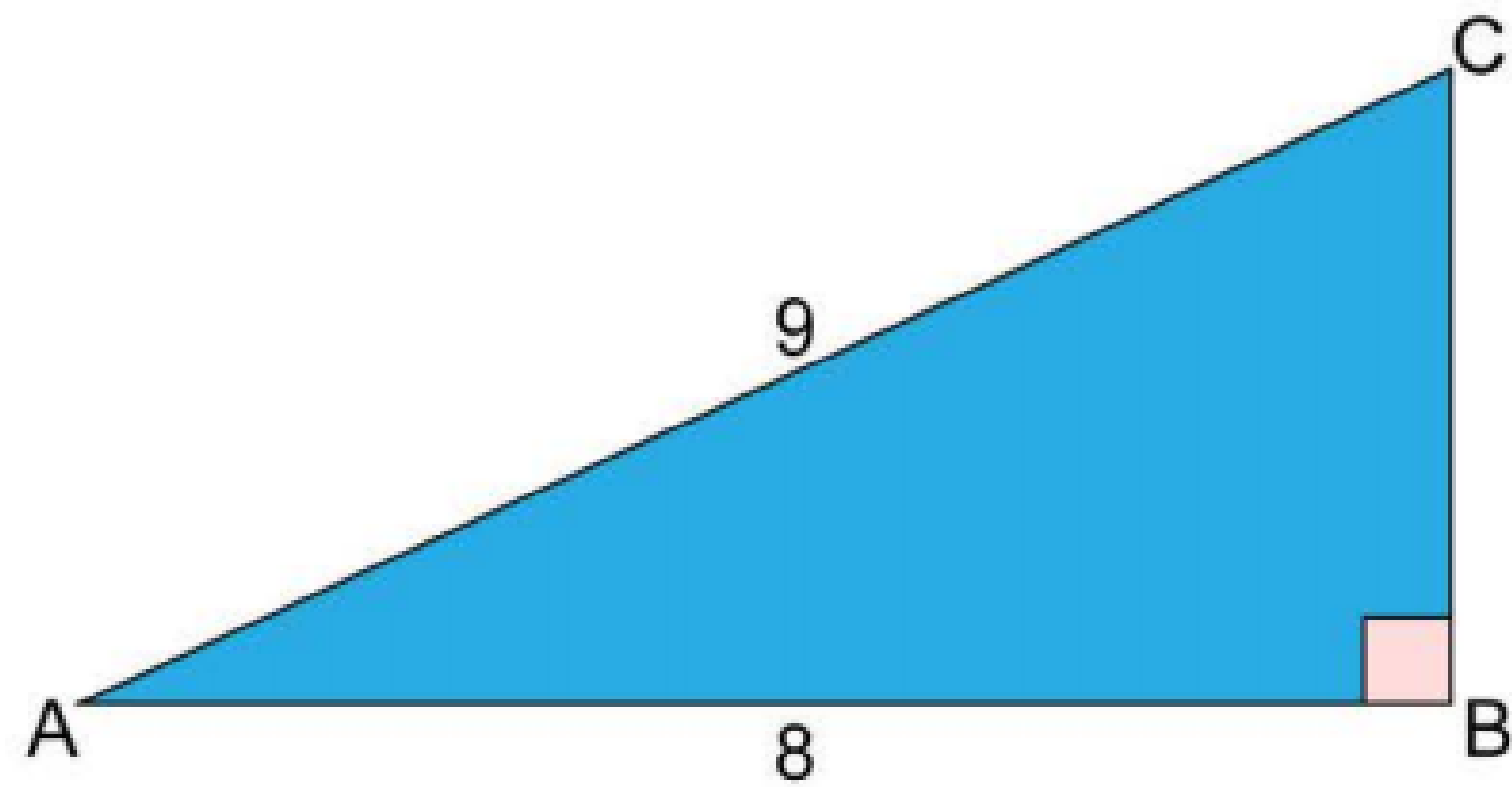
Show that  $BC = 4$  to the nearest unit.

Rich text editor toolbar with the following icons: Bold (B), Italic (I), Undo, Redo, Underline (U), Subscript ( $x_2$ ), Superscript ( $x^2$ ), Bulleted list, Numbered list, Insert link ( $\Omega$ ), and Insert table ( $\Sigma$ ). Below the toolbar is a text input area.



The diagram shows the right-angled triangle ABC.

Diagram not to scale



Question 4b (1 mark)

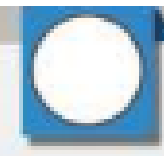
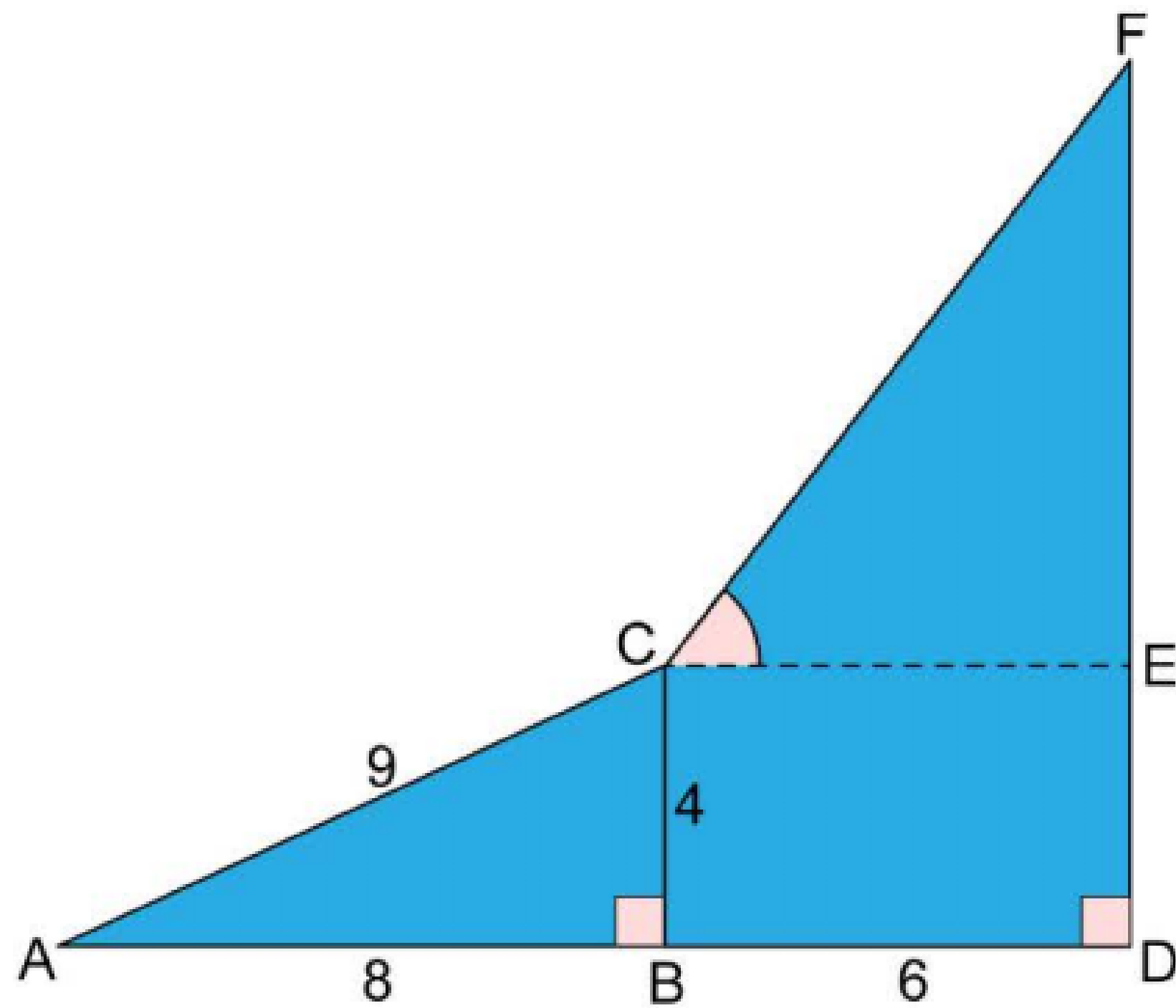
Hence, **determine** the area of the triangle ABC.

Rich text editor toolbar with buttons for Bold (B), Italic (I), Undo, Redo, Underline (U), Subscript ( $x_2$ ), Superscript ( $x^2$ ), Bulleted List, Numbered List, Link (Ω), and Unlink (Σ). Below the toolbar is a text input area with a "Styles" dropdown and a "Calculator" icon.



The line AB is extended and the trapezium BCFD is formed as shown in the diagram.

Diagram not to scale



#### Question 4c (1 mark)

The areas of trapezium BCFD and triangle ABC are in the ratio

area BCFD : area ABC

3 : 1

**Determine** the area of the trapezium BCFD.

**B**

**I**

←

→

U

$x_2$

$x^2$

$\frac{1}{2}$

$\frac{3}{4}$

$\Omega$

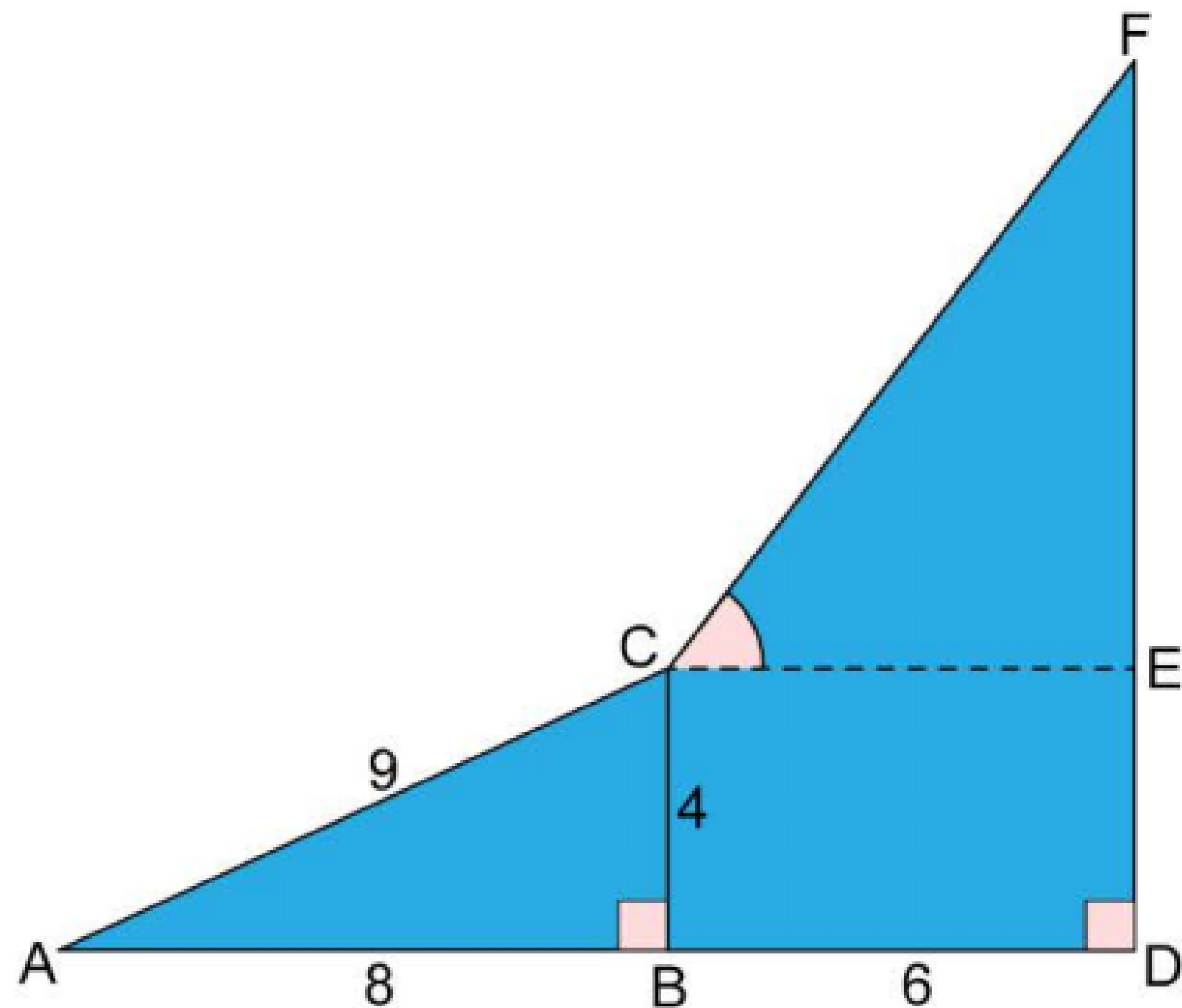
$\Sigma$

Styles



The line AB is extended and the trapezium BCFD is formed as shown in the diagram.

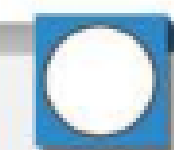
Diagram not to scale



Question 4d (2 marks)

Determine FD.

Rich text editor toolbar with buttons for Bold (B), Italic (I), Undo, Redo, Underline (U), Subscript ( $x_2$ ), Superscript ( $x^2$ ), Bulleted List, Numbered List, Link ( $\Omega$ ), and Unlink ( $\Sigma$ ). A Styles dropdown menu and a document icon are also present.

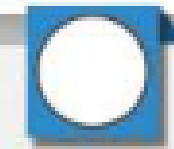
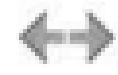
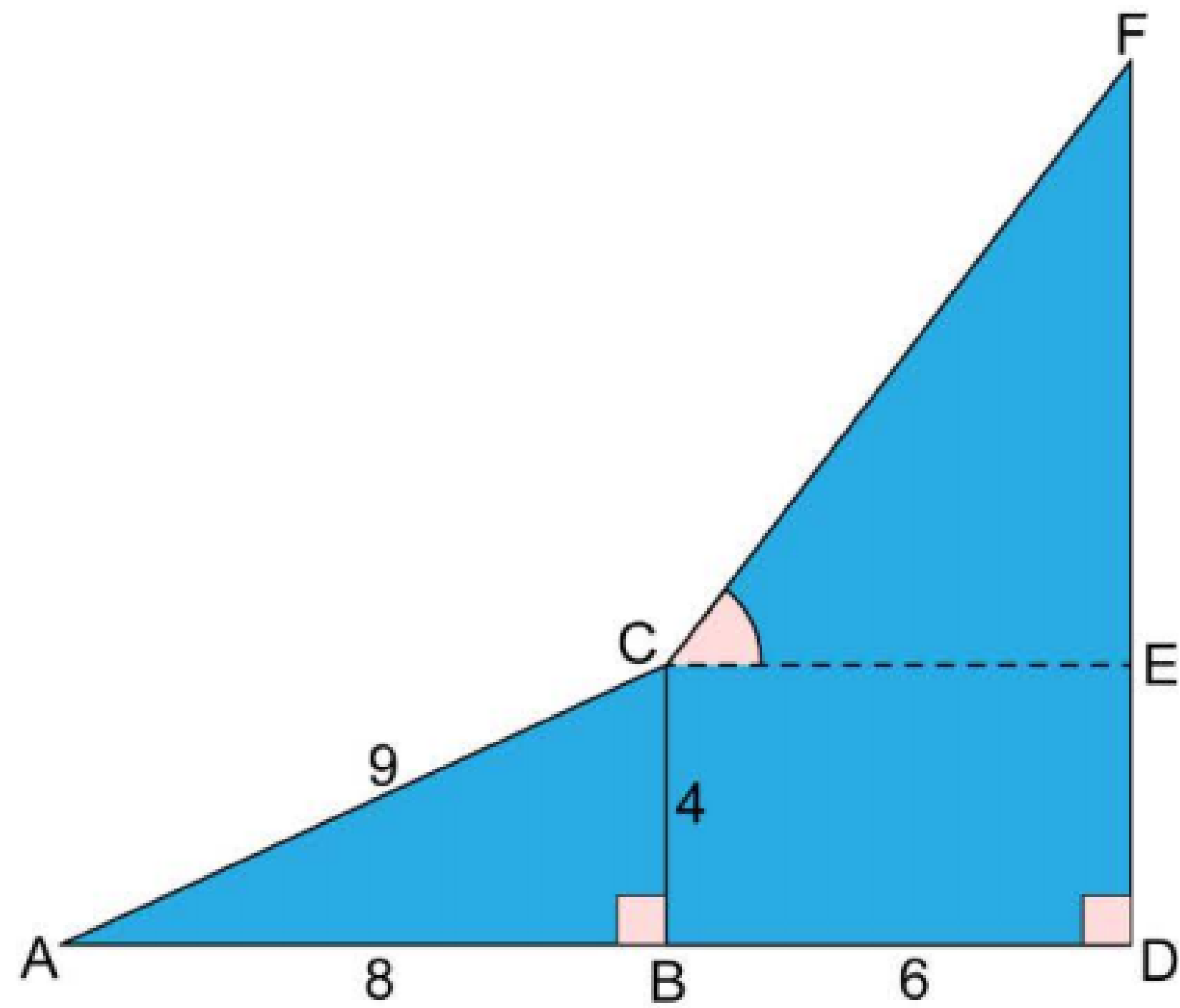


Question 4e (3 marks)

Find the size of the angle FCE

The line AB is extended and the trapezium BCFD is formed as shown in the diagram.

Diagram not to scale



Question 4e (3 marks)

Find the size of the angle  $FCE$ .

**B**

**I**



U

$x_2$

$x^2$

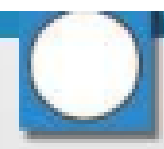


$\Omega$

$\Sigma$

Styles



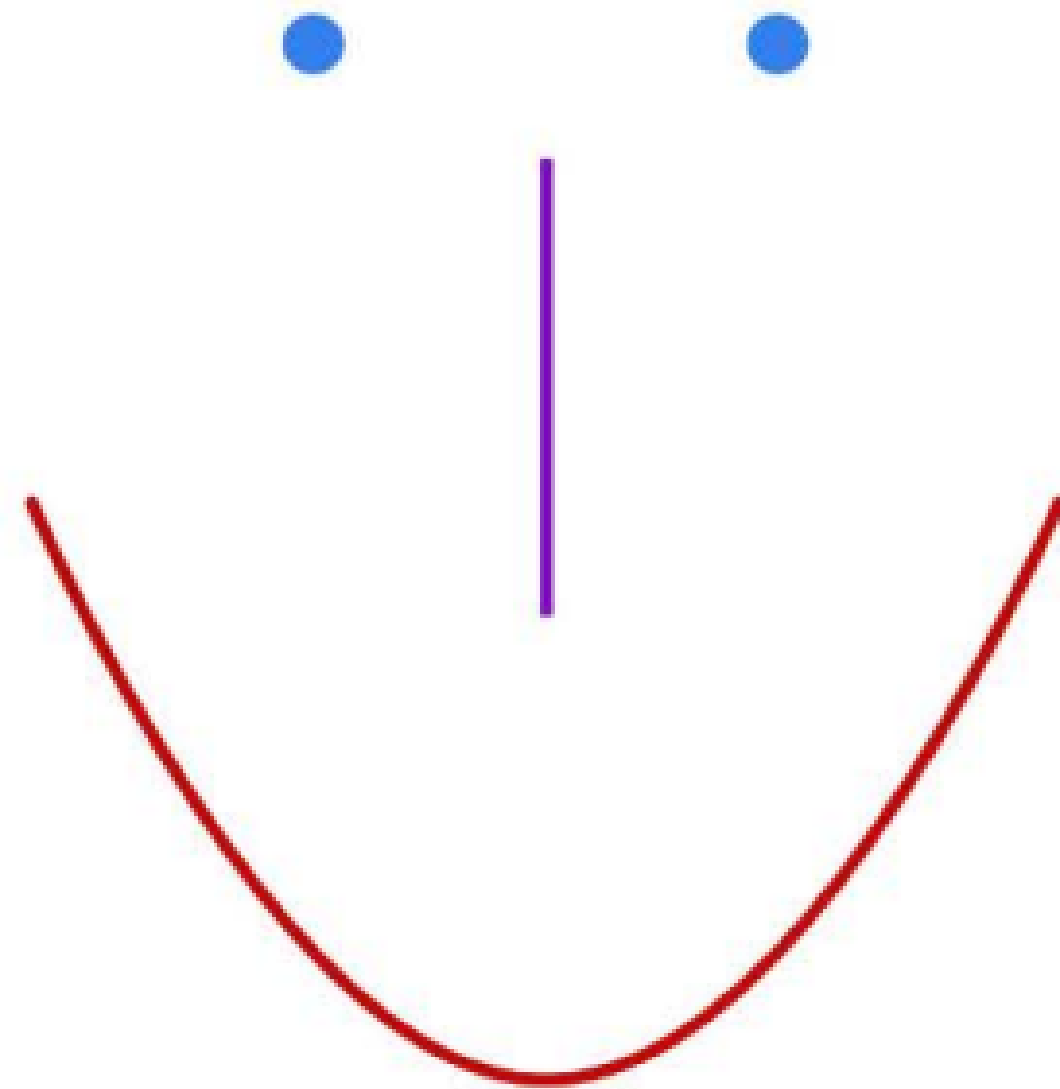


Question 5 (9 marks)

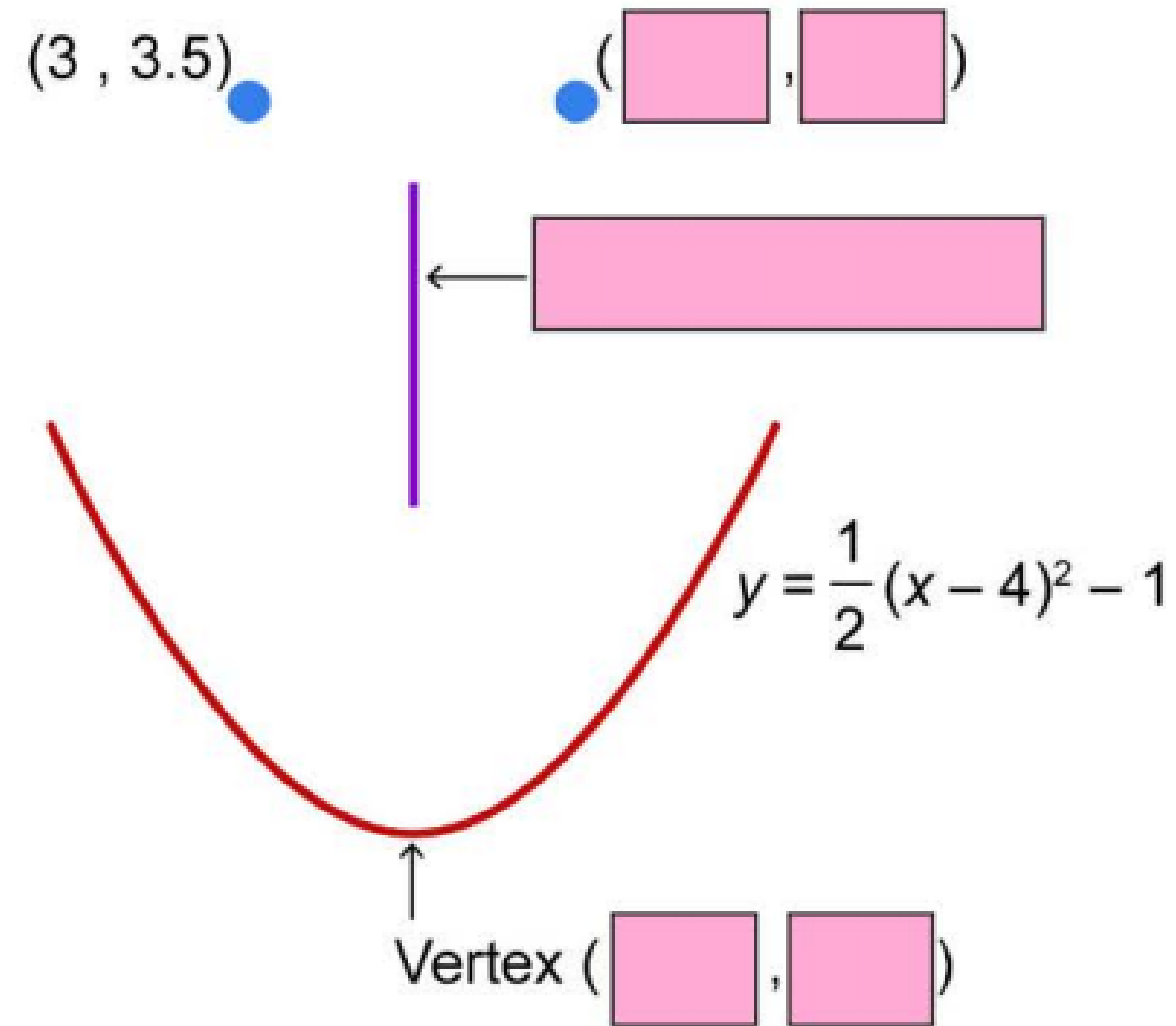


Question 5a (3 marks)

A **symmetrical** smiley face is plotted using two points, a line, and a parabola.



**Determine** the missing coordinates and the equation of the line.





Question 5b (2 marks)

By expanding the brackets, **show that**  $y = \frac{1}{2}(x - 4)^2 - 1$  can be written as

$$y = \frac{1}{2}x^2 - 4x + 7.$$

**B**

**I**



U

$x_2$

$x^2$

$\frac{1}{2}$

$\frac{3}{4}$

$\Omega$

$\Sigma$

Styles



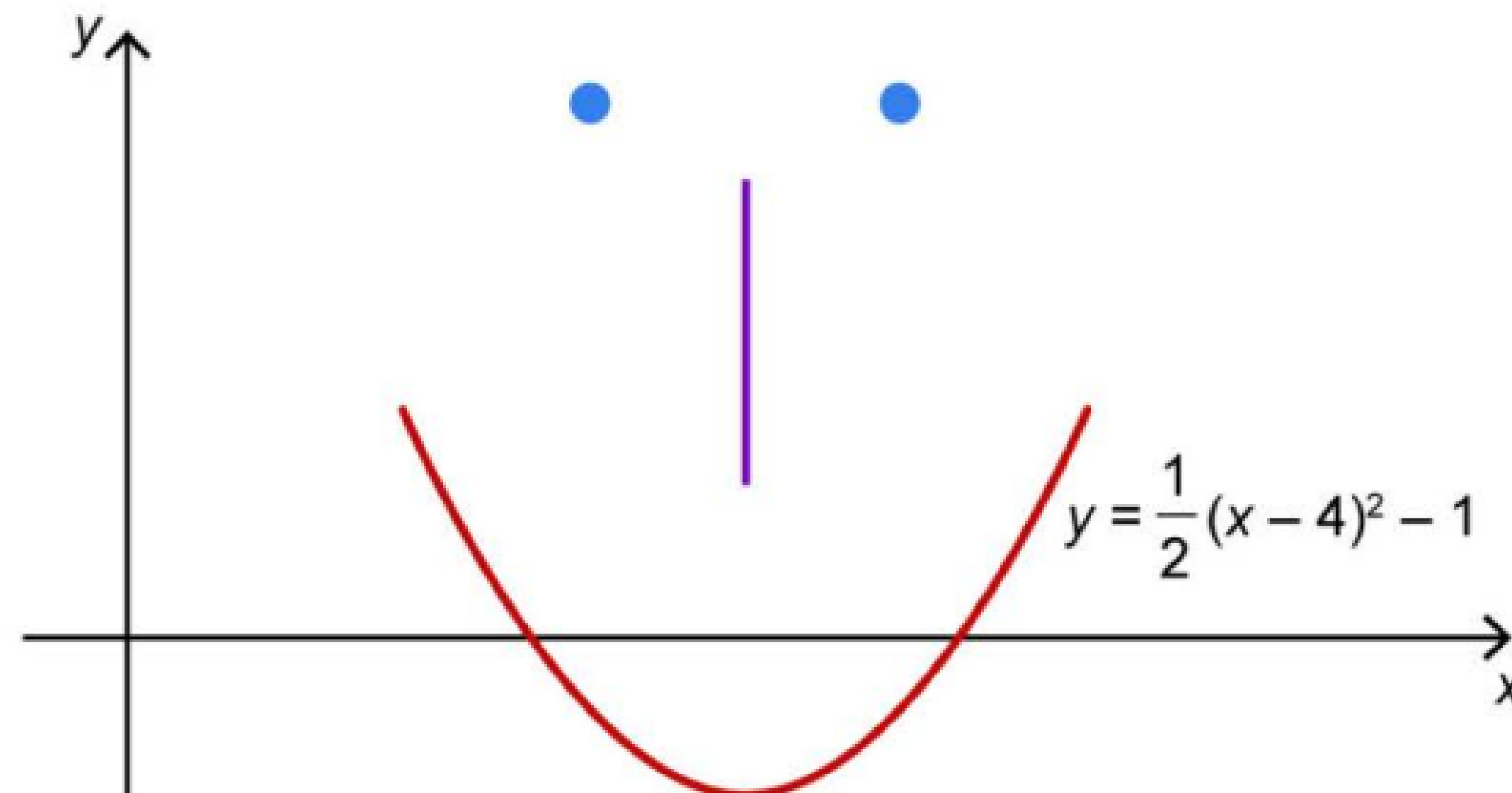


Question 5c (4 marks)

**Calculate** the coordinates of the  $x$ -intercepts of the parabola


$$y = \frac{1}{2}(x - 4)^2 - 1.$$

Give your answer to the nearest one decimal place.



Question 6 (9 marks)

The city council have decided to improve the road safety for cyclists. A survey was conducted to determine the type of cycle facility that the community would like to see built. The result is shown below.

	A shared cycle path with pedestrians	A road with cycle lanes	A road with separated cycle paths
Type of cycle facility	 An illustration of a road with a red car on the left. A yellow double line separates the car lane from a shared path. On the shared path, there are white markings for a pedestrian and a cyclist. A person is walking and a cyclist is riding. A blue circular sign with a white bicycle and a white pedestrian symbol is on the right.		
Number of votes	40	1180	1620

Type of cycle facility	A shared cycle path with pedestrians	A road with cycle lanes	A road with separated cycle paths
Number of votes	40	1180	1620

A shared cycle path with pedestrians

A road with cycle lanes

A road with separated cycle paths

Type of cycle facility



Number of votes

40

1180

1620



Question 6a (2 marks)

The city council will build the type of cycle facility that receives more than 55 % of the total number of votes.

**Show that** the city council will build “a road with separated cycle paths”.

**B**

*I*



U

$x_2$

$x^2$



$\Omega$

$\Sigma$

Styles

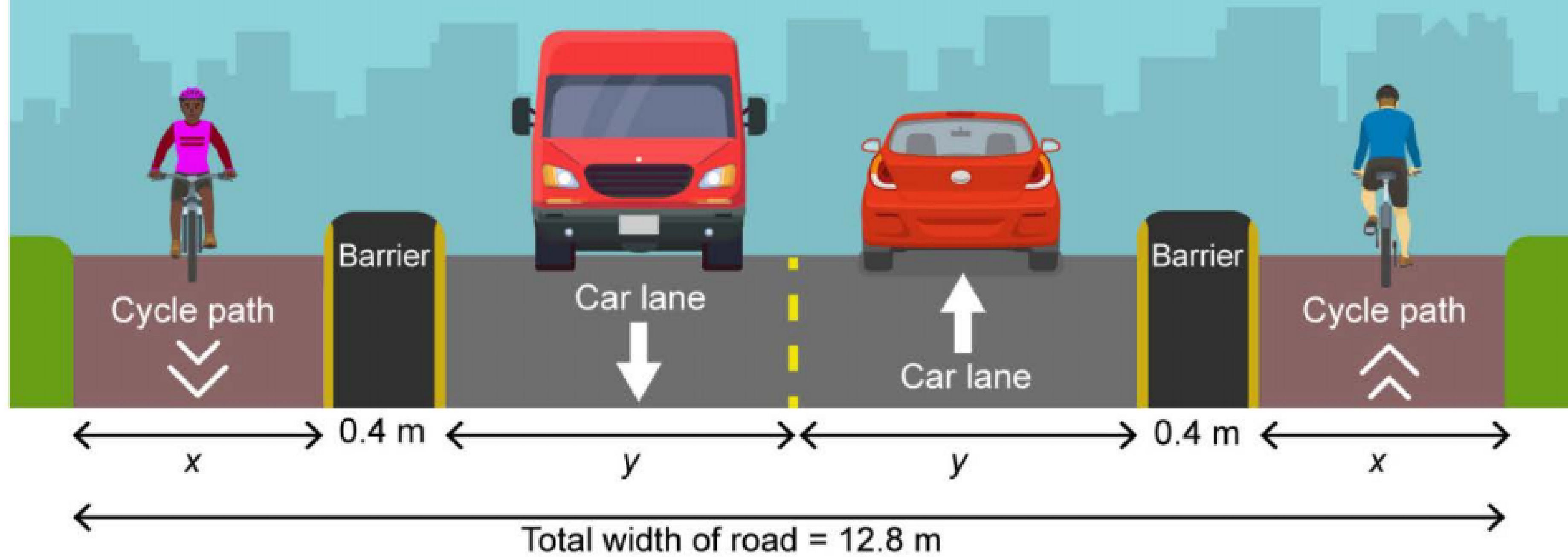


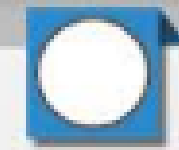
**Key:**

$x$  = width of one cycle path, in metres (m)

$y$  = width of one car lane, in metres (m)

Diagram not to scale



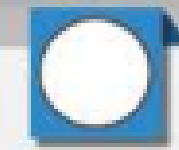


### Question 6b (1 mark)

Using the information given in the diagram, **show that**  $y = 6 - x$ .

**B** *I* | ← → |  x<sub>2</sub> x<sup>2</sup>  | ≡ ≡≡ | Ω Σ

Styles ▾ | 📄 ↕

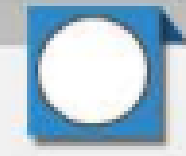


### Question 6c (3 marks)

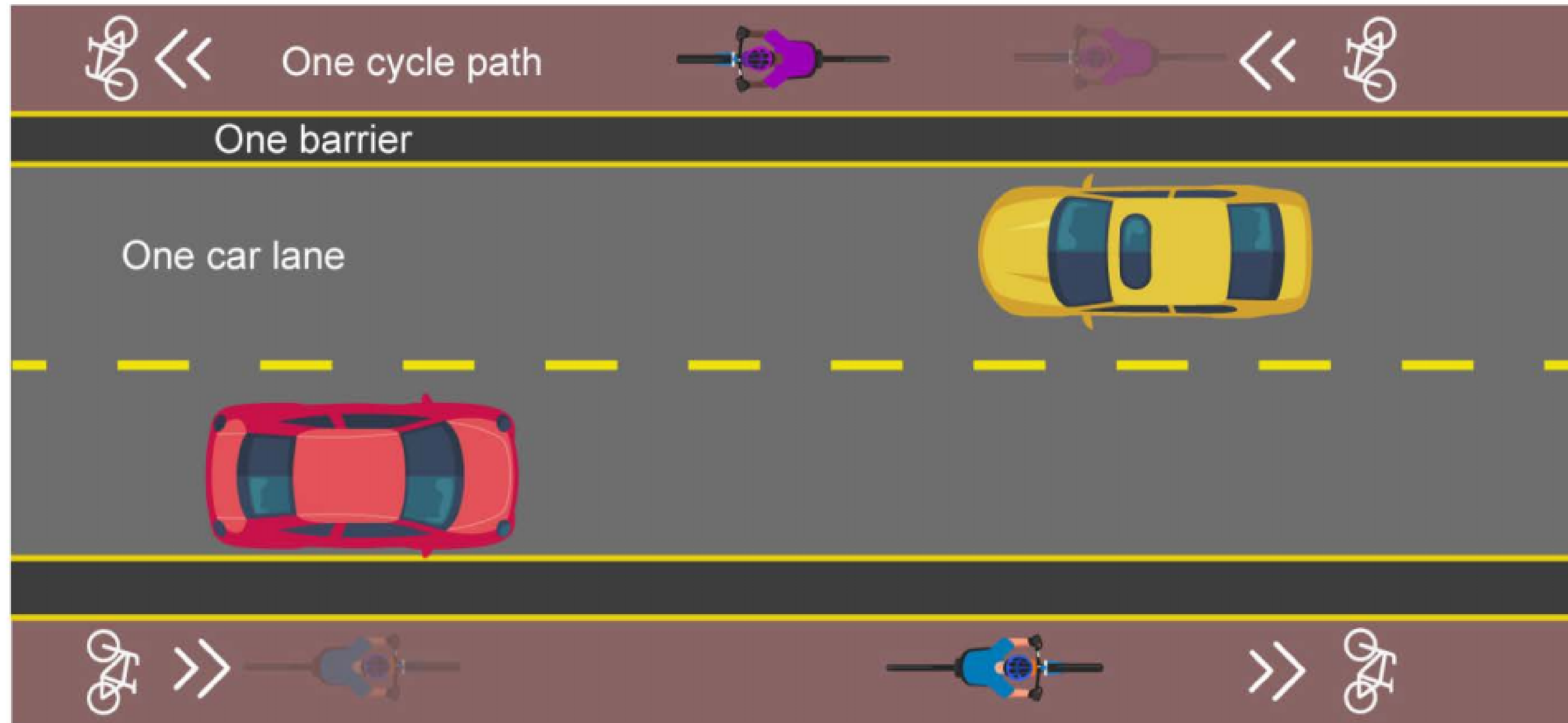
Given that  $y = \frac{3}{2}x$  and  $y = 6 - x$ , **find** the value of  $x$  and the value of  $y$ .

**B** *I* | ← → |  x<sub>2</sub> x<sup>2</sup>  | ≡ ≡≡ | Ω Σ

Styles ▾ | 📄 ↕



Question 6d (3 marks)



The plan is to construct a **3 km long** road with separated cycle paths. The cost to construct each part of the road is listed in the table below.

Item	Cost
One cycle path	\$0.6 million per kilometre (km)
One barrier	\$115 per metre (m)
One car lane	\$3.1 million per kilometre (km)

**Calculate** the total cost to construct the road.

**B** *I* ← → U  $x_2$   $x^e$  ☰ ☷ Ω Σ

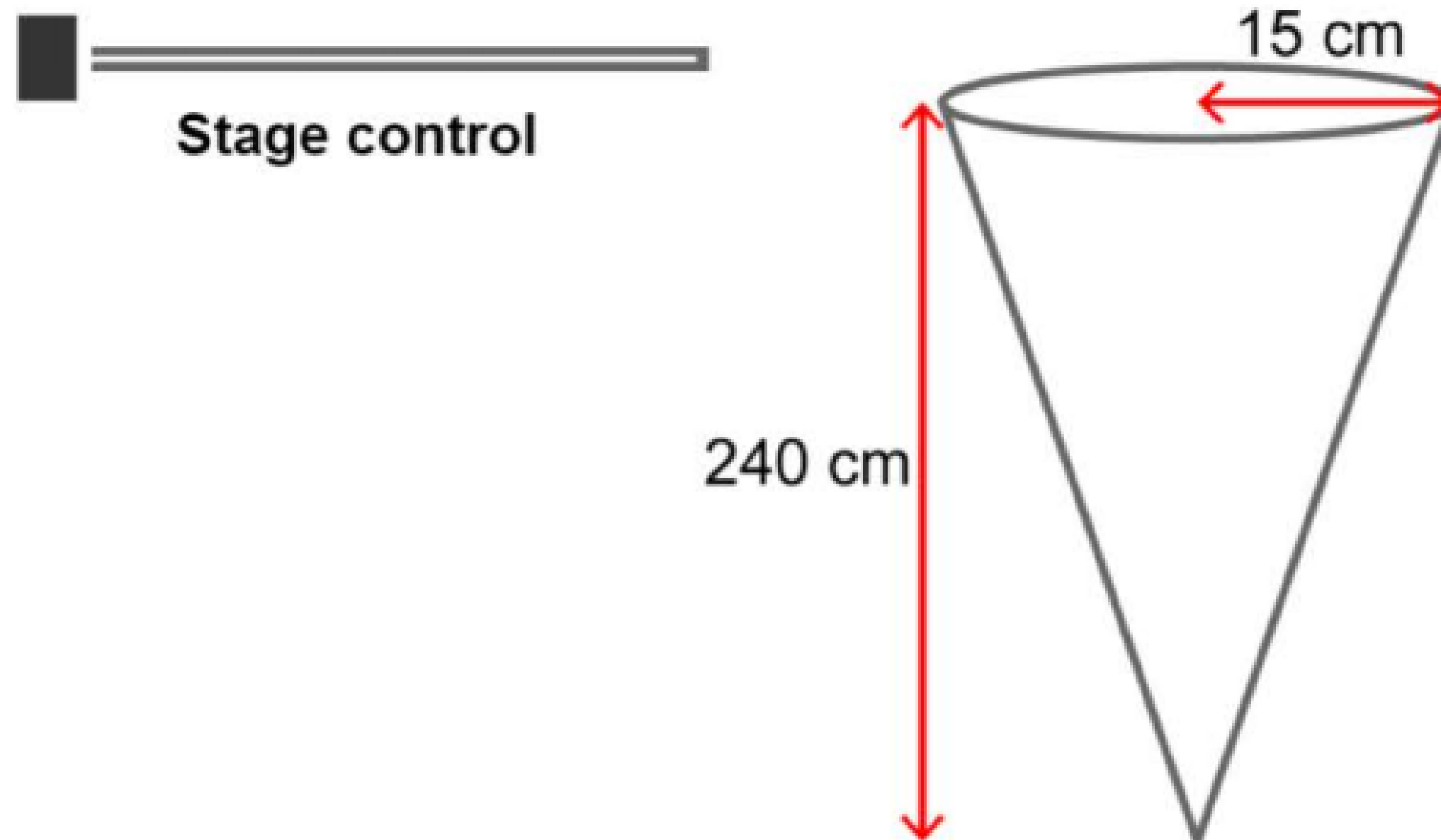
Styles ▾ 📱



**Question 7** (22 marks)

In this question you will make calculations to help a community design a rooftop garden to grow tomato plants.

Tomato plants are grown in a pot. A pot is a truncated cone. Interact with the simulation to reveal how a pot is formed.

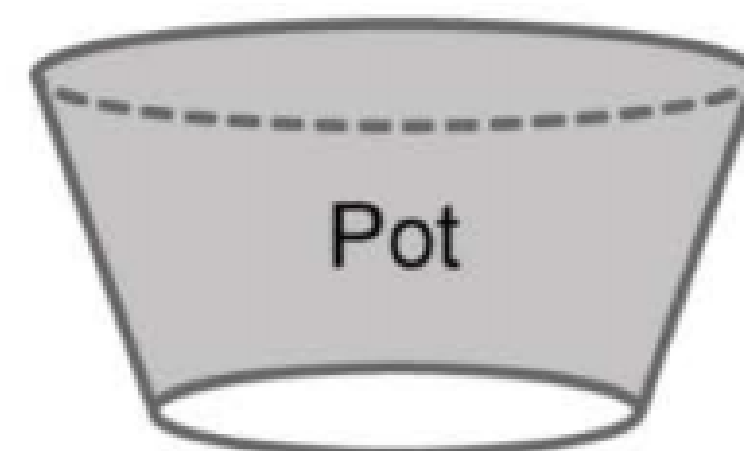




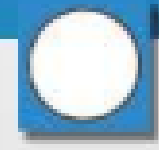
### Question 7 (22 marks)

In this question you will make calculations to help a community design a rooftop garden to grow tomato plants.

Tomato plants are grown in a pot. A pot is a truncated cone. Interact with the simulation to reveal how a pot is formed.



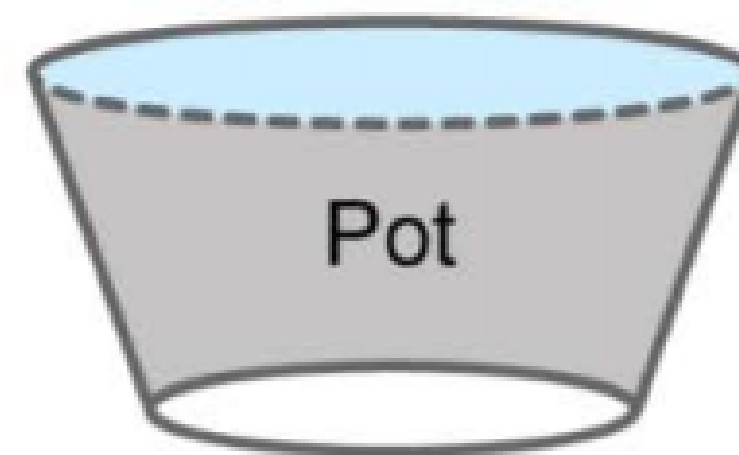
Removed cone  
Volume =  $32\,720\text{ cm}^3$



### Question 7 (22 marks)

In this question you will make calculations to help a community design a rooftop garden to grow tomato plants.

Tomato plants are grown in a pot. A pot is a truncated cone. Interact with the simulation to reveal how a pot is formed.



Volume of pot?



Question 7a (4 marks)

**Calculate** the volume of the pot. Give your answer to the nearest 10 cm<sup>3</sup>.

**B** *I* | ← → U  $x_2$   $x^2$  | ☰ ☷ | Ω Σ | Styles ▾ | 📄 ↕

Cost of items	
1 tomato plant	\$6.00
1 Litre (L) soil	\$0.40
1 empty pot	\$1.50

$1 \text{ cm}^3 = 1 \text{ mL}$

### Question 7b (2 marks)

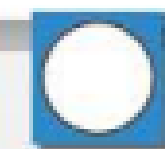
Pots will be filled with soil up to 90 % of maximum capacity. **Determine** the volume in litres (L) of soil needed for one pot.

**B** *I* ← → U  $x_2$   $x^2$   $\frac{1}{x}$   $\frac{1}{x^2}$   $\Omega$   $\Sigma$

Styles ▾ 

Cost of items	
1 tomato plant	\$6.00
1 Litre (L) soil	\$0.40
1 empty pot	\$1.50

$1 \text{ cm}^3 = 1 \text{ mL}$



### Question 7c (2 marks)

**Determine** the total cost to grow one tomato plant in a pot.

**B** *I* ← → U  $x_2$   $x^2$   $\frac{1}{2}$   $\frac{3}{4}$   $\Omega$   $\Sigma$

Styles ▾

[Video](#)

[Script](#)

This community will grow their tomato plants in pots in a rooftop garden.

Each plant should have space around the pot for the plant to grow and for people to walk in between.

This circular shape represents the space required for each plant.

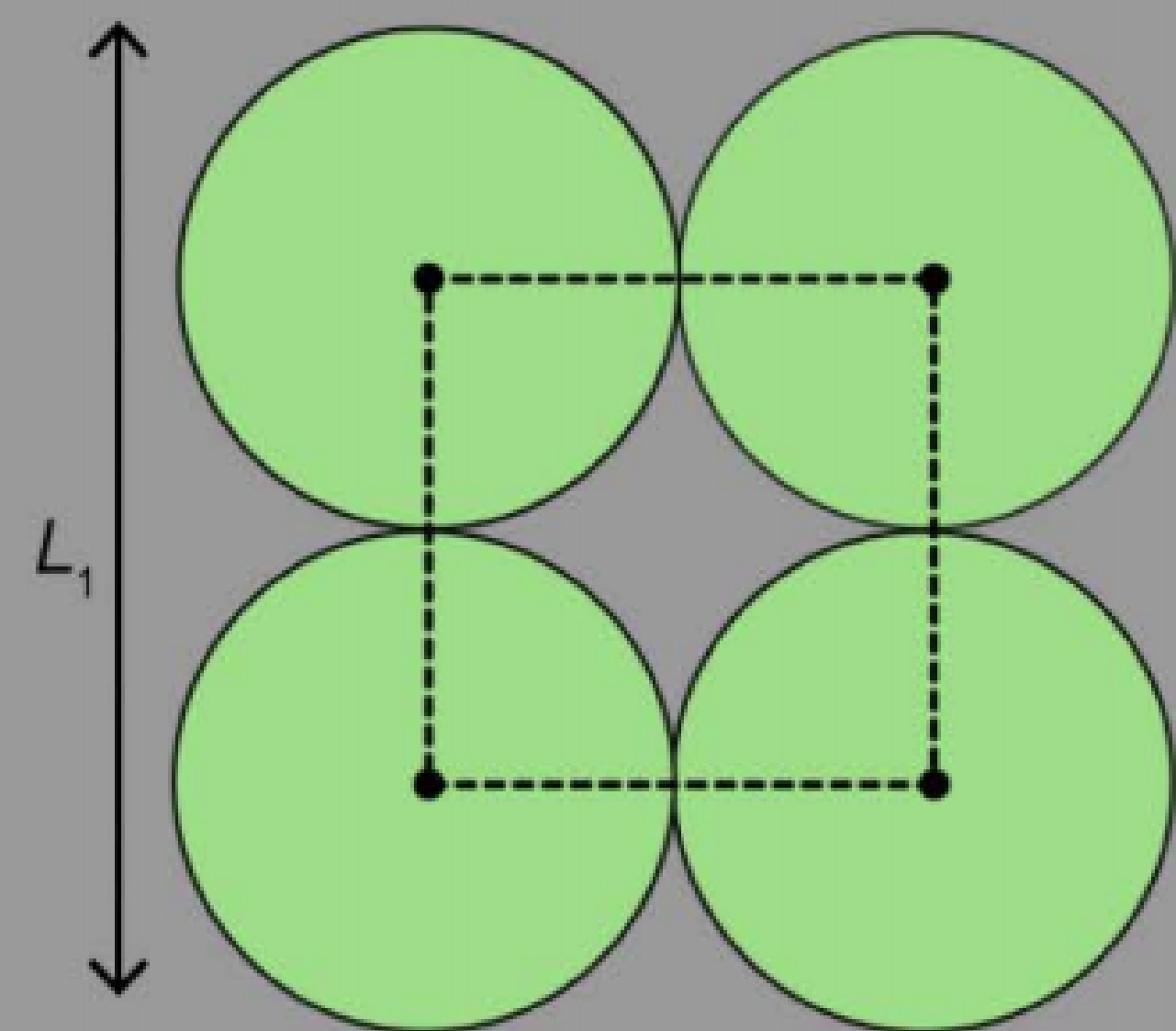
The circular shapes can be arranged in different ways to make best use of the space available in the garden.

Here is a square arrangement and here is a triangular arrangement.

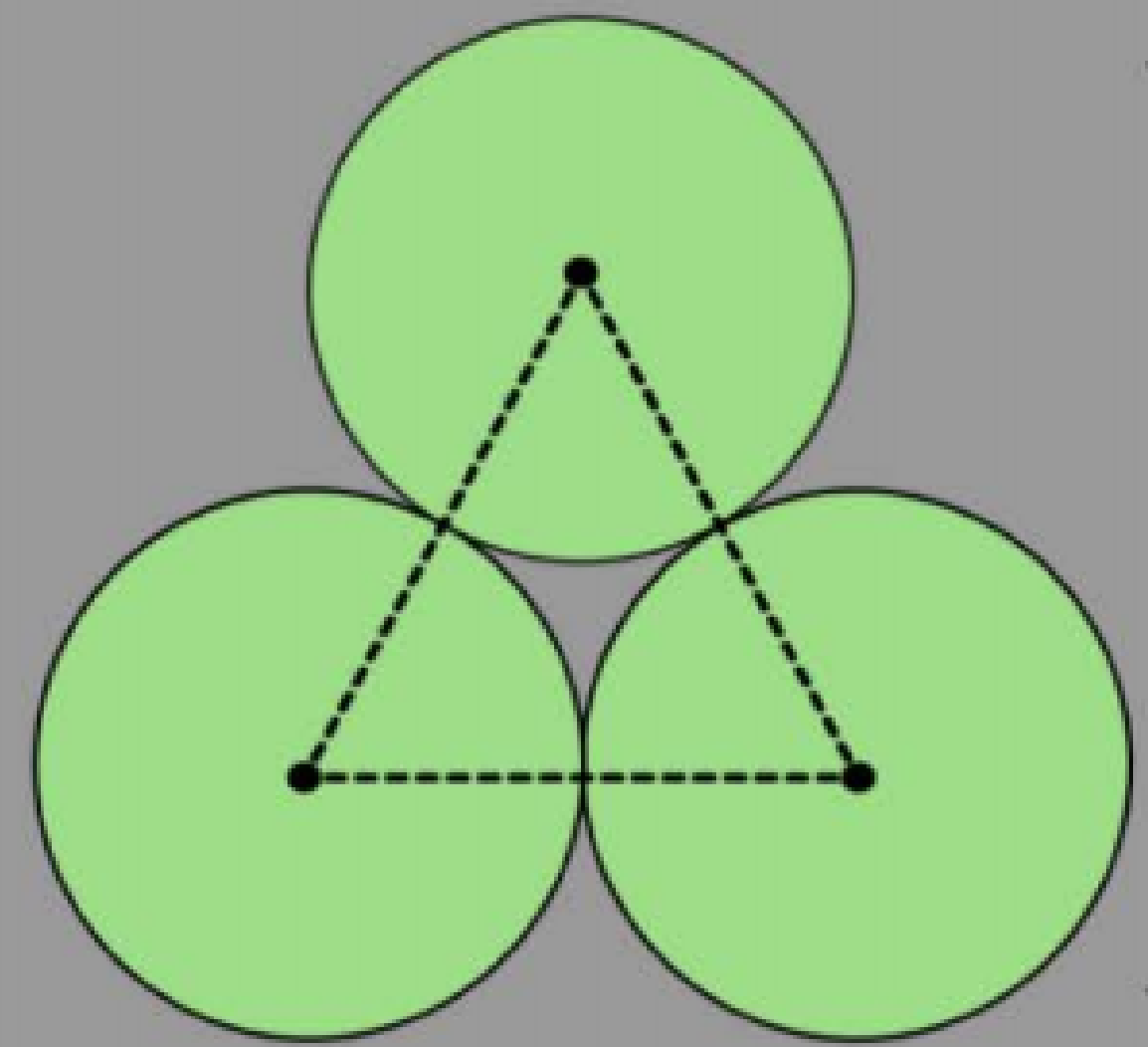
In the following questions, you will make calculations to make the best use of the space available.



Question 7d (1 mark)

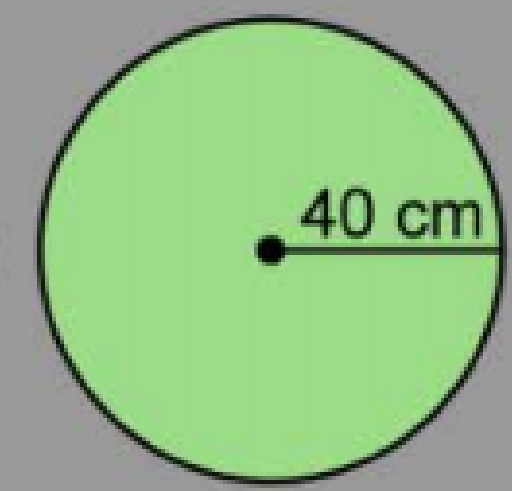


Square arrangement



Triangular arrangement

Key:





### Question 7d (1 mark)

**Determine** the length of  $L_1$  for the square arrangement.

**B** *I* | ← → U  $x_2$   $x^e$   $\frac{1}{2} =$   $:=$   $\Omega$   $\Sigma$

Styles ▾



### Question 7e (3 marks)

**Find** the length of  $L_2$  for the triangular arrangement.

**B** *I* | ← → U  $x_2$   $x^e$   $\frac{1}{2} =$   $:=$   $\Omega$   $\Sigma$

Styles ▾



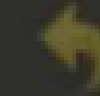


### Question 7f (10 marks)

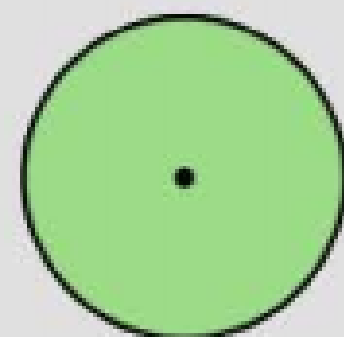
**Design** a rooftop garden to grow the tomato plants. Your design should make best use of all the rooftop garden space to grow as many tomato plants as possible.

In your answer you should:

- identify **three** relevant factors for your design
- show calculations for your design
- show your design on the canvas
- calculate the cost to a sensible degree of accuracy (using your result in part (c))
- justify whether your results make sense in the context of the question.

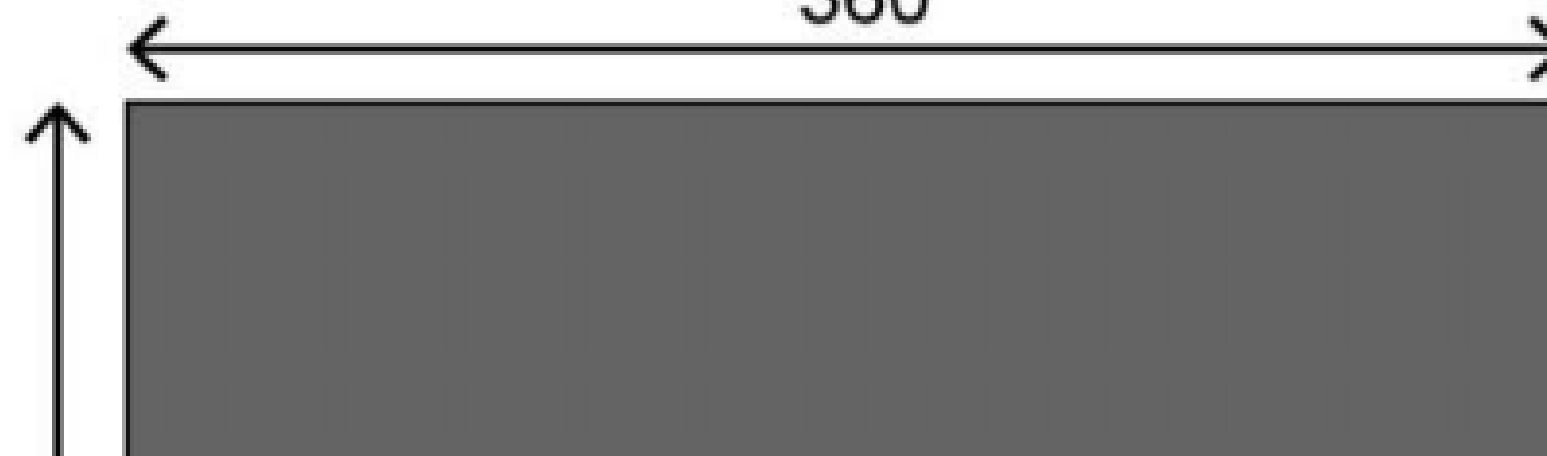


**Draggable  
circular spaces:**



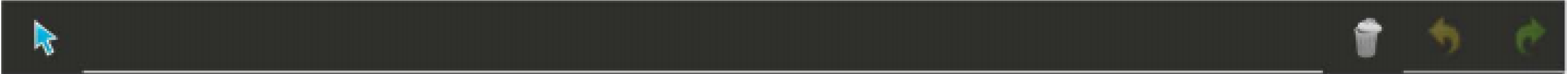
**Rooftop garden**

360

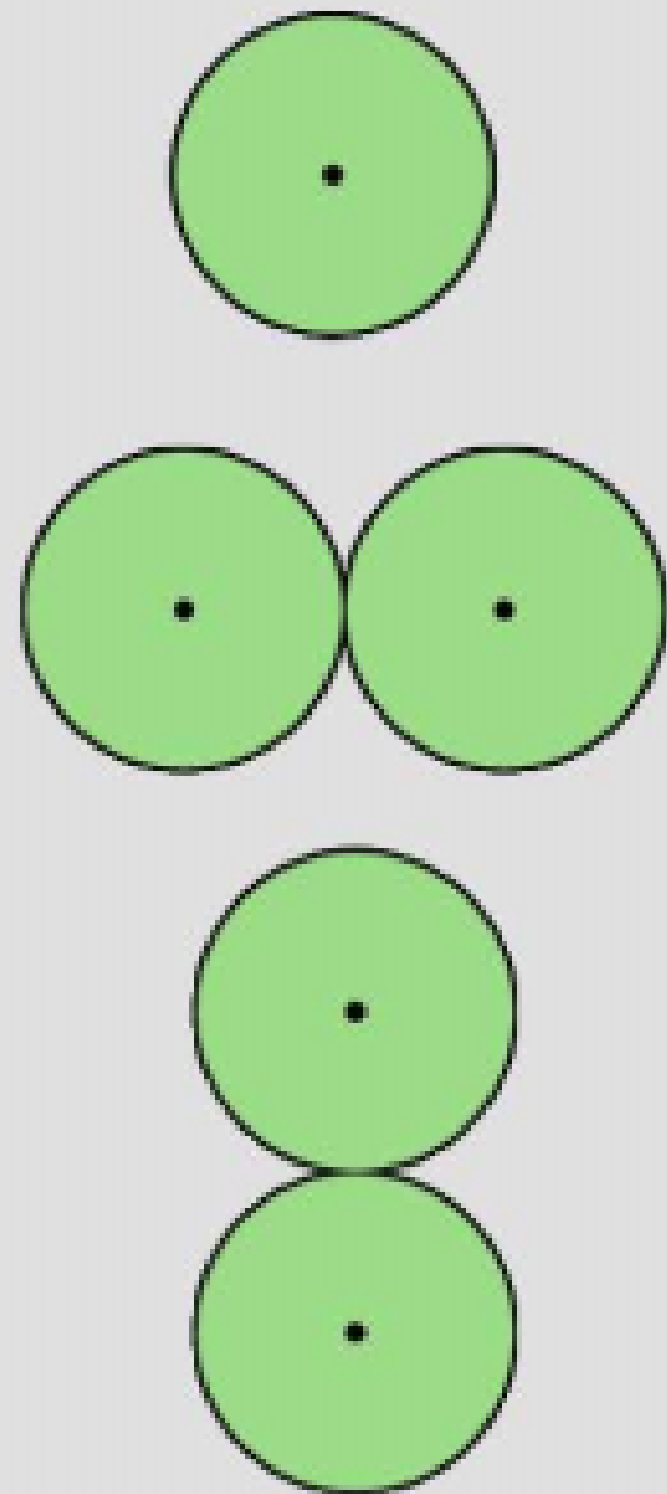


**Diagram to scale**

Lengths in centimetres

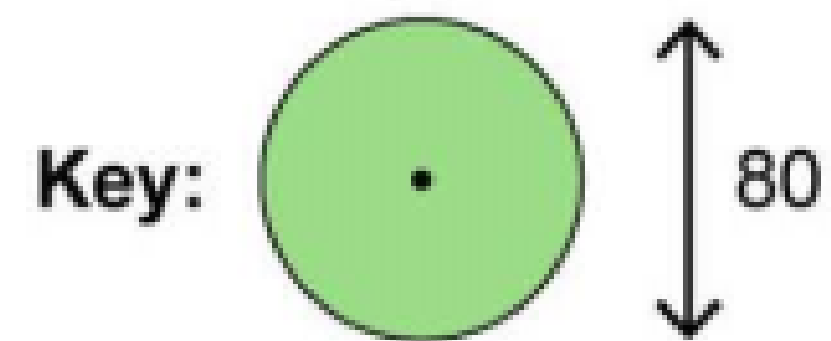
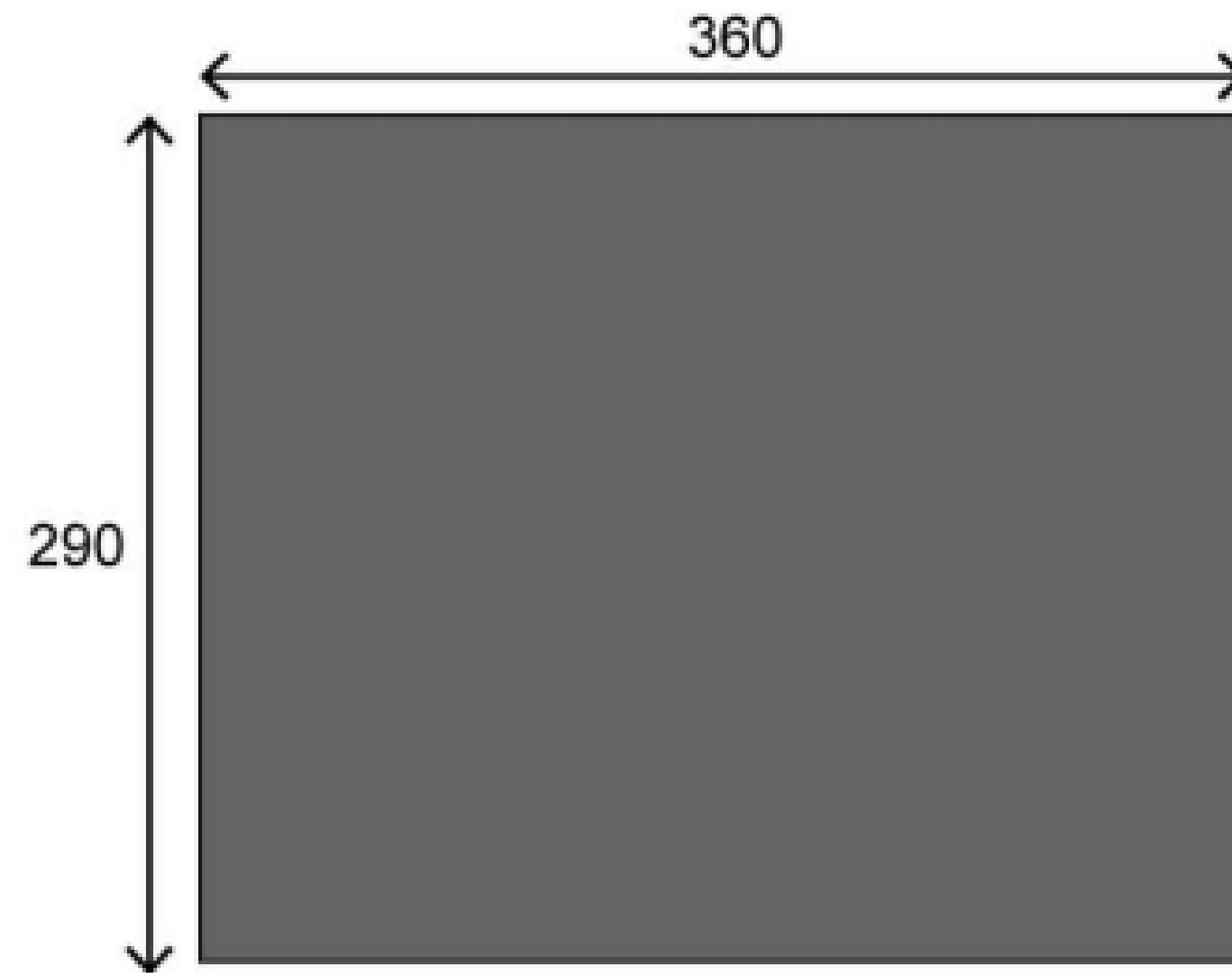


**Draggable  
circular spaces:**



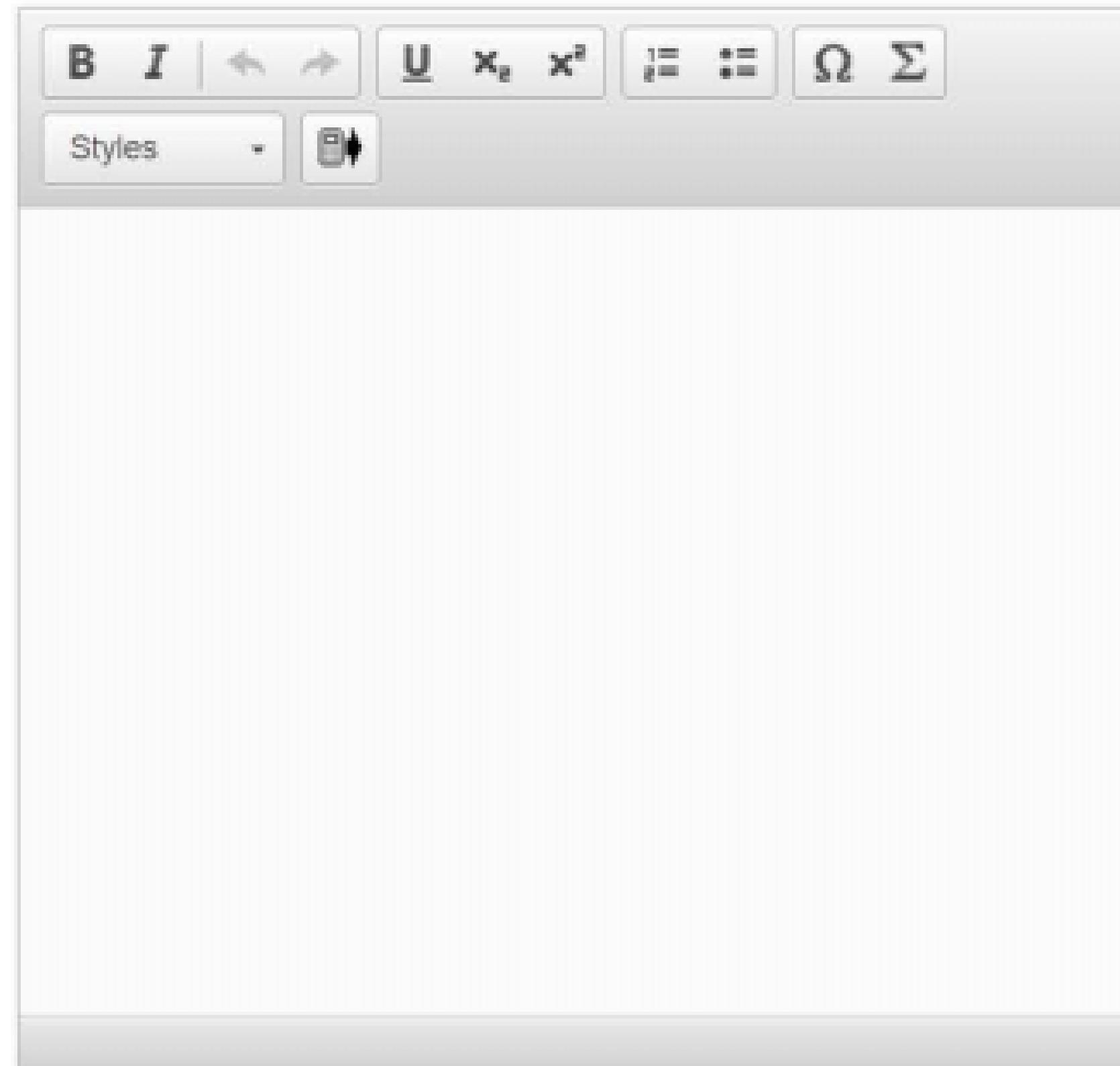
**Rooftop garden**

**Diagram to scale**  
Lengths in centimetres



Circular space for each  
tomato plant to grow

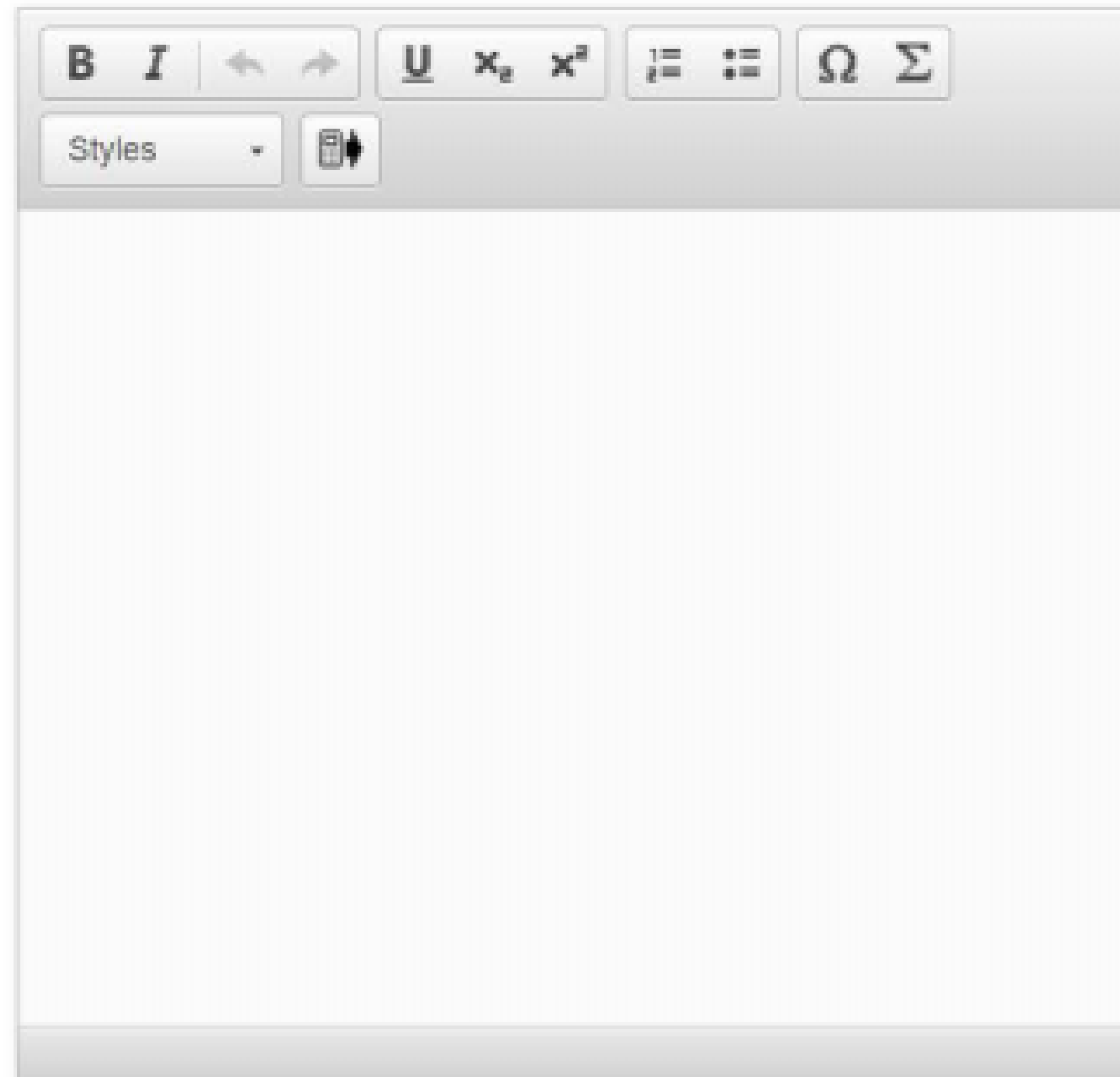
Relevant factors:



A rich text editor interface with a toolbar at the top. The toolbar includes buttons for bold (B), italic (I), left-align, right-align, underline (U), subscript (x₂), superscript (x²), bulleted list, numbered list, link (Ω), and unlink (Σ). Below the toolbar is a 'Styles' dropdown menu and a 'List' icon. The main editing area is currently empty.



Calculations and justification:



A rich text editor interface with a toolbar at the top. The toolbar includes buttons for bold (B), italic (I), left-align, right-align, underline (U), subscript (x₂), superscript (x²), bulleted list, numbered list, link (Ω), and unlink (Σ). Below the toolbar is a 'Styles' dropdown menu and a 'List' icon. The main editing area is currently empty.





Question 8 (31 marks)

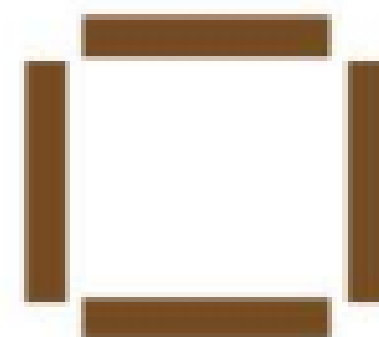
A sequence of shapes is created using sticks. In this question you will investigate the number of sticks ( $S$ ) forming these shapes.

Interact with the stage control to see how  $S$  increases.



Stage control

Stage 1



$S = 4$



### Question 8 (31 marks)

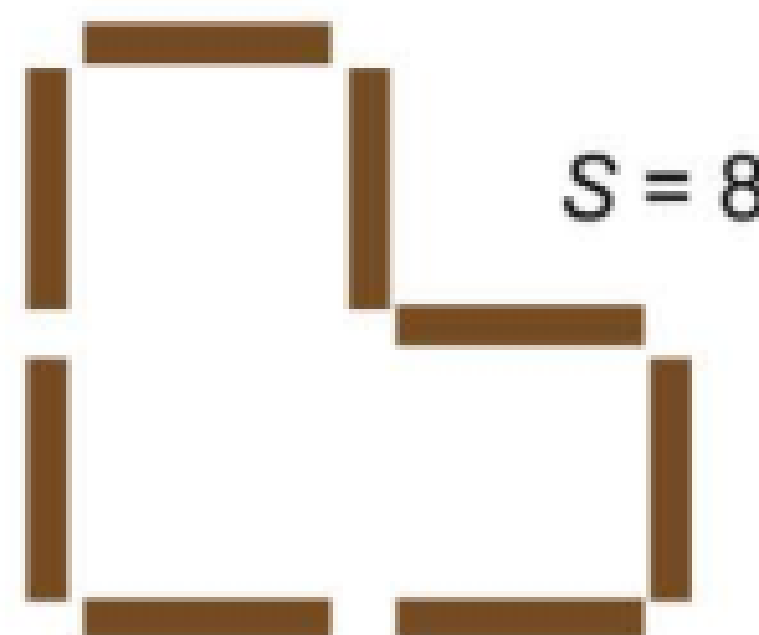
A sequence of shapes is created using sticks. In this question you will investigate the number of sticks ( $S$ ) forming these shapes.

Interact with the stage control to see how  $S$  increases.



**Stage control**

Stage 2



**Question 8** (31 marks)

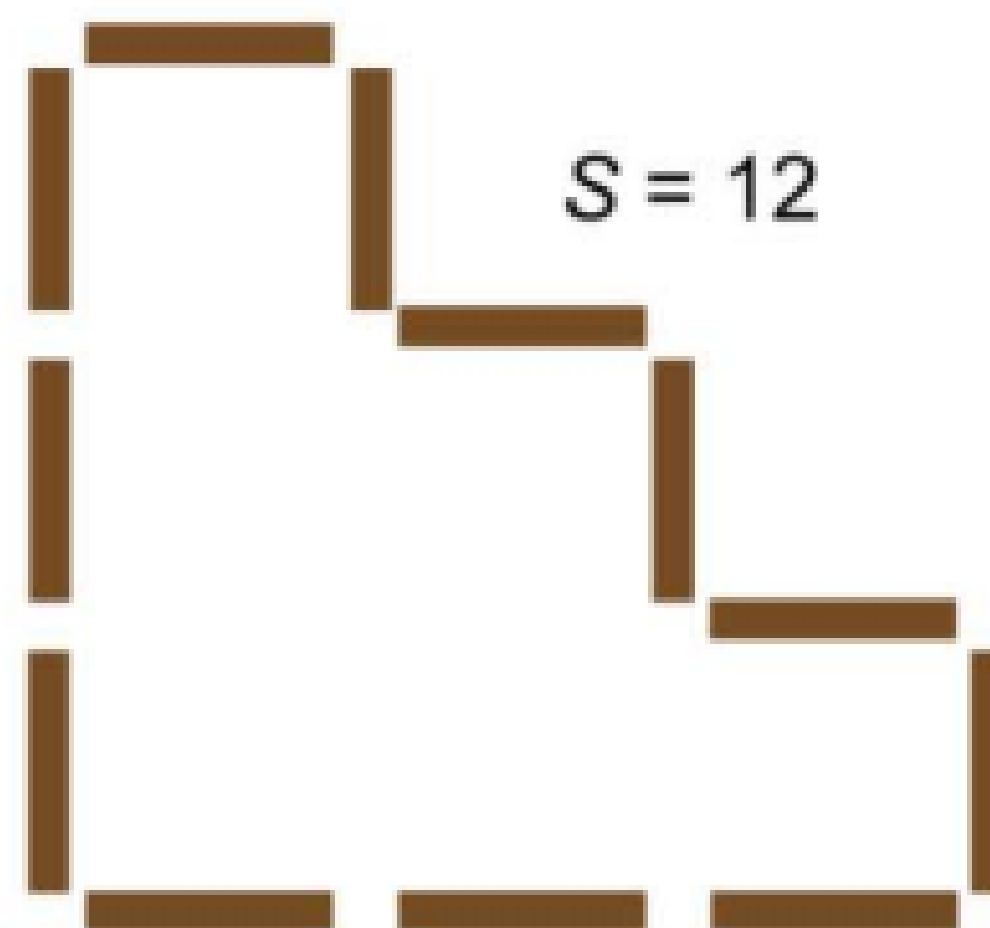
A sequence of shapes is created using sticks. In this question you will investigate the number of sticks ( $S$ ) forming these shapes.

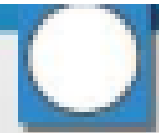
Interact with the stage control to see how  $S$  increases.



**Stage control**

Stage 3

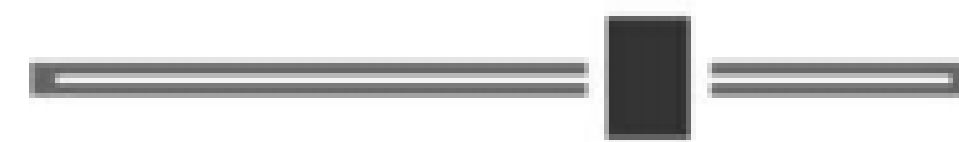




### Question 8 (31 marks)

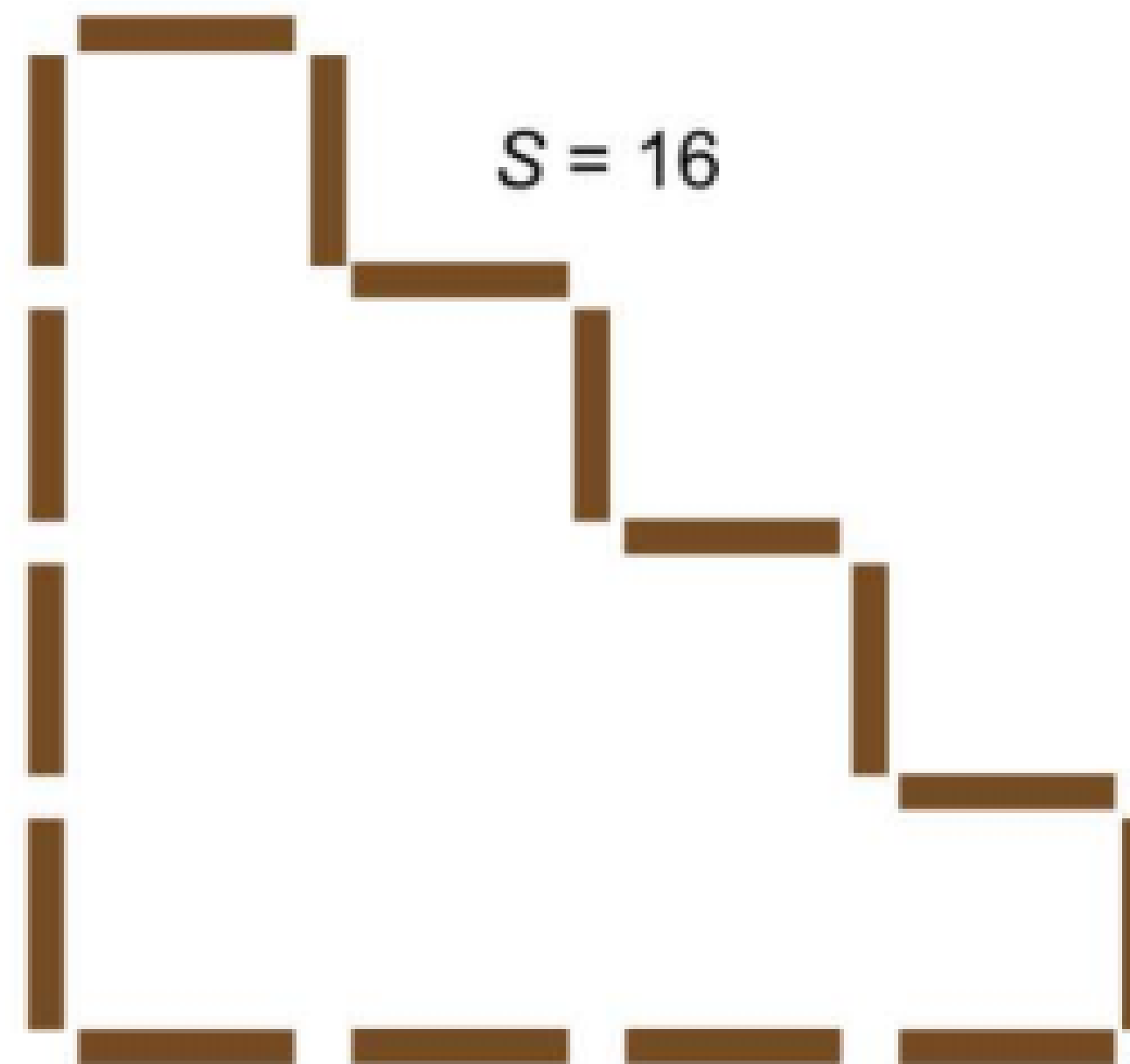
A sequence of shapes is created using sticks. In this question you will investigate the number of sticks ( $S$ ) forming these shapes.

Interact with the stage control to see how  $S$  increases.



Stage control

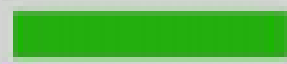
Stage 4



**Construct** stage 5 by completing the diagram on the canvas.



**Draggable sticks:**



Stage 5





### Question 8b (1 mark)

**Write down** the missing values in the table up to row 6.

Stage number ( $n$ )	Number of sticks ( $S$ )
1	4
2	8
3	12
4	16
5	
6	



### Question 8c (2 marks)

**Describe**, in words, two patterns in the table for the number of sticks ( $S$ ).

**B** **I** | ← → | U  $x_2$   $x^e$  | := := |  $\Omega$   $\Sigma$

Styles - [icon]



### Question 8b (1 mark)

**Write down** the missing values in the table up to row 6.

Stage number ( $n$ )	Number of sticks ( $S$ )
1	4
2	8
3	12
4	16
5	
6	



### Question 8d (2 marks)

**Write down**, in simplest form, a general rule for  $S$  in terms of  $n$ .

**B** ***I*** ← → U  $x_0$   $x^2$  ;= := Ω Σ

Styles - 📱



### Question 8b (1 mark)

**Write down** the missing values in the table up to row 6.

Stage number ( $n$ )	Number of sticks ( $S$ )
1	4
2	8
3	12
4	16
5	
6	



### Question 8e (3 marks)

**Verify** your general rule for  $S$ .

**B** **I** ← → U  $x_2$   $x^2$   $\int$   $\frac{d}{dx}$   $\Omega$   $\Sigma$

Styles -



Question 8f (22 marks)

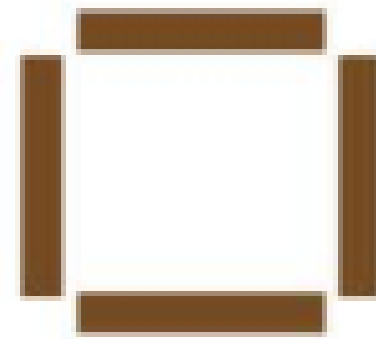
The following sequence of shapes is formed using external and internal sticks. You will now investigate the total number of sticks ( $T$ ) which includes the external and internal sticks.

Interact with the stage control to see how  $T$  increases.



Stage control

Stage 1



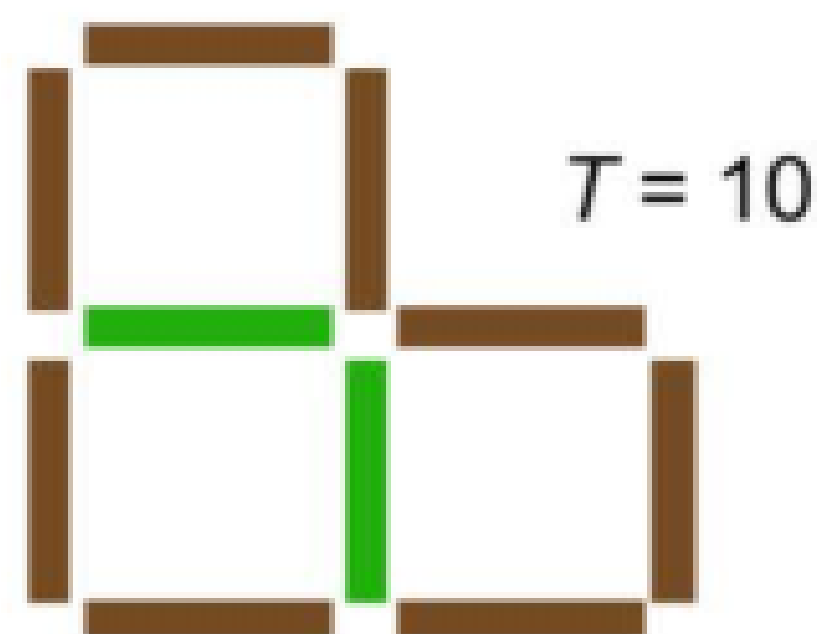
$T = 4$



Question 8f (22 marks)

The following sequence of shapes is formed using external and internal sticks. You will now investigate the total number of sticks ( $T$ ) which includes the external and internal sticks.

Interact with the stage control to see how  $T$  increases.

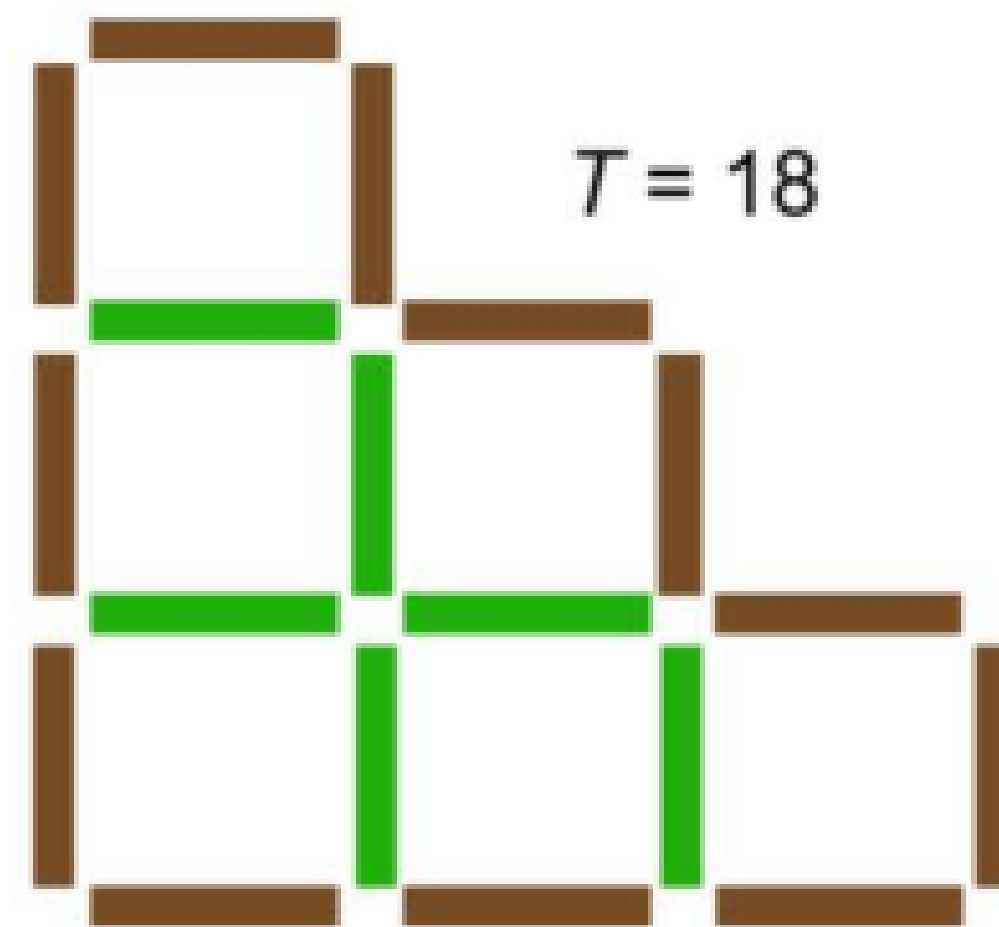




Question 8f (22 marks)

The following sequence of shapes is formed using external and internal sticks. You will now investigate the total number of sticks ( $T$ ) which includes the external and internal sticks.

Interact with the stage control to see how  $T$  increases.

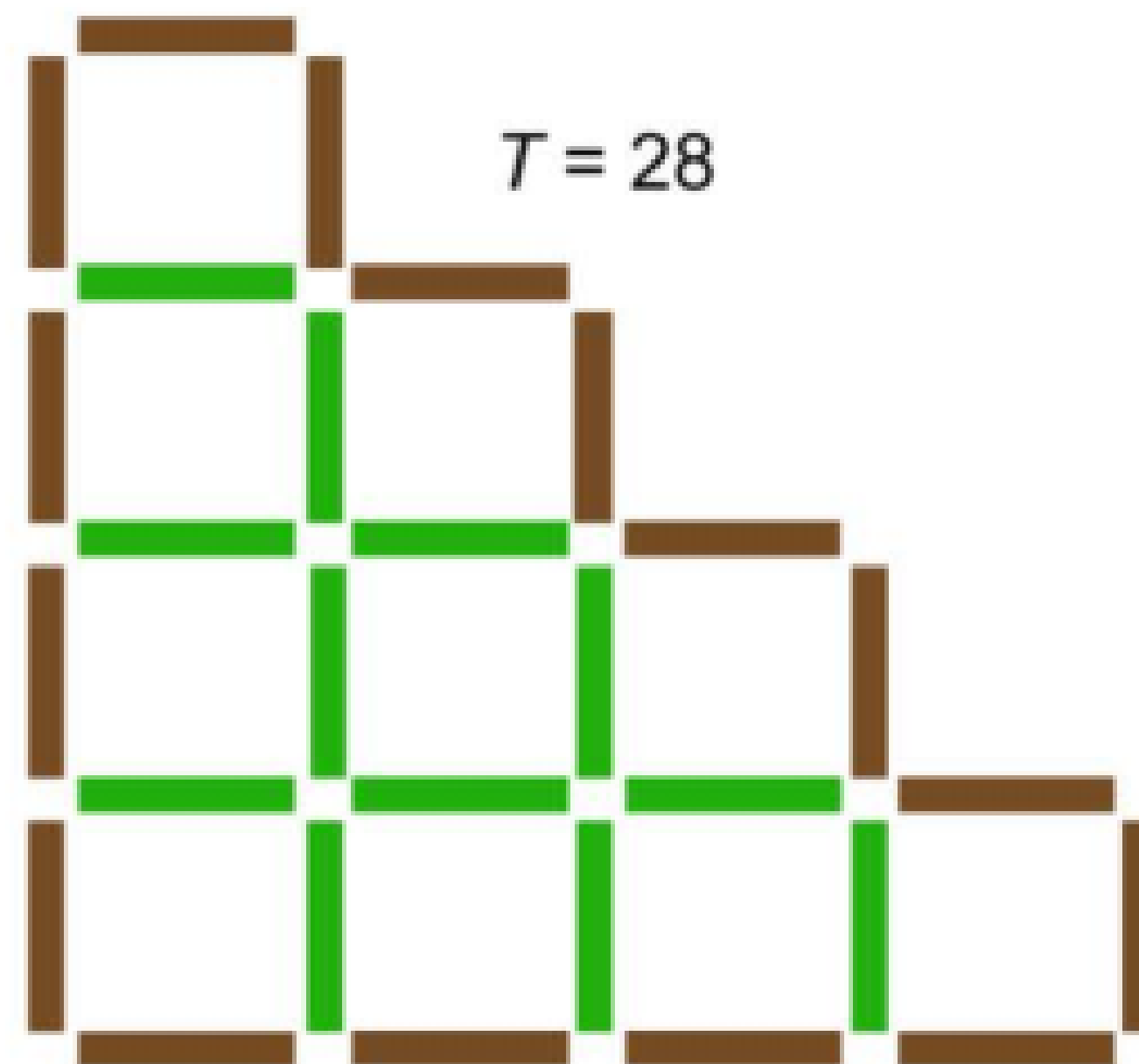


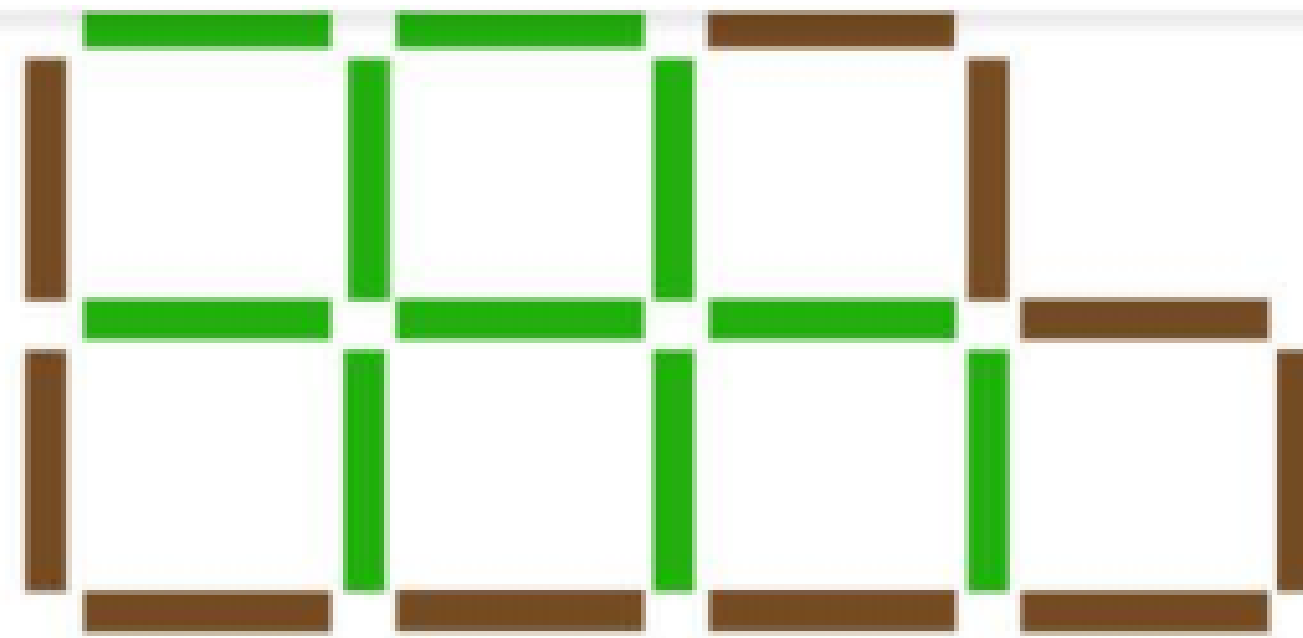


Question 8f (22 marks)

The following sequence of shapes is formed using external and internal sticks. You will now investigate the total number of sticks ( $T$ ) which includes the external and internal sticks.

Interact with the stage control to see how  $T$  increases.





Stage number ( $n$ )	External sticks ( $S$ )	Internal sticks ( $L$ )	Total number of sticks ( $T$ )
1	4	0	4
2	8	2	10
3	12	6	18
4	16	12	28
5			
6			

**Investigate** the values in the table to find a relationship for the total number of sticks ( $T$ ) in terms of  $n$ . In your answer, you should communicate the following in an organized and coherent manner:

- predict more values and record these in the table
- describe in words a pattern in the table for total number of sticks ( $T$ )
- write down, in simplest form, a general rule for  $T$  in terms of  $n$
- test and verify your general rule for  $T$
- justify your general rule for  $T$ .



A screenshot of a rich text editor toolbar. The top row contains buttons for Bold (B), Italic (I), Undo (left arrow), Redo (right arrow), Underline (U), subscript (x₂), superscript (x²), Bulleted List (≡), Numbered List (≡), and Insert Link (Ω) and Unlink (Σ). The bottom row contains a Styles dropdown menu and a link icon.