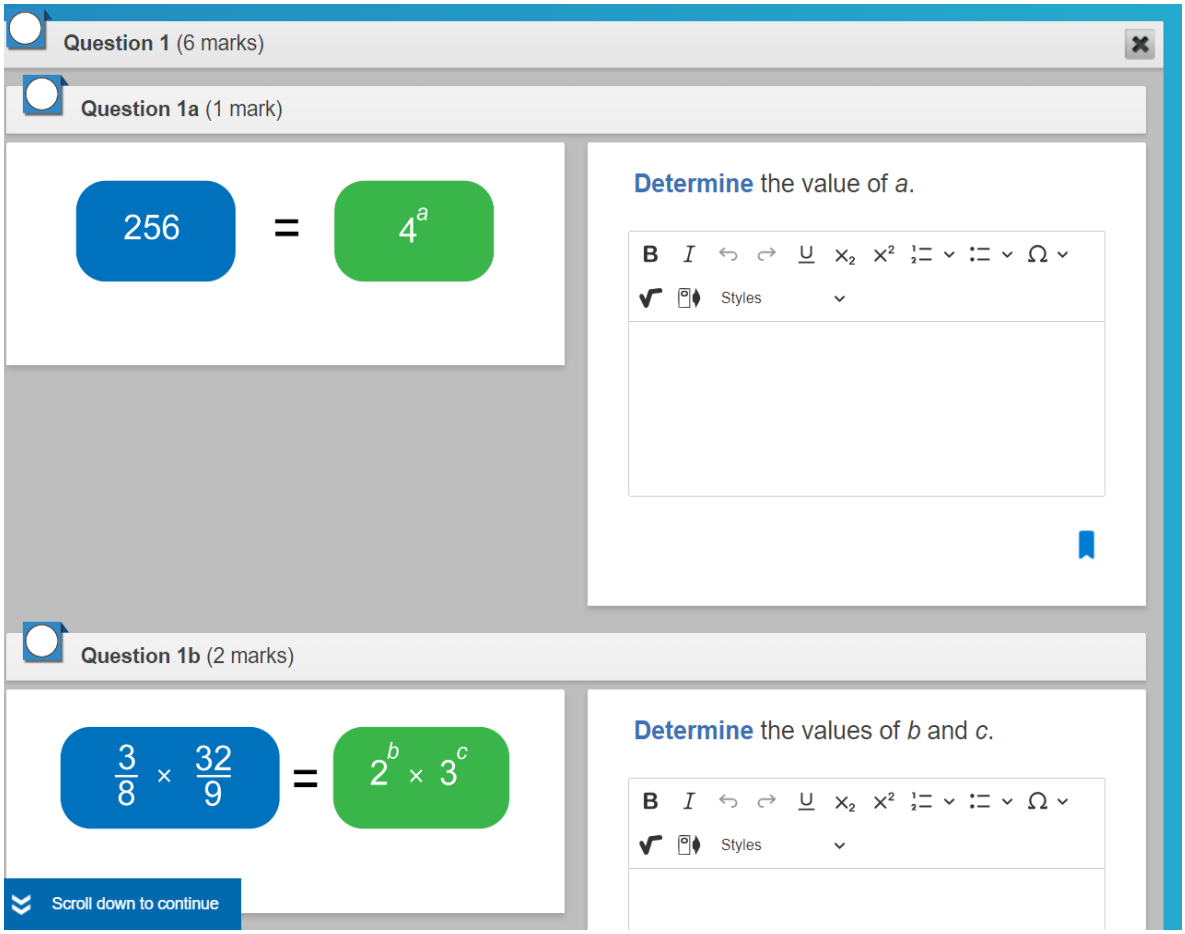

Question 1 (6 marks)
Question 1a (1 mark)
256 = 4^a
Determine the value of a.
Styles
Question 1b (2 marks)
3/8 × 32/9 = 2^b × 3^c
Determine the values of b and c.
Styles
Scroll down to continue

Question 1b (2 marks)

$$\frac{3}{8} \times \frac{32}{9} = 2^{b} \times 3^{c}$$

Determine the values of *b* and *c*.

Styles

Question 1c (3 marks)

$$\sqrt{45} - d\sqrt{e} = \sqrt{5}$$

Find the values of *d* and *e*, that gives the surd in its simplest form.

Styles

Scroll down to continue

Question 2 (6 marks)

Ingrid and Étienne went to a supermarket.

Ingrid bought two watermelons and three pineapples for $11.50.
Étienne bought three watermelons and two pineapples for $13.50.

Let x represent the price for one watermelon and y represent the price of one pineapple.

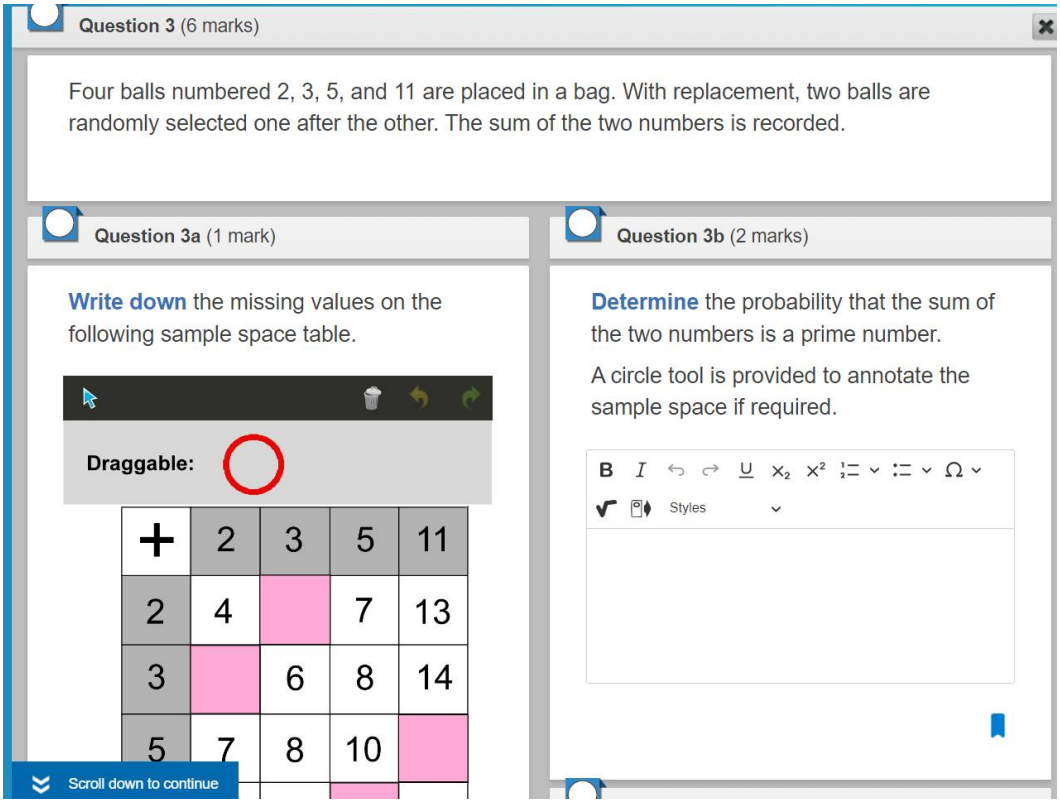
Question 2a (2 marks)

Write down the missing values in the two equations below.

$$2x + \square y = 11.5$$
$$\square x + 2y = \square$$

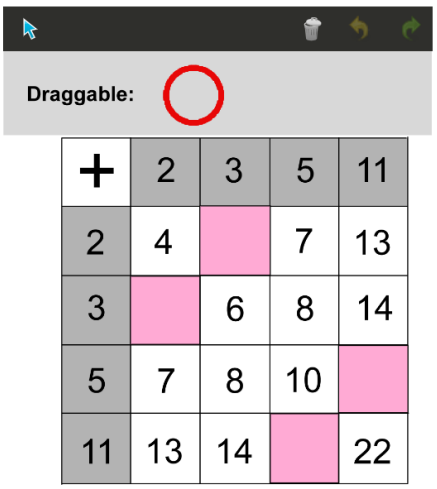
Question 2b (4 marks)

Hence, **find** the values of x and y.


Question 3 (6 marks)
Four balls numbered 2, 3, 5, and 11 are placed in a bag. With replacement, two balls are randomly selected one after the other. The sum of the two numbers is recorded.
Question 3a (1 mark)
Write down the missing values on the following sample space table.
Draggable:
+ 2 3 5 11
2 4 7 13
3 6 8 14
5 7 8 10
Scroll down to continue
Question 3b (2 marks)
Determine the probability that the sum of the two numbers is a prime number.
A circle tool is provided to annotate the sample space if required.
Styles

Question 3a (1 mark)

Write down the missing values on the following sample space table.



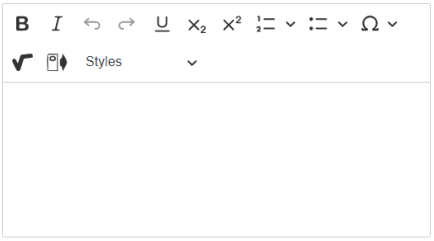
+	2	3	5	11
2	4		7	13
3		6	8	14
5	7	8	10	
11	13	14		22

Scroll down to continue

Question 3b (2 marks)

Determine the probability that the sum of the two numbers is a prime number.

A circle tool is provided to annotate the sample space if required.



Question 3c (2 marks)

Determine the probability that the sum of the two numbers is a prime number or a square number.

A circle tool is provided to annotate the sample space if required.

Question 3a (1 mark)

Write down the missing values on the following sample space table.

Draggable:

+	2	3	5	11
2	4		7	13
3		6	8	14
5	7	8	10	
11	13	14		22

Scroll down to continue

Question 3c (2 marks)

Determine the probability that the sum of the two numbers is a prime number or a square number.

A circle tool is provided to annotate the sample space if required.

Styles

11	13	14		22

Styles

Question 3d (1 mark)

Let:

- event R be the sum of the two numbers is a prime number
- event S be the sum of the two numbers is a square number.

Write down the mathematical terminology to complete the following statement.

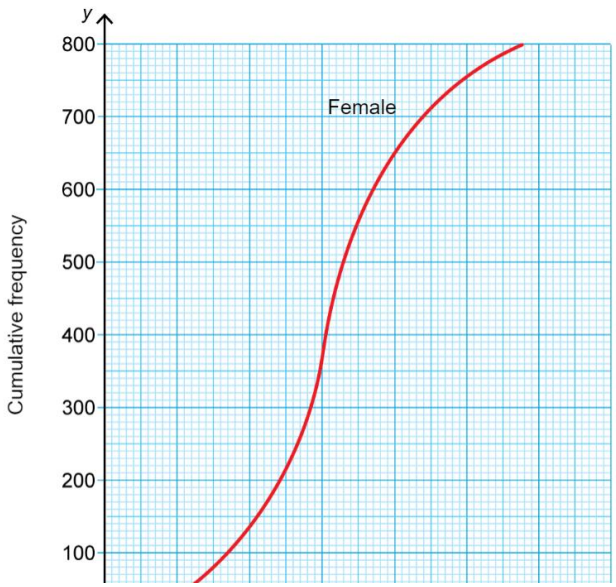
$P(R \cap S) = 0$ because event R and event S are _____ events.

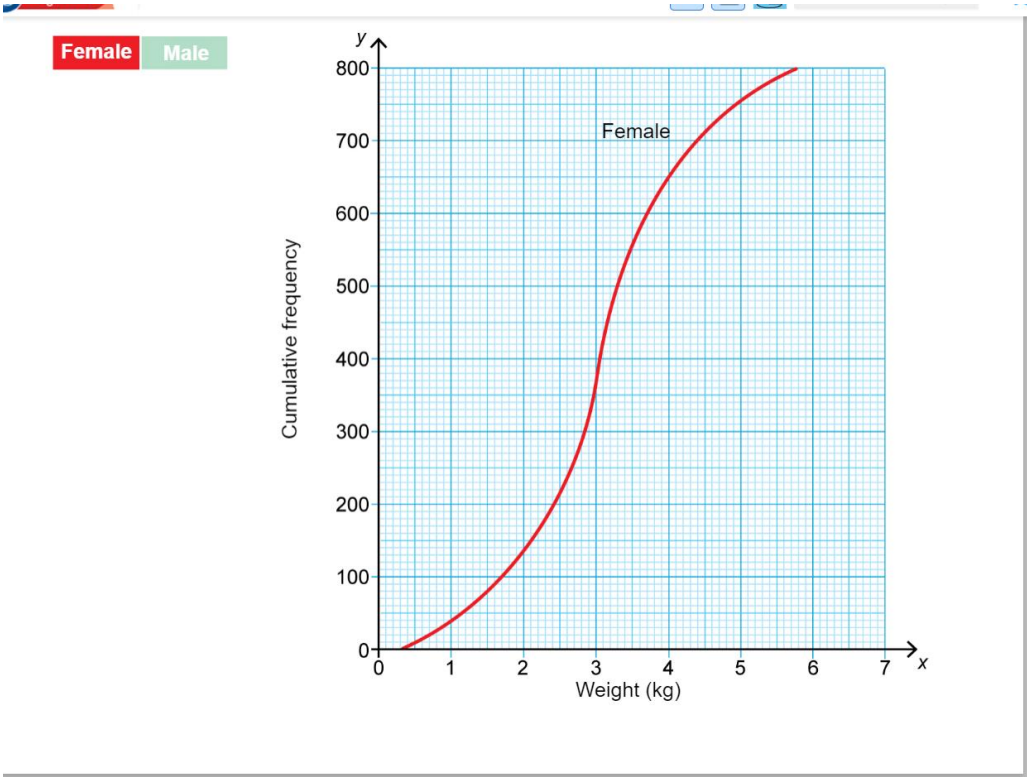
Question 4 (9 marks)

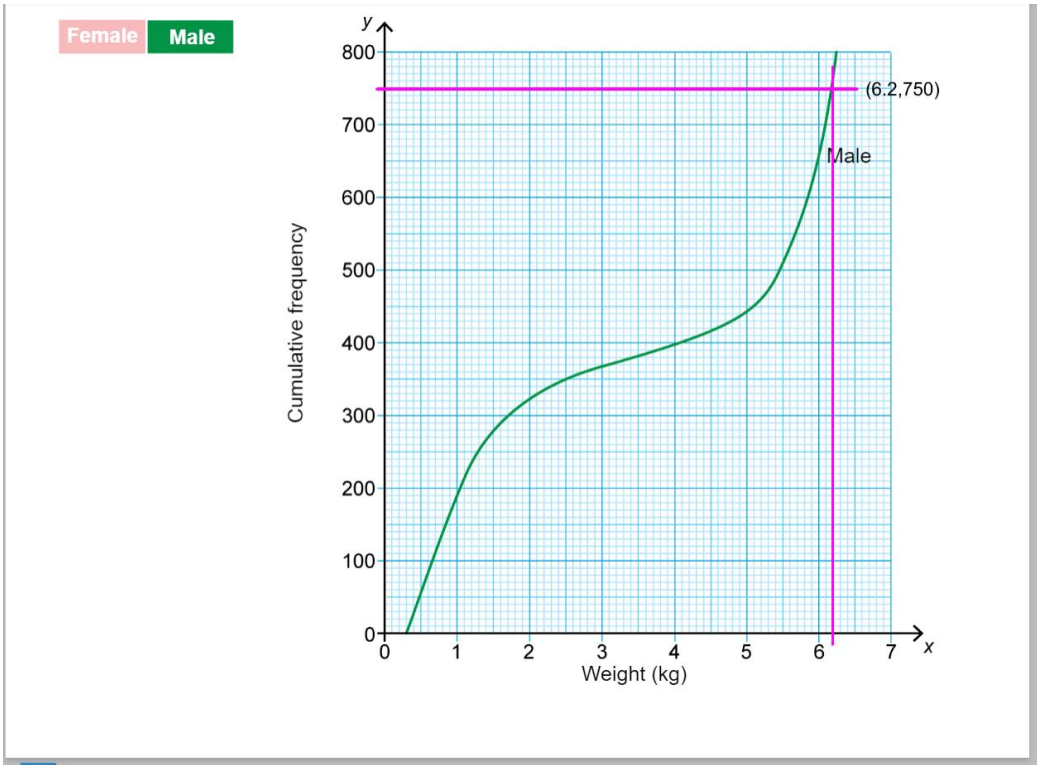
The cumulative frequency graph shows the weights of female and male Persian cats. Weights measured in kilograms (kg).

This media is interactive

Female Male

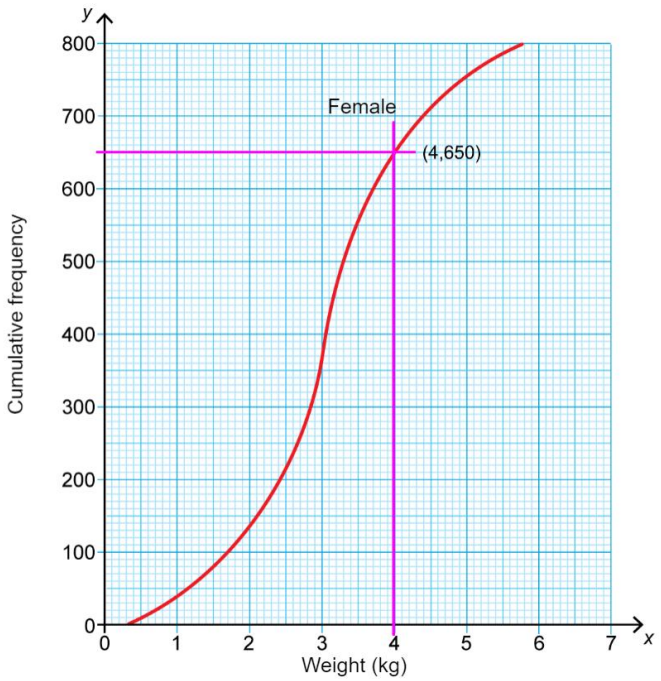



Female
Male
y
800
700
600
500
400
300
200
100
0
Female
Cumulative frequency
0
1
2
3
4
5
6
7
x
Weight (kg)


Female
Male
y
800
700
600
500
400
300
200
100
0
Cumulative frequency
(6.2,750)
Male
0
1
2
3
4
5
6
7
x
Weight (kg)

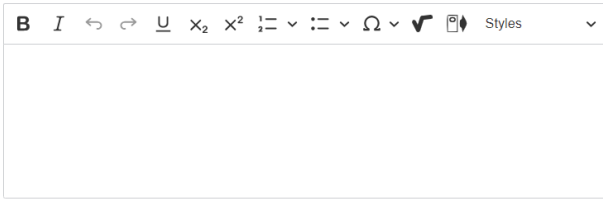
This media is interactive

Female Male



Question 4a (3 marks)

Calculate the percentage of female cats that weigh at least 4 kg.



Question 4b (4 marks)

Use the graph to determine the missing values on the following table.

	Weight of female Persian cats (kg)	Weight of male Persian cats (kg)
Lower quartile (1st quartile)	2.4	
Median	3.1	
Upper quartile (3rd quartile)		5.9

Scroll down to continue

Question 4b (4 marks)

Use the graph to determine the missing values on the following table.

	Weight of female Persian cats (kg)	Weight of male Persian cats (kg)
Lower quartile (1st quartile)	2.4	
Median	3.1	
Upper quartile (3rd quartile)		5.9
Interquartile range (IQR)		

Reset

Question 4c (2 marks)

Using information from the table, **write down** the missing statistical terms in the following statements:

Scroll down to continue

is larger for the male cats, therefore the male

Interquartile range (IQR)		

Reset

Question 4c (2 marks)

Using information from the table, **write down** the missing statistical terms in the following statements:

The _____ is larger for the male cats, therefore the male cats are heavier than the female cats.

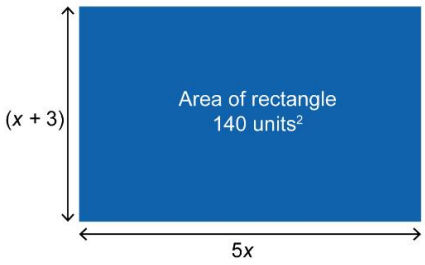
The _____ is larger for the male cats, therefore the weights of the male cats are more dispersed than the weights of the female cats.

Question 5 (8 marks)

Question 5a (4 marks)

The following diagram shows a rectangle.

Diagram not to scale



Find the value of x.

B I U x_2 x^2 Styles

Question 5b (1 mark)

Hence, **determine** values for length and width of the rectangle.

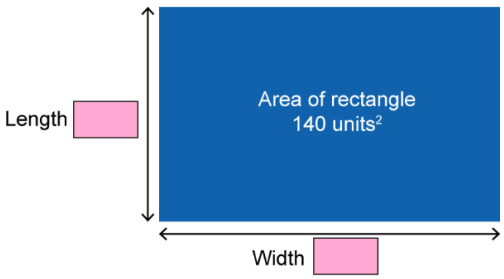
Diagram not to scale

Scroll down to continue

Question 5b (1 mark)

Hence, **determine** values for length and width of the rectangle.

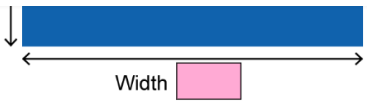
Diagram not to scale



Question 5c (3 marks)

The rectangle is enlarged. The area of the enlarged rectangle is 1260 units^2. **Find** the length and the width of the enlarged rectangle.

Scroll down to continue



Question 5c (3 marks)

The rectangle is enlarged. The area of the enlarged rectangle is 1260 units^2. **Find** the length and the width of the enlarged rectangle.

Question 6 (15 marks)

In this question you will make calculations for tidal energy.

Video | Script

Renewable energy technology has advanced by making use of changing coastal tides to provide clean and reliable energy.

There are some physical requirements needed in order to utilise energy from tides. It is essential to have a large tidal range.

The tidal range is the difference in height of the low tide and the high tide.

The tidal range may change slightly during stormy weather and during the full and new moon phase.

Another physical requirement is a suitable location to create a large tidal lagoon. A tidal lagoon is a lake that holds water at high tide. For financial and ecological reasons, the best location for a tidal lagoon is where the coastline forms a bay.

Tidal energy is dependent on the tidal range and the area of the lagoon seabed.

In this question you will make calculations for the Energy and tidal range for two different lagoon designs.

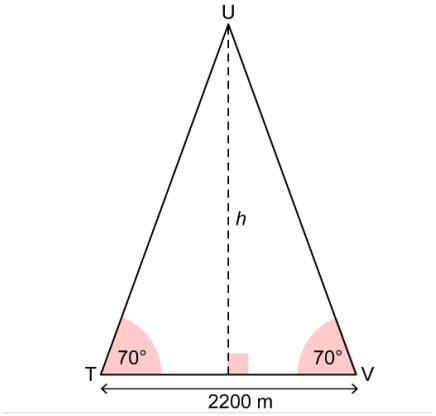
Scroll down to continue

Question 6a (3 marks)

The following diagram shows an isosceles triangle with dimensions indicated on the diagram.

Diagram not to scale

Design T



Show that the height h of the triangle is 3022 to the nearest metre (m).

Question 6b (2 marks)

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

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Assistance

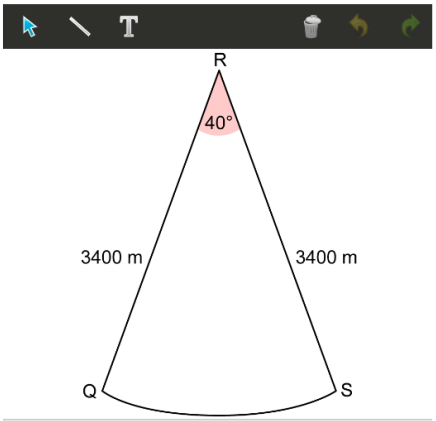
1:19

Question 6c (3 marks)

The sector QRS has the dimensions indicated on the diagram.

Diagram not to scale

Design S



Show that the area of the sector QRS is 4 040 000 m^2 correct to three significant figures.

Styles

Scroll down to continue

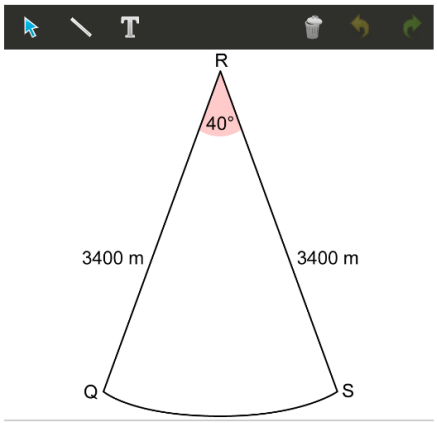
1 (6 marks)
2 (6 marks)
3 (6 marks)
4 (9 marks)
5 (8 marks)
6 (15 marks)
Question 6a
Question 6b
Question 6c
Question 6d
Question 6e
Question 6f
7 (20 marks)
8 (30 marks)

Question 6c (3 marks)

The sector QRS has the dimensions indicated on the diagram.

Diagram not to scale

Design S



Show that the area of the sector QRS is 4 040 000 m^2 correct to three significant figures.

The energy (E), produced by a tidal lagoon, is given by the following formula

$$E = \frac{1}{700} Ad^2$$

Where:

E = Tidal energy (kilo Watt hours, kWh)
A = Area of the lagoon seabed (square metres, m^2)
d = Tidal range (metres, m)

Scroll down to continue

Question 6d (2 marks)

Information for Design T

A = your answer from part (b)

d = 15 m

Determine the value of E.

B I ↩ ↪ U x_2 x^2 Styles

Question 6e (3 marks)

Information for Design S

E = 1 500 000 kWh
A = 4 040 000 m^2

Calculate the value of d.

The energy (E), produced by a tidal lagoon, is given by the following formula

$$E = \frac{1}{700} Ad^2$$

Where:

E = Tidal energy (kilo Watt hours, kWh)
A = Area of the lagoon seabed (square metres, m^2)
d = Tidal range (metres, m)

Question 6e (3 marks)

Information for Design S

E = 1 500 000 kWh
A = 4 040 000 m^2

Calculate the value of d.

Styles

Scroll down to continue

$$E = \frac{1}{700} Ad^2$$

Where:

E = Tidal energy (kilo Watt hours, kWh)
A = Area of the lagoon seabed (square metres, m^2)
d = Tidal range (metres, m)

Styles

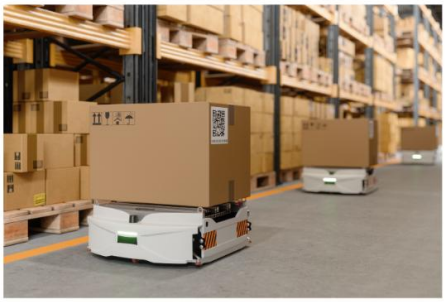
Question 6f (2 marks)

Due to a storm, d increases by 10%. **Determine** the percentage increase of E.

Styles

Question 7 (20 marks)

The warehouse uses two different robots to move items.



Question 7a (1 mark)

The working area of the warehouse has a length of 32 m and a width of 16 m shown in the following diagram.

All robots are designed to start at point A, move to pick up an item at point P, then move to drop off the item at point B.

Robot 1 can only move parallel to the walls of the warehouse as shown in the diagram. Robot 1 ck up an item at point P(16,12).

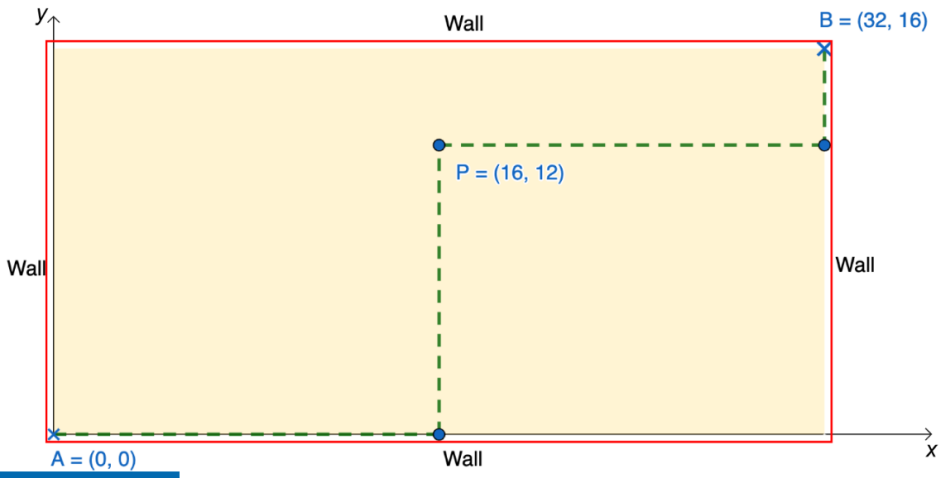
Scroll down to continue

Question 7a (1 mark)

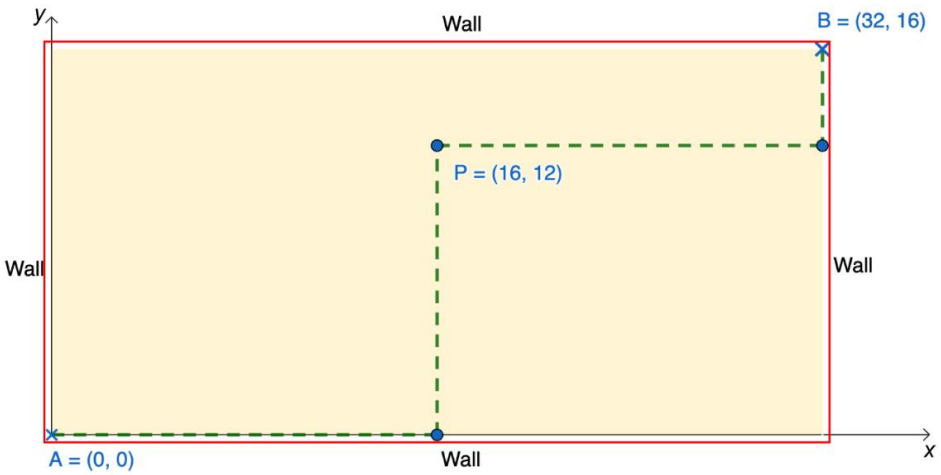
The working area of the warehouse has a length of 32 m and a width of 16 m shown in the following diagram.

All robots are designed to start at point A, move to pick up an item at point P, then move to drop off the item at point B.

Robot 1 can only move parallel to the walls of the warehouse as shown in the diagram. Robot 1 is instructed to pick up an item at point P(16,12).



Scroll down to continue



Let D_1 be the distance travelled by Robot 1 from starting point A to drop-off point B.

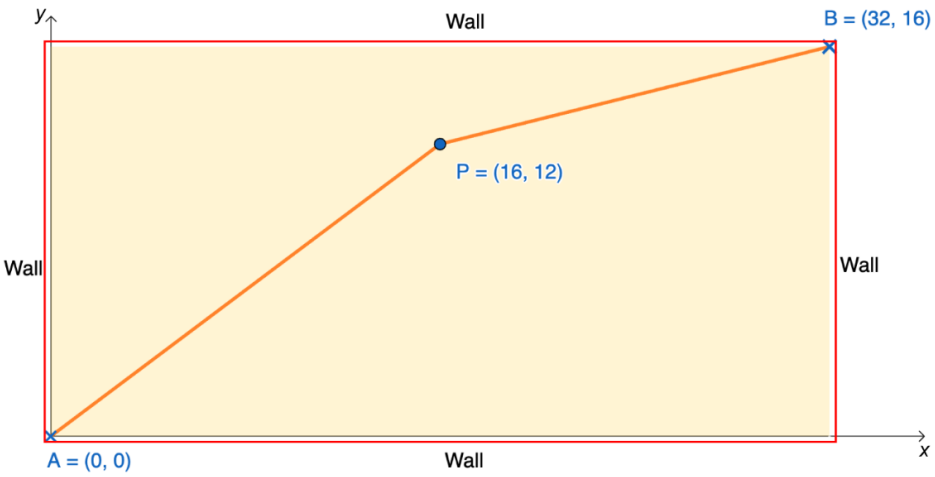
Determine the value of D_1.

B I Styles

Question 7b (4 marks)

Robot 2 can move directly from one point to another as shown in the diagram.

Robot 2 is instructed to pick up an item, at the same point, P(16,12). It moves on the path from A to P using equation $y = \frac{3}{4}x$.



Scroll down to continue

Question 7b (4 marks)

Find the equation of the path from P to B.

Styles

Question 7c (3 marks)

Let D_2 be the distance travelled by Robot 2 from starting point A to drop-off point B.

Robot 2 travels a distance of 20 m from A to P.

Calculate the value of D_2, give your answer correct to two decimal places.

Styles

Question 7d (2 marks)

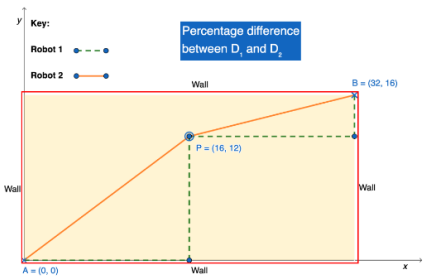
...entage difference of D_1 and D_2, such that:

Scroll down to continue

Question 7d (2 marks)

Let K be the percentage difference of D_1 and D_2, such that:

$$k = \frac{|D_2 - D_1|}{D_1} \times 100$$

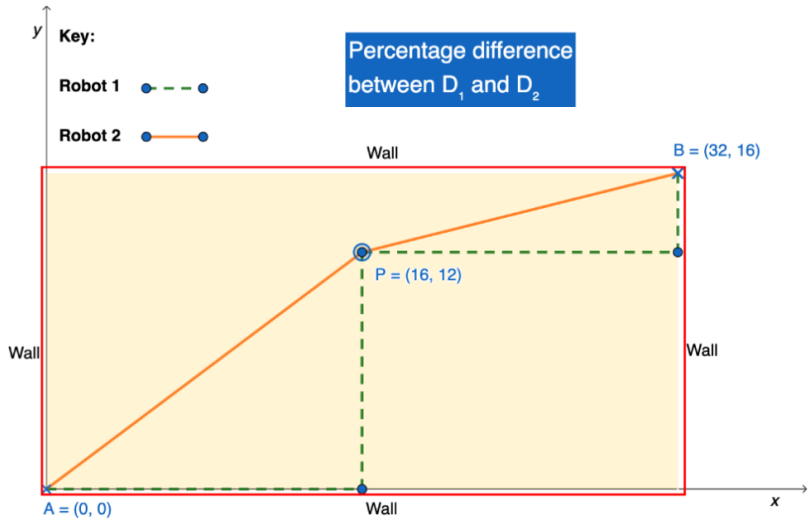


Using your answers from (a) and (c), **determine** the value of K, for P(16,12).

Styles

Question 7e (10 marks)

Scroll down to continue



Question 7e (10 marks)

The following simulation is provided for part (e).

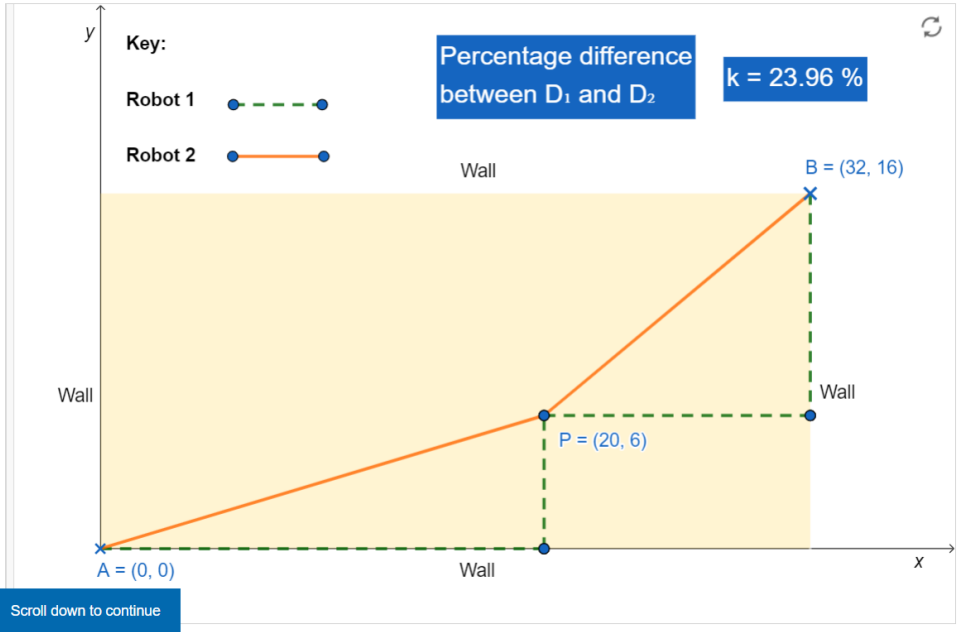
Scroll down to continue

Question 7e (10 marks)

The following simulation is provided for part (e).

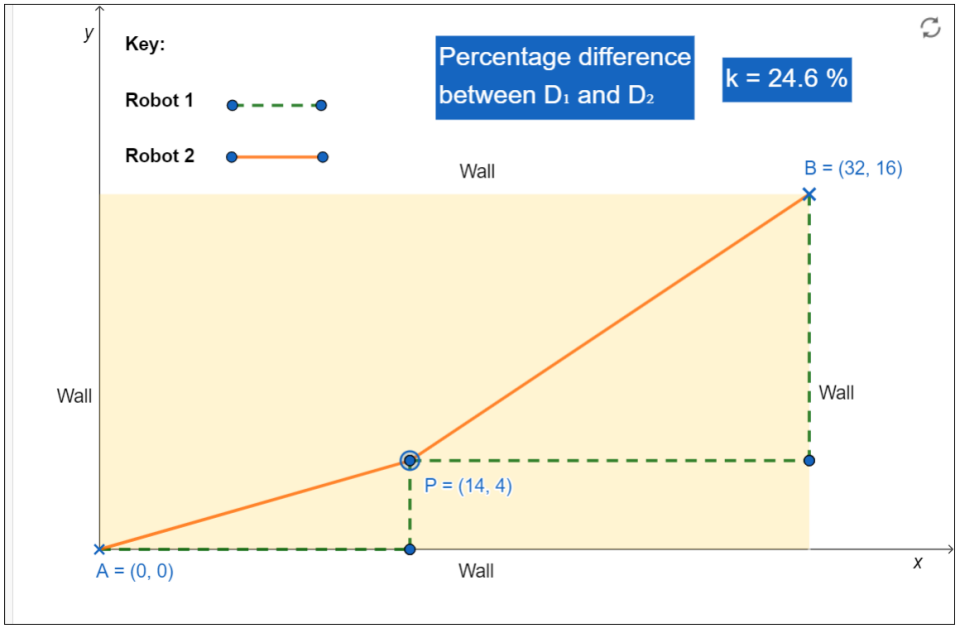
This media is interactive

Drag the point P to reveal the value of *K* at different positions.

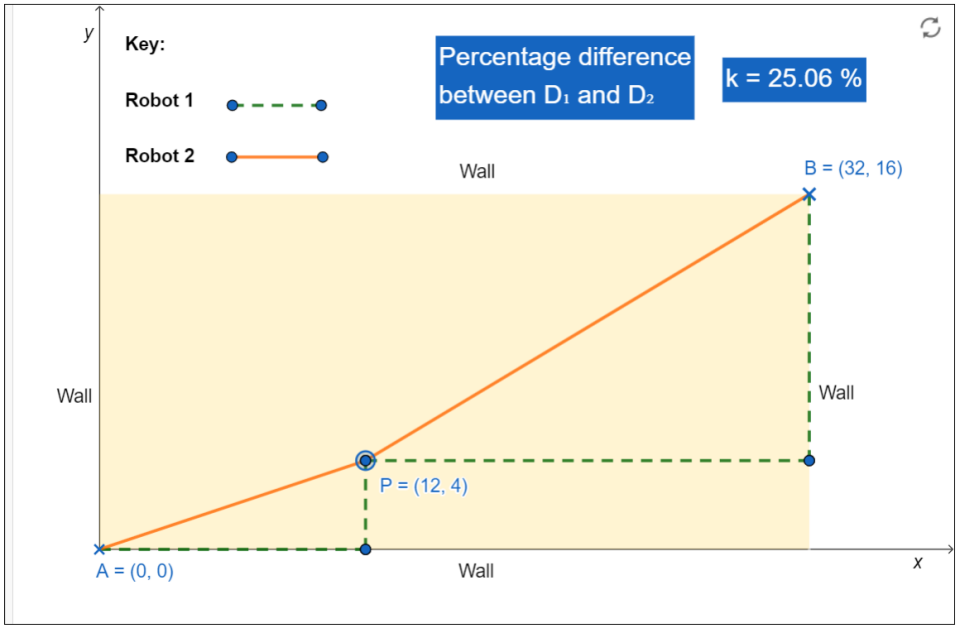


Scroll down to continue

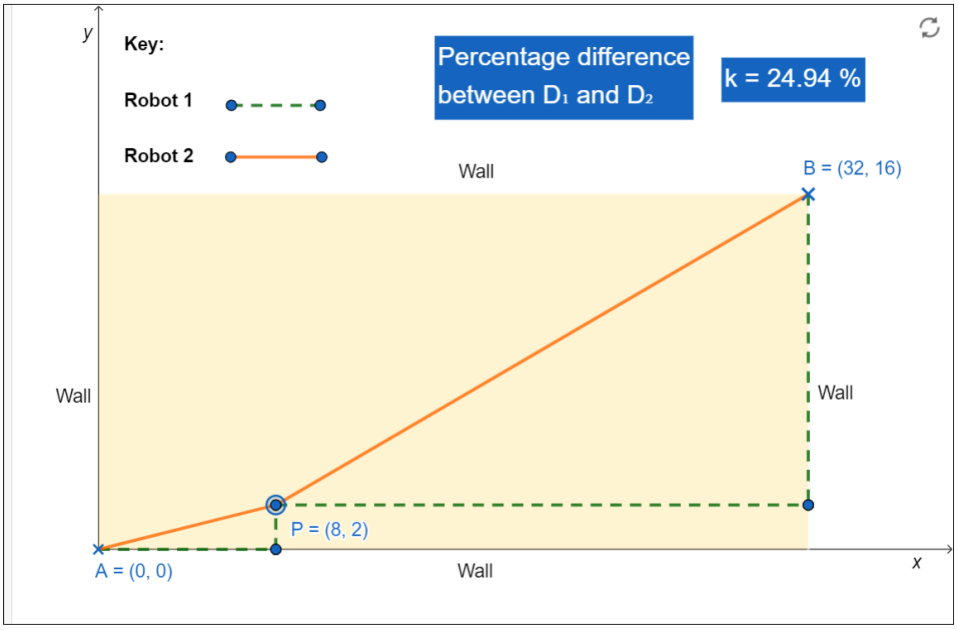
Drag the point P to reveal the value of *K* at different positions.



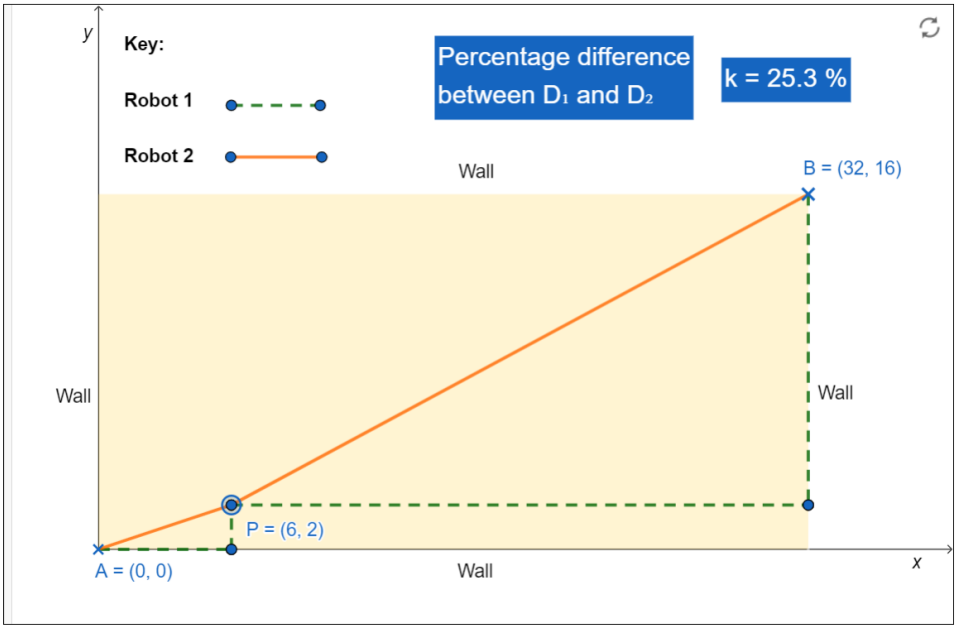
Drag the point P to reveal the value of *K* at different positions.



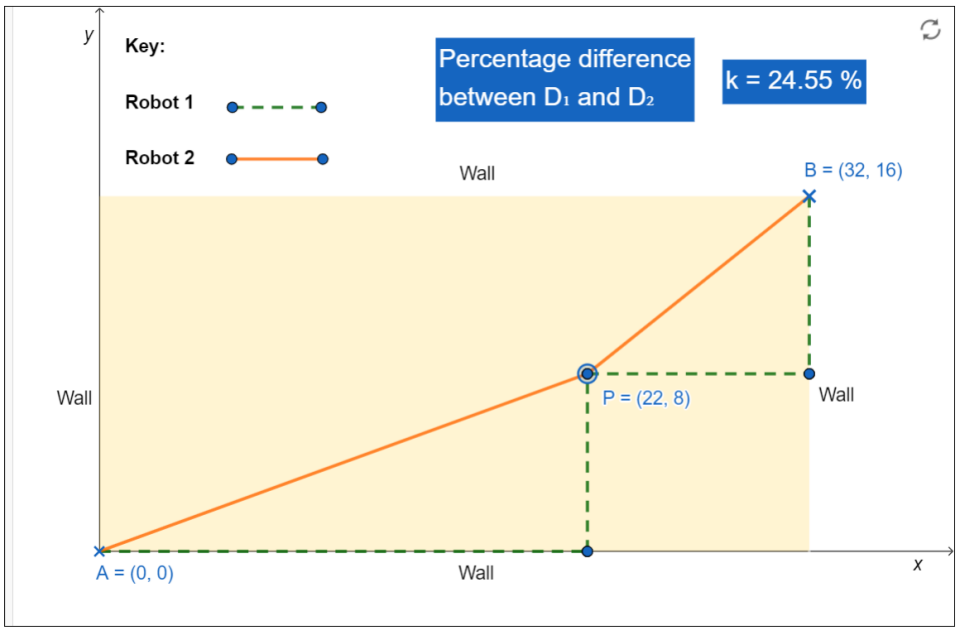
Drag the point P to reveal the value of *K* at different positions.



Drag the point P to reveal the value of *K* at different positions.



Drag the point P to reveal the value of *K* at different positions.



Additional information about the robots.

	Robot 1	Robot 2
Price (USD)	1000	1200
Speed (m/sec)	0.75	0.5

distance = speed × time

The warehouse manager wants to buy another robot. **Analyse** the information given to recommend the appropriate robot type to buy. In your answer, you should:

- state **three** relevant factors
- show calculations for the minimum and maximum value of *K*
- show calculations for the minimum time needed for Robot 1 and Robot 2
- justify your recommendation for whether to buy Robot 1 or Robot 2.

Factors:

Styles

Calculations and recommendations:

Styles

Scroll down to continue

Question 8 (30 marks)

A structure is created using cubes. In this question you will investigate the number of cubes in the structures.

Interact with the stage control to reveal the structure and number of cubes (C).

Stage control

Stage 1: $C = 5$

Question 8a (1 mark)

Scroll down to continue

5 by completing the structure on the canvas.

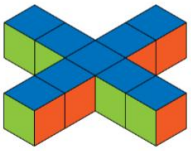
Question 8 (30 marks)

A structure is created using cubes. In this question you will investigate the number of cubes in the structures.

Interact with the stage control to reveal the structure and number of cubes (C).

Stage control

Stage 2: $C = 9$



Question 8a (1 mark)

Scroll down to continue

5 by completing the structure on the canvas.

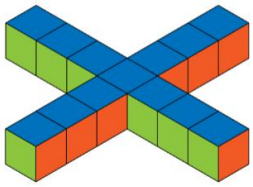
Question 8 (30 marks)

A structure is created using cubes. In this question you will investigate the number of cubes in the structures.

Interact with the stage control to reveal the structure and number of cubes (C).

Stage control

Stage 3: $C = 13$



Question 8a (1 mark)

Scroll down to continue

5 by completing the structure on the canvas.

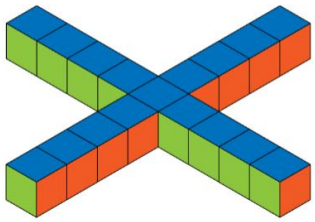
Question 8 (30 marks)

A structure is created using cubes. In this question you will investigate the number of cubes in the structures.

Interact with the stage control to reveal the structure and number of cubes (C).

Stage control

Stage 4: $C = 17$



Question 8a (1 mark)

Scroll down to continue

5 by completing the structure on the canvas.

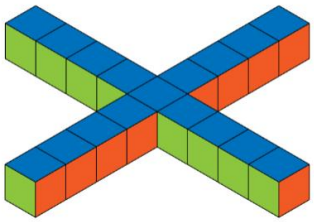
Question 8 (30 marks)

A structure is created using cubes. In this question you will investigate the number of cubes in the structures.

Interact with the stage control to reveal the structure and number of cubes (C).

Stage control

Stage 4: $C = 17$



Question 8a (1 mark)

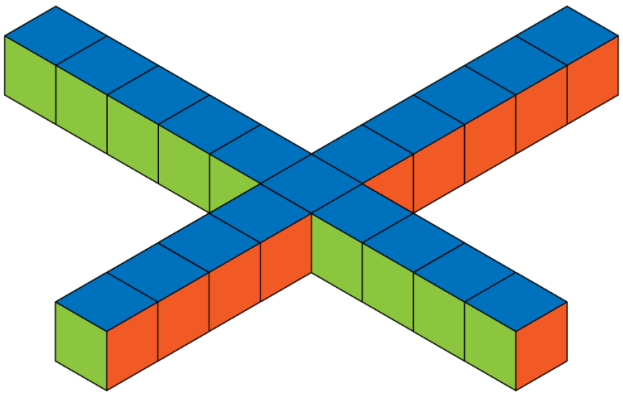
Scroll down to continue

5 by completing the structure on the canvas.

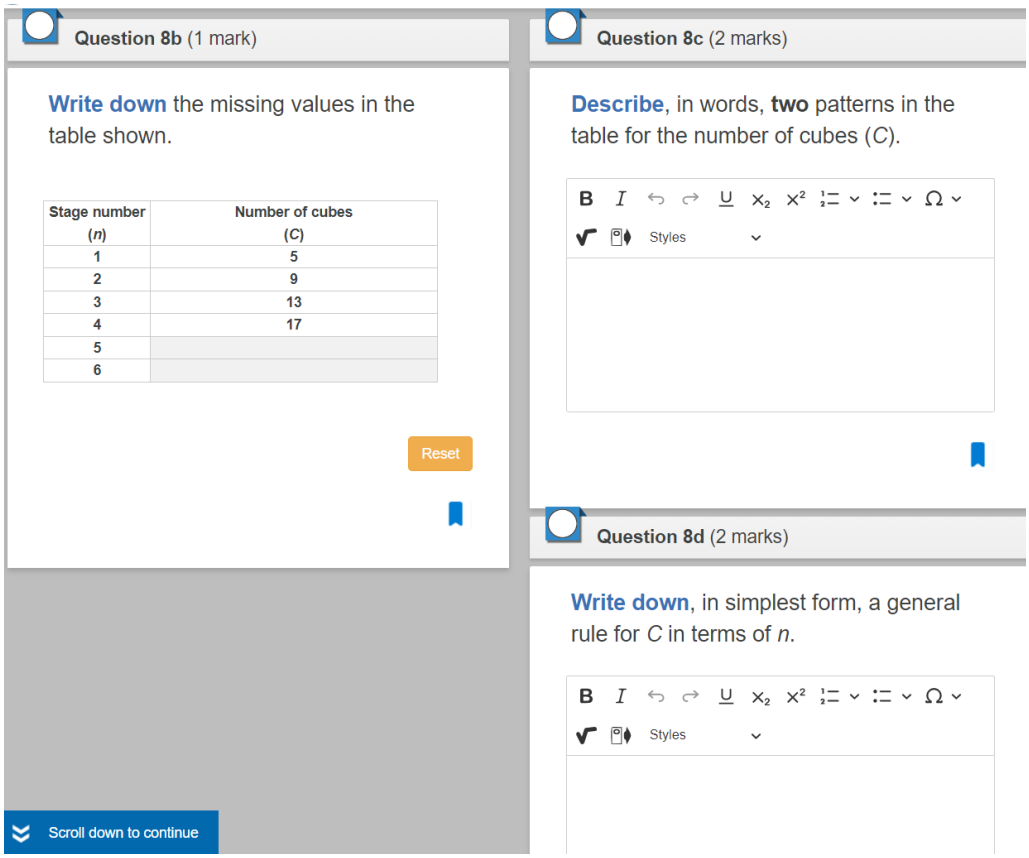
Question 8a (1 mark)

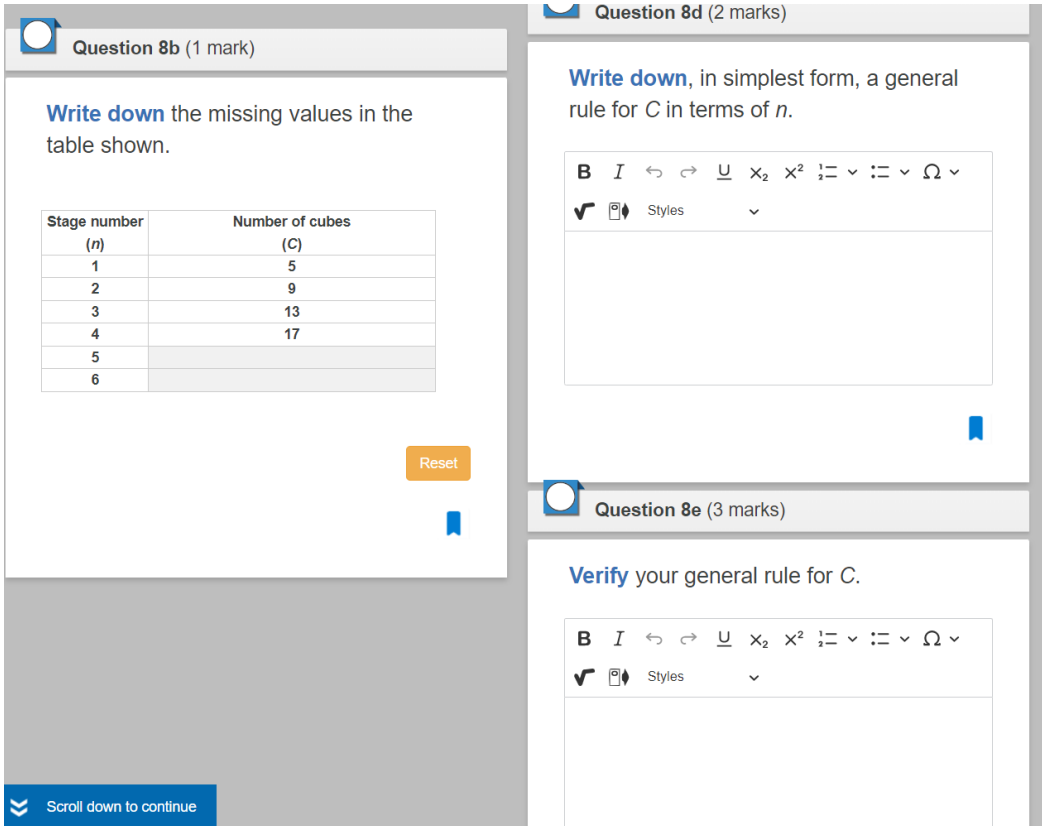
Construct Stage 5 by completing the structure on the canvas.

Draggable cubes:



Scroll down to continue


Question 8b (1 mark)
Write down the missing values in the table shown.
Stage number (n)
Number of cubes (C)
1
5
2
9
3
13
4
17
5
6
Reset
Question 8c (2 marks)
Describe, in words, two patterns in the table for the number of cubes (C).
Styles
Question 8d (2 marks)
Write down, in simplest form, a general rule for C in terms of n.
Styles
Scroll down to continue


Question 8b (1 mark)
Write down the missing values in the table shown.
Stage number (n)
Number of cubes (C)
1
5
2
9
3
13
4
17
5
6
Reset
Scroll down to continue
Question 8d (2 marks)
Write down, in simplest form, a general rule for C in terms of n.
Styles
Question 8e (3 marks)
Verify your general rule for C.
Styles

Question 8f (1 mark)

You will now investigate the total number of cubes in a new structure.

Interact with the stage control to reveal the structure and number of cubes (V).

Stage control

Stage 1: $V = 6$

3D view

Plan view

Write down the number of cubes that will be added to Stage 4 to construct Stage 5.

B I U x_2 x^2 Styles

Scroll down to continue

Question 8f (1 mark)

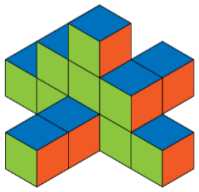
You will now investigate the total number of cubes in a new structure.

Interact with the stage control to reveal the structure and number of cubes (V).

Stage control

Stage 2: $V = 13$

3D view



Plan view

Write down the number of cubes that will be added to Stage 4 to construct Stage 5.

B I U x_2 x^2 Styles

Scroll down to continue

Question 8f (1 mark)

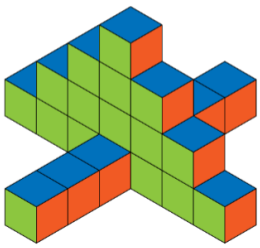
You will now investigate the total number of cubes in a new structure.

Interact with the stage control to reveal the structure and number of cubes (V).

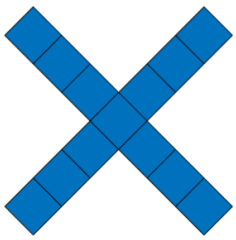
Stage control

Stage 3: $V = 22$

3D view



Plan view



Write down the number of cubes that will be added to Stage 4 to construct Stage 5.

B I U x_2 x^2 Styles

Scroll down to continue

Question 8f (1 mark)

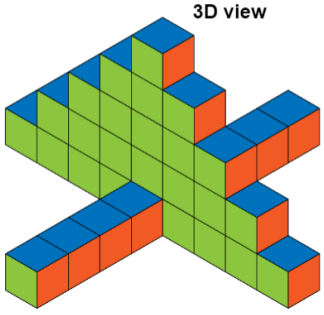
You will now investigate the total number of cubes in a new structure.

Interact with the stage control to reveal the structure and number of cubes (V).

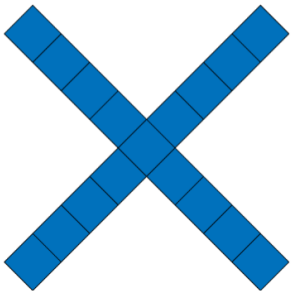
Stage control

Stage 4: $V = 33$

3D view



Plan view



Write down the number of cubes that will be added to Stage 4 to construct Stage 5.

B I U x_2 x^2 Styles

Scroll down to continue

Question 8f (1 mark)

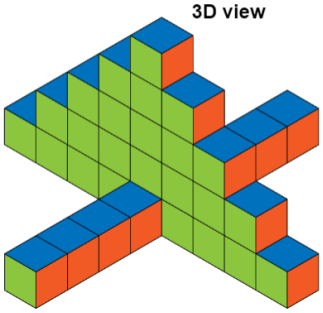
You will now investigate the total number of cubes in a new structure.

Interact with the stage control to reveal the structure and number of cubes (V).

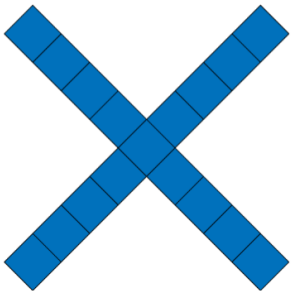
Stage control

Stage 4: $V = 33$

3D view



Plan view



Write down the number of cubes that will be added to Stage 4 to construct Stage 5.

B I U x_2 x^2 Styles

Question 8g (20 marks)

Investigate the values in the table to find a relationship for the number of cubes (V) 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 **two** patterns in the table for the number of cubes (V)
- write down, in simplest form, a general rule for V in terms of n
- test and verify your general rule for V
- justify your general rule for V.

Stage number (n)	Number of cubes (V)	
1	6	
2	13	
3	22	
4	33	
5		
6		

Reset

Styles

Scroll down to continue