



Question 1a (1 mark)

The probability of two events, A and B, are illustrated in the Venn diagram below.

It is given that $P(A' \cap B) = 3x$, $P(A \cap B') = 4x$ and $P(A \cap B) = x$.

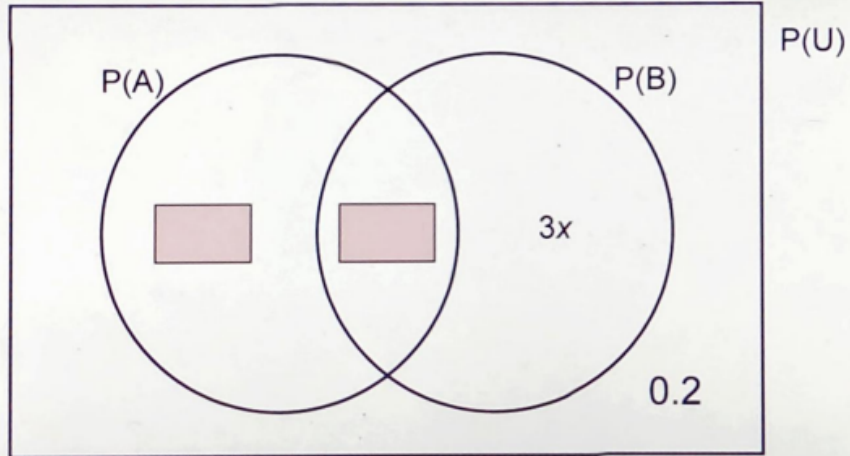
Select the missing probabilities to complete the Venn diagram.



Draggable items:

x

$4x$





Question 1b (1 mark)

Write down the value of $P(A \cup B)$.

B *I* | ← → | U x_2 x^2 | $\frac{1}{2}$ $\frac{3}{2}$ | Ω Σ

Styles ▾



Question 1c (3 marks)

Find the value of $P(A \cap B)$.

B *I* | ← → | U x_2 x^2 | $\frac{1}{2}$ $\frac{3}{2}$ | Ω Σ

Styles ▾





Question 1d (2 marks)

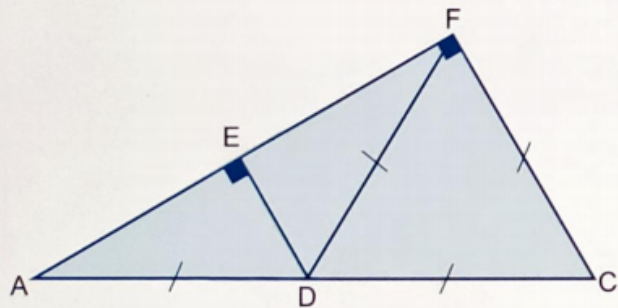
Hence, **identify** if events A and B are mutually exclusive.

B *I* | ← → | x₂ x² | ¶ := := | Ω Σ | Styles ▾ | 📄 ↕





Question 2 (7 marks)



Given that $AD = DC = DF = FC = 5$ m:



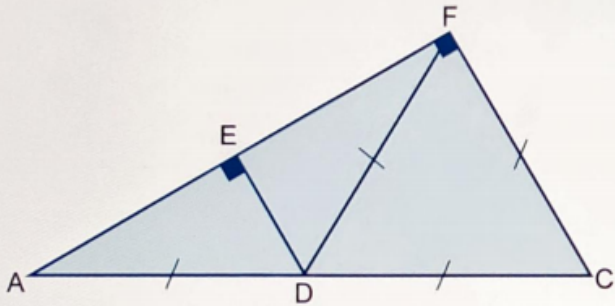
Question 2a (2 marks)

Determine the length of AF.

B *I* \leftarrow \rightarrow \times_2 \times^2 \int $\frac{\square}{\square}$ Ω Σ

Styles \downarrow





Given that $AD = DC = DF = FC = 5$ m:

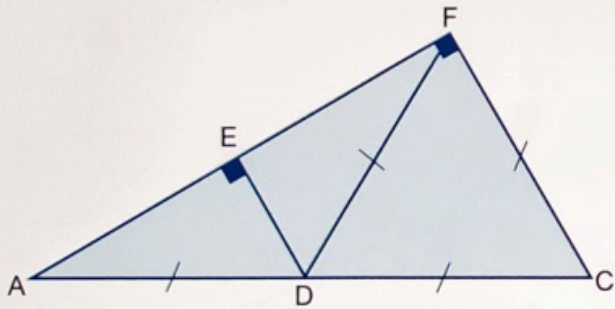


Question 2b (2 marks)

Show that triangle AFC is similar to triangle AED.

B **I** \leftarrow \rightarrow \times_2 \times^2 \equiv \equiv Ω Σ

Styles \downarrow



Given that $AD = DC = DF = FC = 5$ m:



Question 2c (3 marks)

Hence, **find** the length of AE.

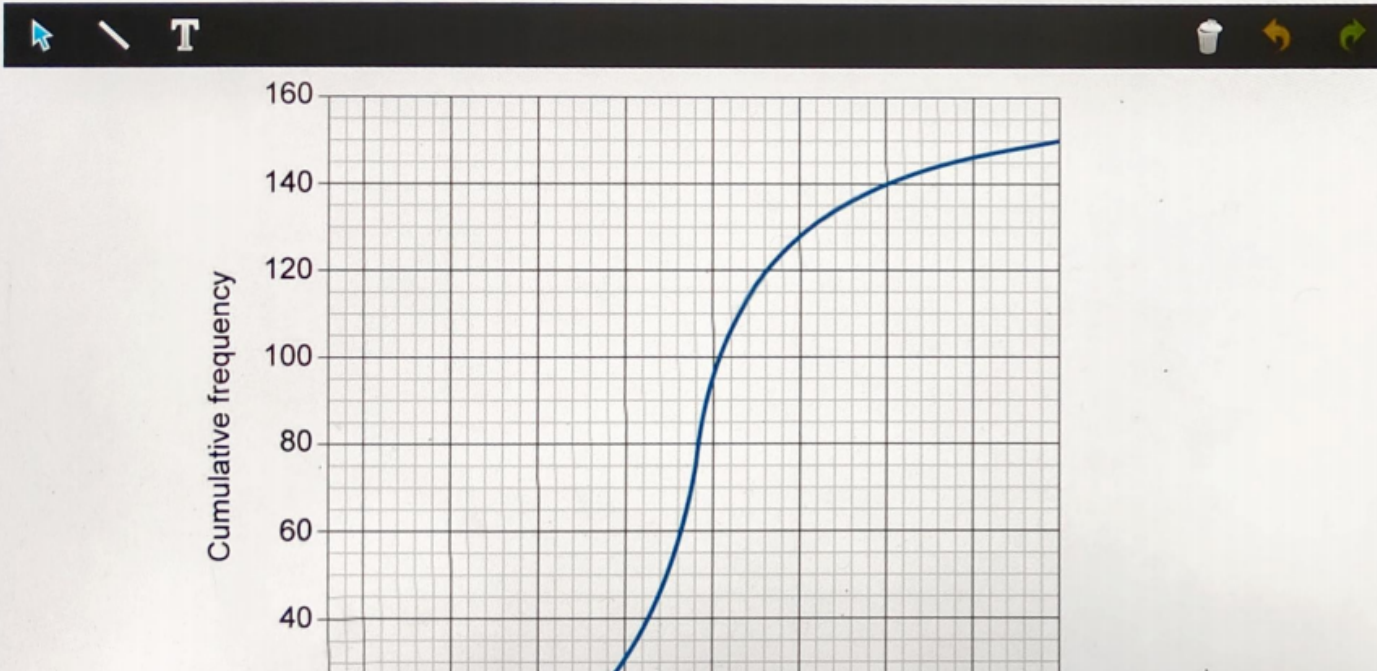
B *I* ← → U x_2 x^2 \int $\frac{d}{dx}$ Ω Σ

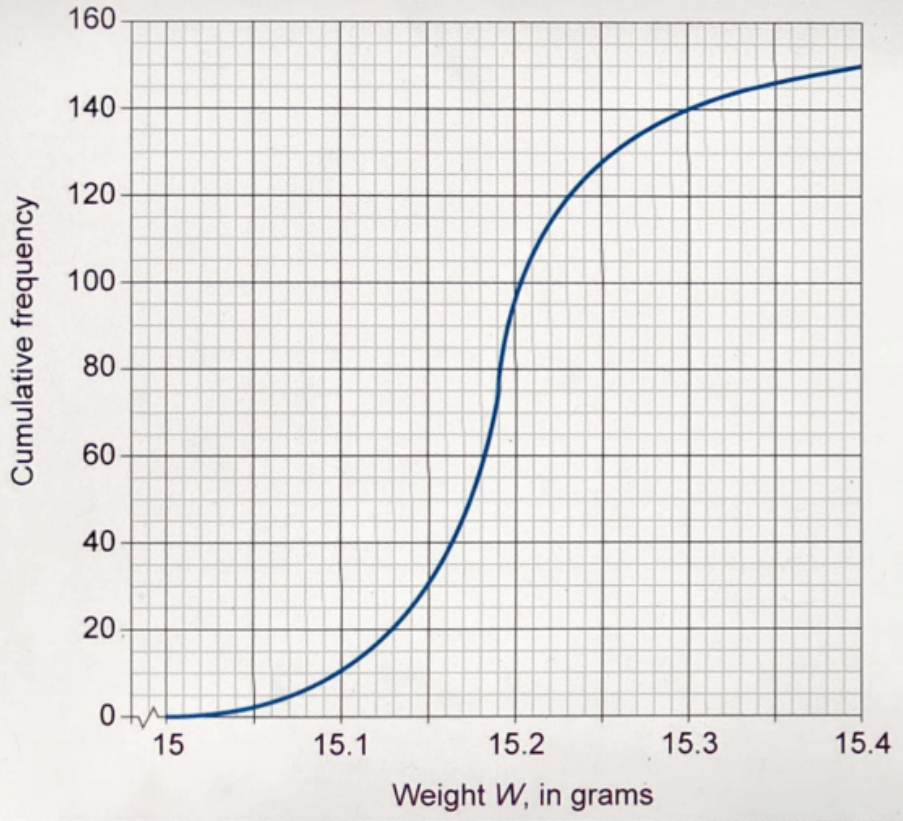
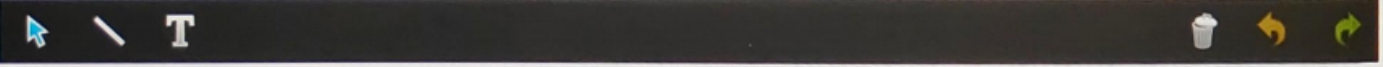
Styles

Question 3a (2 marks)

The following data is based on candy produced in a factory. A quality control manager samples 150 bars of candy and records the weight, W in grams, of each candy bar.

The data is shown in the cumulative frequency graph below.







There are 12 candy bars in a pack. Using the median weight of one bar of candy, **determine** the weight of a pack of candy.

B *I* ← → U \times_2 \times^2 \int \sum Ω Σ

Styles -

The candy is categorized, by weight, into three different sizes.

Weight (grams)	Frequency
$15 \leq W < 15.1$	10
$15.1 \leq W < k$	120
$k \leq W < 15.4$	n



Question 3b (2 marks)

Determine the value of n .

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 "Paste" icon.



The candy is categorized, by weight, into three different sizes.

Weight (grams)	Frequency
$15 \leq W < 15.1$	10
$15.1 \leq W < k$	120
$k \leq W < 15.4$	n



Question 3c (2 marks)

Hence, **determine** the value of k .

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, and Unlink. Below the toolbar is a "Styles" dropdown menu and a "Mobile" icon. The main text area is currently empty.

The candy is categorized, by weight, into three different sizes.

Weight (grams)	Frequency
$15 \leq W < 15.1$	10
$15.1 \leq W < k$	120
$k \leq W < 15.4$	n



Question 3d (3 marks)

6 % of candies are rejected as the size is too large.

Find the minimum weight of the rejected candy.

Rich text editor toolbar with buttons for Bold (B), Italic (I), Undo, Redo, 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 small icon with a double-headed arrow. The main text area is currently empty.

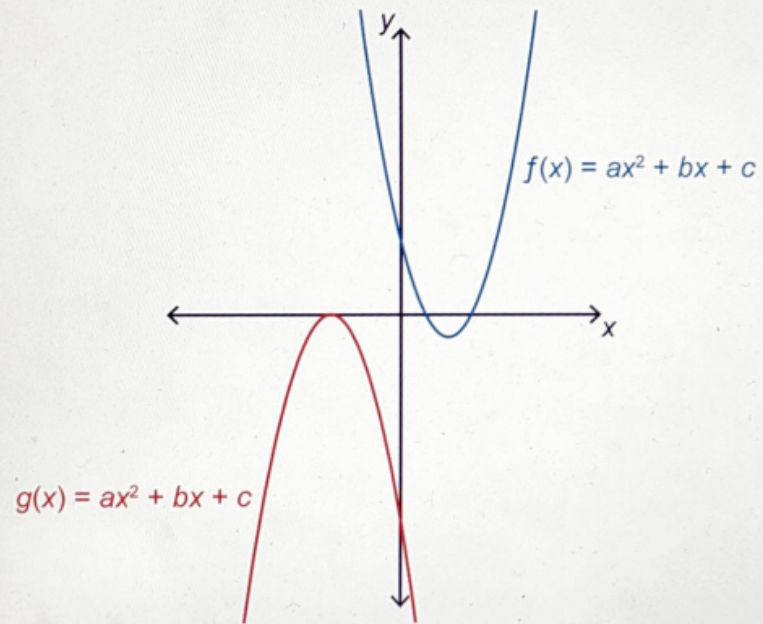




Question 4 (4 marks)



The functions, $f(x)$ and $g(x)$, are shown in the graph below.



The values of a , b and c are different for $f(x)$ and $g(x)$.

Select the correct options to complete the table. Use the draggable items provided.

Draggable items:		a	b	c
Zero	$f(x)$	<input type="text"/>	<input type="text"/>	<input type="text"/>
Positive	$g(x)$	<input type="text"/>	<input type="text"/>	<input type="text"/>
Negative		<input type="text"/>	<input type="text"/>	<input type="text"/>

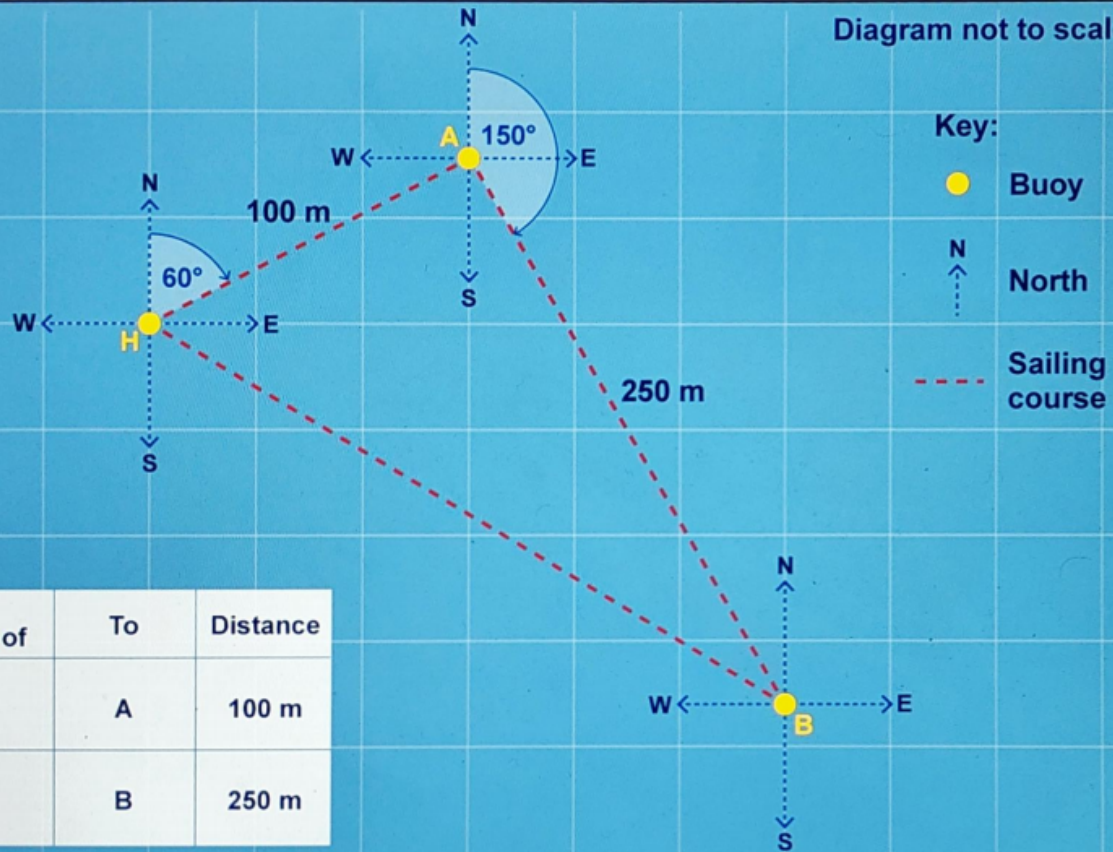


Question 5a (2 marks)

The diagram below shows a sailing course for a yacht race. The route for the course is laid out with buoys that the yachts must pass. The details of the sailing course are provided in the table.



Diagram not to scale



From	On a bearing of	To	Distance
H	060	A	100 m
A	150	B	250 m



Question 5a (2 marks)

Show that the size of the angle HAB is 90 degrees.

B *I* | ← → | x_2 x^2 | $\frac{1}{2}$ = := | Ω Σ

Styles - |



Question 5b (3 marks)

Calculate the distance from B to H to the nearest metre.

B *I* | ← → | x_2 x^2 | $\frac{1}{2}$ = := | Ω Σ

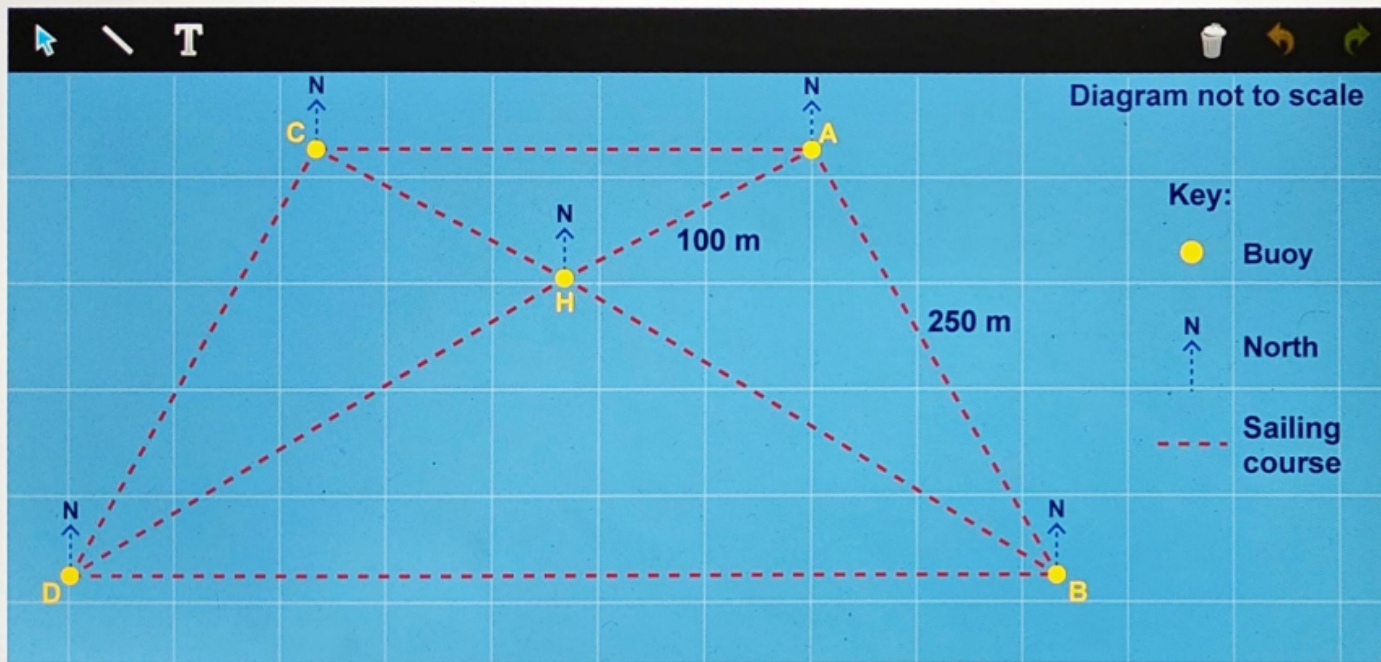
Styles - |





Question 5c (5 marks)

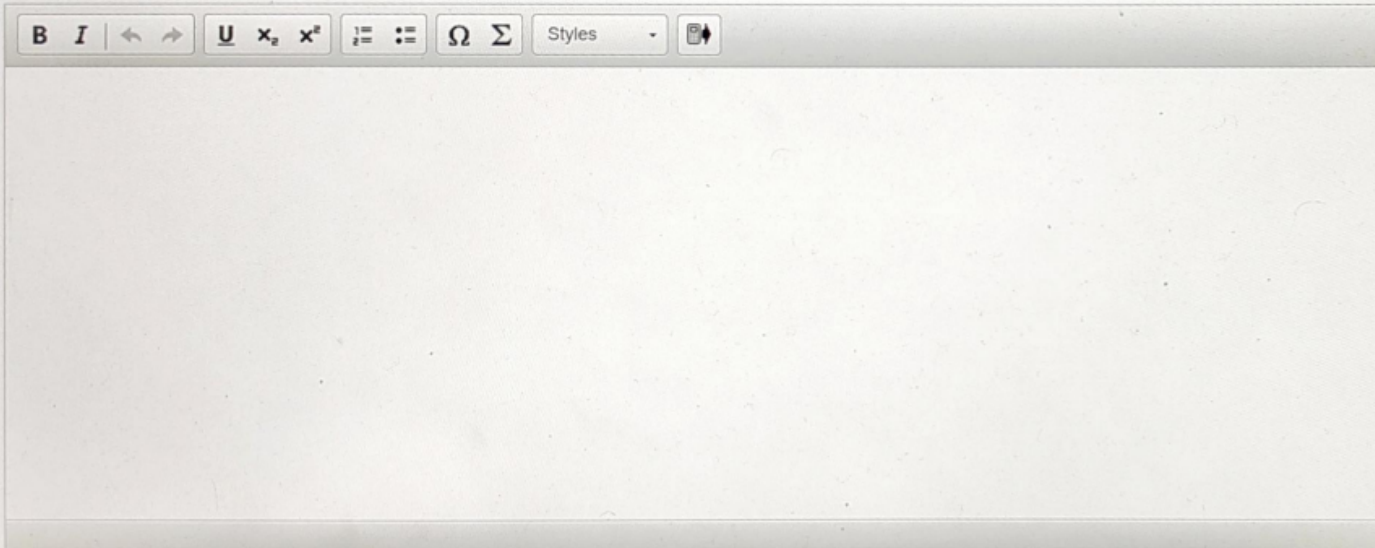
The course for the yacht race is made longer by setting two more buoys at C and D. They are set as a reflection of buoys A and B respectively, on the vertical line passing through buoy H.



The race will start from buoy H and the yachts must pass all the buoys exactly once and return to H.

The route for the race will be in the order H-B-A-C-D-H.

Find the total distance travelled.



A rich text editor toolbar with the following icons from left to right: Bold (B), Italic (I), Undo (left arrow), Redo (right arrow), Underline (U), Subscript (x₂), Superscript (x²), Bulleted List (list with dots), Numbered List (list with numbers), Omega (Ω), Sigma (Σ), a dropdown menu labeled "Styles", and a Help icon (question mark).



Question 6 (12 marks)

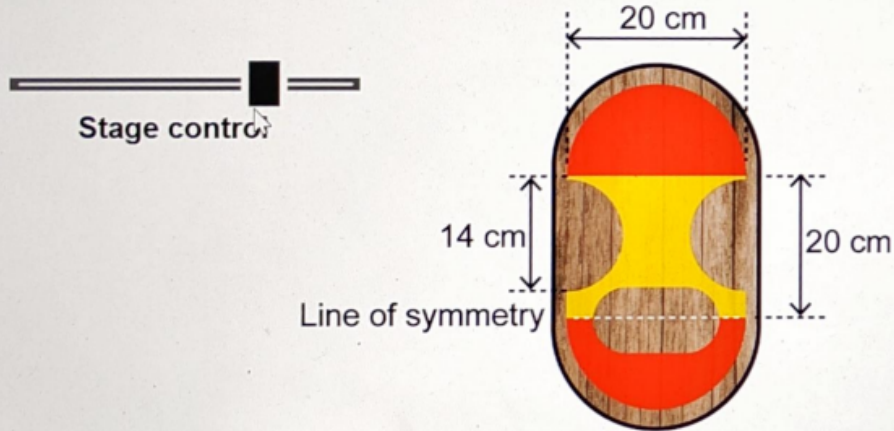


"In Africa, masks serve an important role in rituals or ceremonies with varied purposes like ensuring a good harvest, addressing tribal needs in time of peace or war, or conveying spiritual presences in initiation rituals or burial ceremonies."

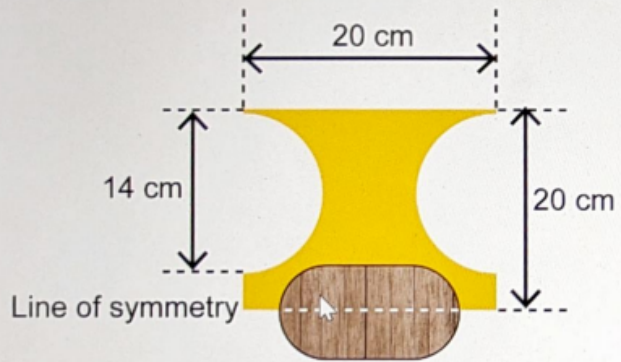
A designer is creating two masks, Mask A and Mask B. They are created using geometrical shapes and symmetrical properties. Interact with the stage control to see how Mask A is created.

Mask A

Diagram not to scale



Stage 3



Key:



Area of mouth 100 cm^2

Show that the area in yellow is 196 cm^2 to the nearest whole number.

B *I* ← → U \times_2 \times^2 $\frac{1}{z}$ z^z Ω Σ

Styles -



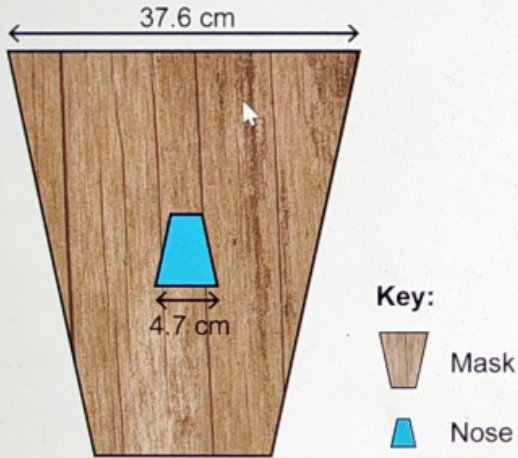


Question 6b (3 marks)

The wooden template for Mask B is shown below.

Mask B

Diagram not to scale



For artistic purposes, the designer wants

The area of the mask is 1184 cm^2 . **Show that** the area of the nose is 18.5 cm^2 .

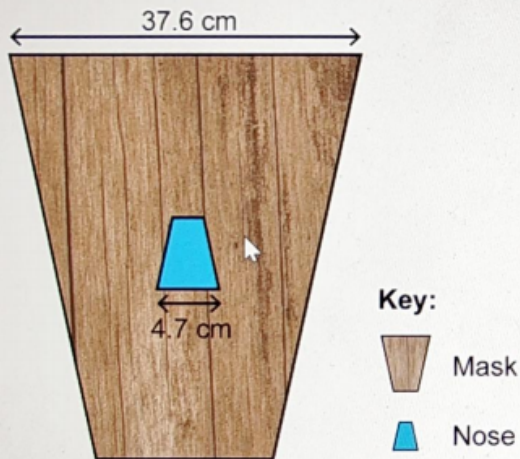
Rich text editor toolbar with buttons for Bold (B), Italic (I), Undo, Redo, Underline (U), Subscript (x_2), Superscript (x^2), Bulleted List, Numbered List, Link, and Unlink. Below the toolbar is a text input area.



The wooden template for Mask B is shown below.

Mask B

Diagram not to scale



For artistic purposes, the designer wants the mask and nose to be in the shape of **similar** trapeziums.

The area of the mask is 1184 cm^2 . **Show that** the area of the nose is 18.5 cm^2 .

Rich text editor toolbar with buttons for Bold (B), Italic (I), Undo, Redo, Underline (U), Text Color (x), Background Color (x), Bulleted List, Numbered List, Link (Ω), and Unlink (Σ). Below the toolbar is a text input area.



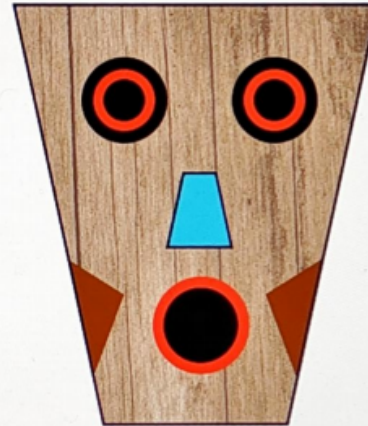


Question 6c (5 marks)


The decoration of Mask B is not complete; the designer will now add triangles of two sizes using yellow paint.


Mask B is decorated with the following instructions:

- the yellow paint available can cover a total area of 80 cm^2
- use yellow paint to add triangles of two sizes
 - small triangle with area of 2 cm^2
 - big triangle with area of 5 cm^2
- the number of small triangles must be equal to 4 times the number of big triangles



Key:
Area of triangles

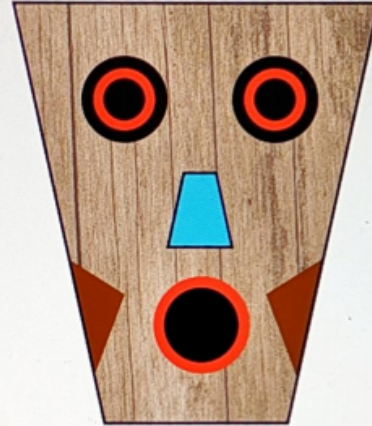
 2 cm^2

 5 cm^2

Given that:

Mask B is decorated with the following instructions:

- the yellow paint available can cover a total area of 80 cm^2
- use yellow paint to add triangles of two sizes
 - small triangle with area of 2 cm^2
 - big triangle with area of 5 cm^2
- the number of small triangles must be equal to 4 times the number of big triangles



Key:

Area of triangles



2 cm^2



5 cm^2

Given that:

x : number of small triangles

y : number of big triangles

$$x = 4y$$

triangles

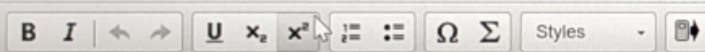
Given that:

x : number of small triangles

y : number of big triangles

$$x = 4y$$

Given that there is only 80 cm^2 of yellow paint available, **find** the maximum number of small and big triangles that can be added to the mask.



Theatre performances are an important form of how society gathers to enjoy and appreciate creative expression. The first examples of theatre performances are thought to date back as far as the 6th century BCE.

Theatre seating is designed to ensure that audiences can enjoy performances from anywhere in the space. Tiered seating is proven to provide the best experience.

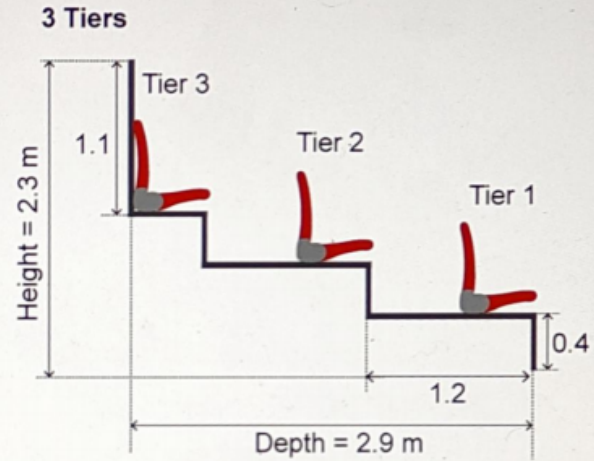
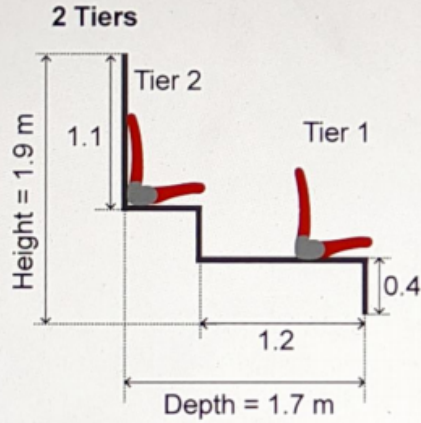
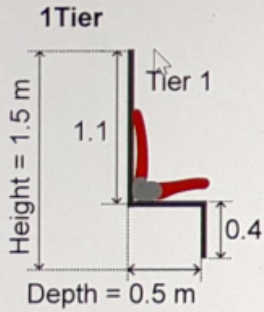
Many small theatres use mobile tiered seating that can be folded away when not in use. Here we have an example of a tiered seating design.

The manufacturers of the mobile seating systems must adhere to the following safety requirements when producing the seating:

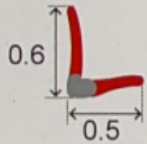
- there must be safety barriers on the side and back of the seating
- the tiered seating must not be above 6 metres high.
- six seats are connected to create sections of seats.
- there must be a gap of 1.5 metres between sections of seats.
- and there must be exit spaces of at least 2 metres on each side of the tiered seating.

In this question you will explore the possible designs for tiered seating for this theatre space.

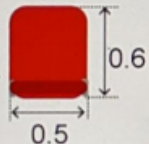
Below is a cross-sectional view of tiered theatre seating.



Seat dimensions



Side view



Front view



Question 7a (3 marks)

Calculate the maximum number of tiers for a height of 6 metres.

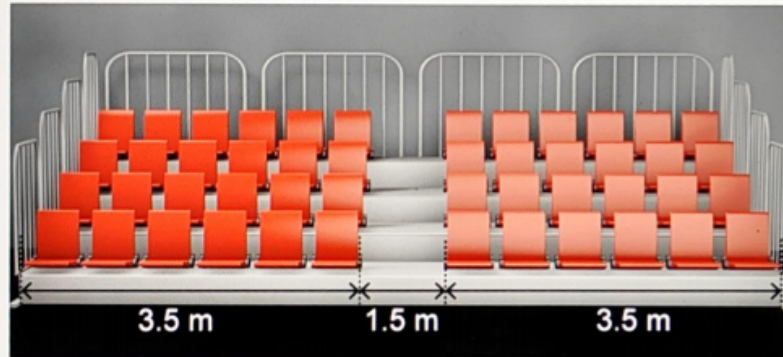
B *I* | ← → U x_2 x^2 $\frac{1}{2}$ $\frac{3}{4}$ Ω Σ Styles -





Question 7b (3 marks)

Each section of seating is 3.5 m wide. For access and safety a 1.5 m gap must be left between each section of seating and 2 m at the ends of each side.





Let x represent the maximum possible number of sections of seating per row that will fit in a theatre of width of 30 m.

Show that $x = 5$.

B *I* | ← → | x_2 x^2 | $\frac{1}{2}$ $\frac{3}{4}$ | Ω Σ | Styles |



Question 7c (10 marks)

The maximum seating capacity for the theatre is 348.


Using the constraints and your answers from previous parts, **design** tiered seating for the theatre for the maximum number of people.

In your answer you should:

- clearly identify **three** relevant factors
- make calculations for the number of seats per row
- make calculations for the number of seats for the whole tiered seating
- use the canvas to illustrate your design
- justify whether your design makes the best use of the theatre space.


Three relevant factors

B *I* | ← → | U x_2 x^2 | \int \sum | Ω Σ

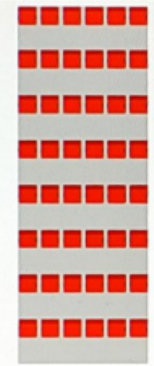
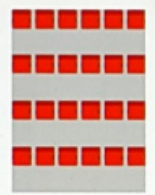
Styles ▾ 

Calculations and justification

B *I* | ← → | U x_2 x^2 | \int \sum | Ω Σ

Styles ▾ 

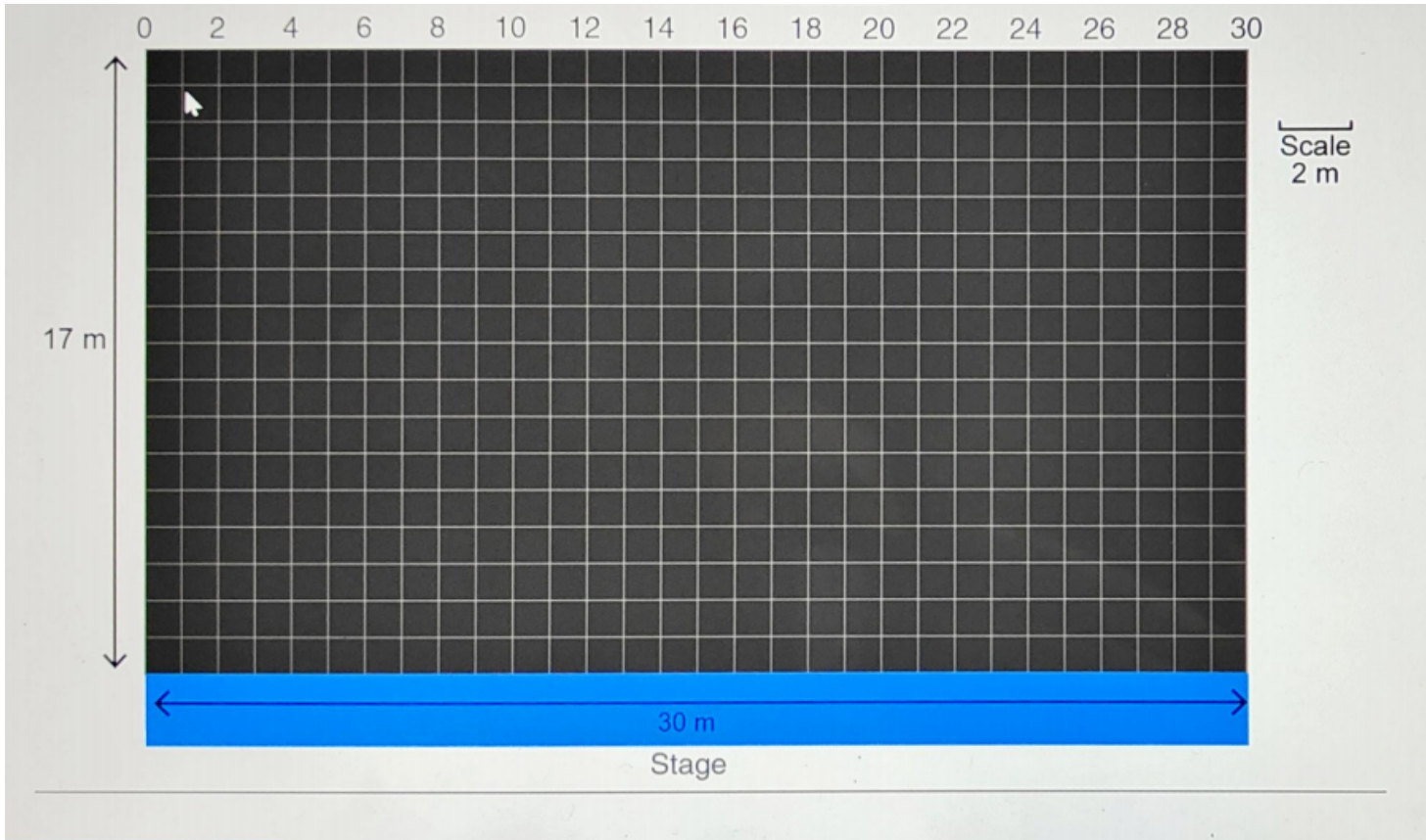
Draggable items:



Key:



6 seats per section of seats



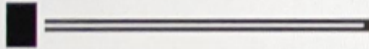


Question 8 (33 marks)



In this task you will investigate triangles.

Interact with the stage control to see how the equilateral triangles are formed.



Stage control

Stage 1



1 triangle

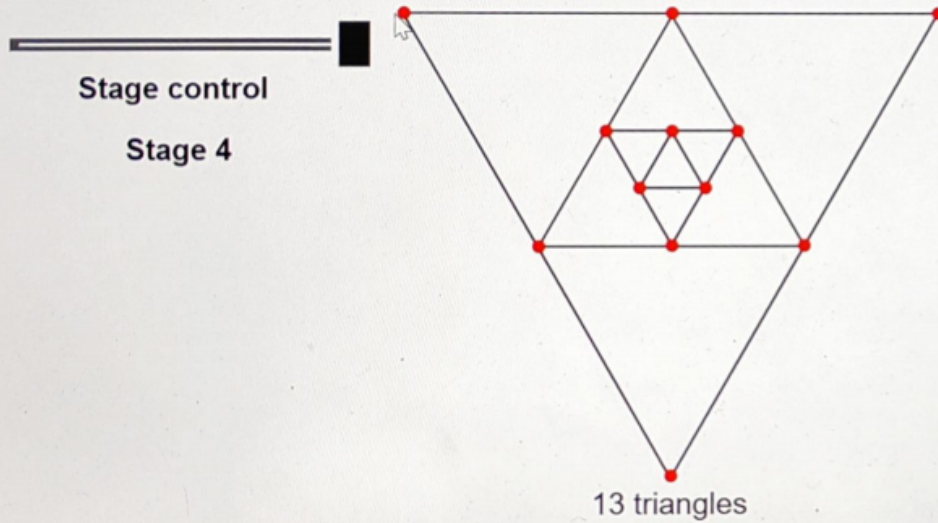


Question 8 (33 marks)



In this task you will investigate triangles.

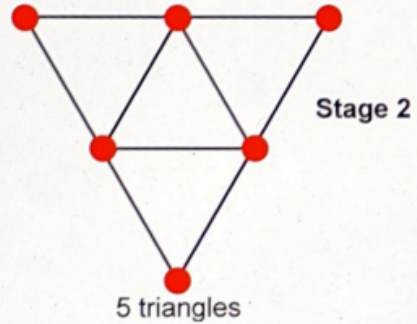
Interact with the stage control to see how the equilateral triangles are formed.





Question 8a (1 mark)

Describe how stage 2 includes 5 triangles.





Question 8b (1 mark)

The table below shows number of triangles in each stage.

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

Stage (n)	Number of triangles (T)
1	1
2	5
3	9
4	13
5	
6	



Question 8c (2 marks)

Describe in words two patterns in the table for the number of triangles (T).

B **I** ← → U \times_2 \times^2 $\frac{1}{2}$ $\frac{1}{3}$ Ω Σ

Styles -





Question 8b (1 mark)

The table below shows number of triangles in each stage.

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

Stage (n)	Number of triangles (T)
1	1
2	5
3	9
4	13
5	
6	

Reset



Question 8d (2 marks)

Write down a general rule for T in terms of n .

Rich text editor toolbar with icons 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 "Styles" dropdown menu and a "Text" icon.

The table below shows number of triangles in each stage.

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

Stage (n)	Number of triangles (T)
1	1
2	5
3	9
4	13
5	
6	

Reset



Question 8e (3 marks)

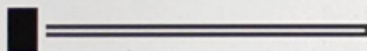
Verify your general rule for T .

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 (Ω), and Insert table (Σ). Below the toolbar is a "Styles" dropdown menu and a "Paste" icon. The main area is a large empty text box for entering the answer.



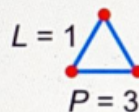
Question 8f (1 mark)

Interact with the stage control to see how the perimeter (P) of the outer triangle increases.



Stage control

Stage 1



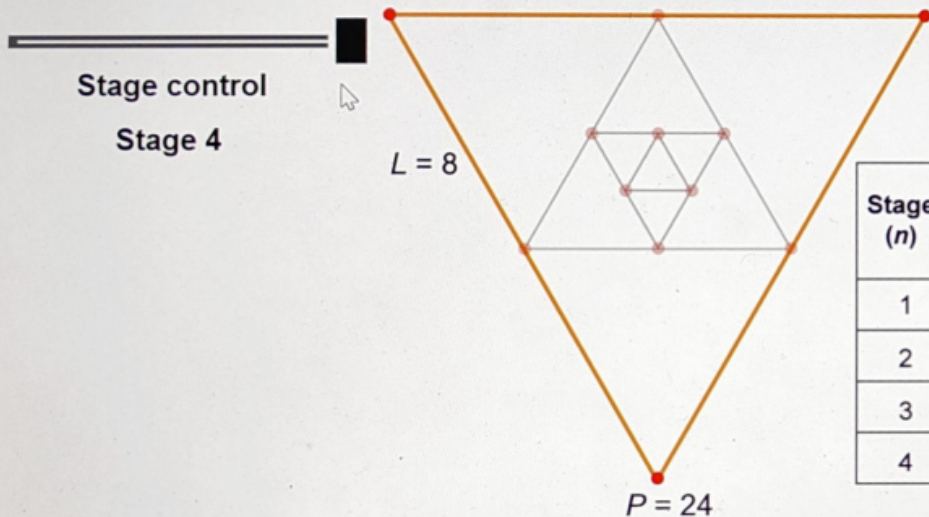
Stage (n)	Side length of outer triangle (L)	Perimeter (P)
1	1	3
2		
3		
4		

Show that the perimeter of the outer triangle in stage 4 is 24.



Question 8f (1 mark)

Interact with the stage control to see how the perimeter (P) of the outer triangle increases.



Stage (n)	Side length of outer triangle (L)	Perimeter (P)
1	1	3
2	2	6
3	4	12
4	8	24

Show that the perimeter of the outer triangle in stage 4 is 24.



Question 8g (23 marks)

Investigate the values in the table to find a relationship for the perimeter (P) 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 the side length (L)
- describe in words a pattern in the table for the perimeter (P)
- write down a general rule for P in terms of n
- test and verify your general rule for P
- justify your general rule for P in relation to the triangles.

Stage (n)	Side length of outer triangle (L)	Perimeter (P)
1	1	3
2	2	6
3	4	12
4	8	24
5		
6		