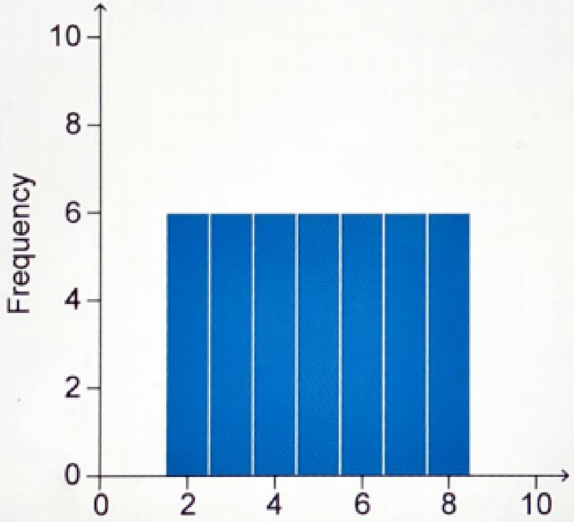
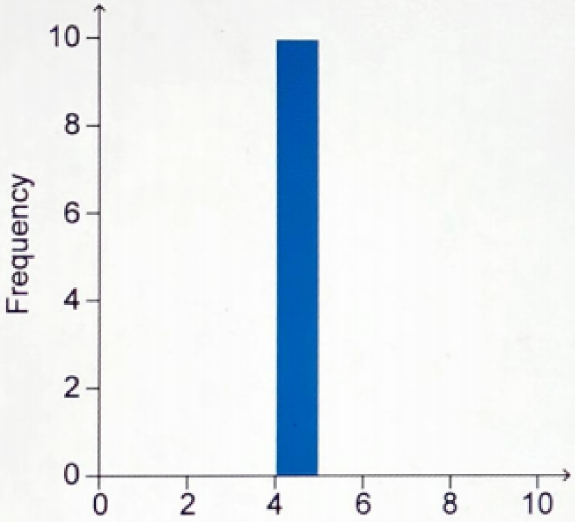
Question 1 (4 marks)

Select the term from the drop-down menu which correctly describes the distribution of each graph.



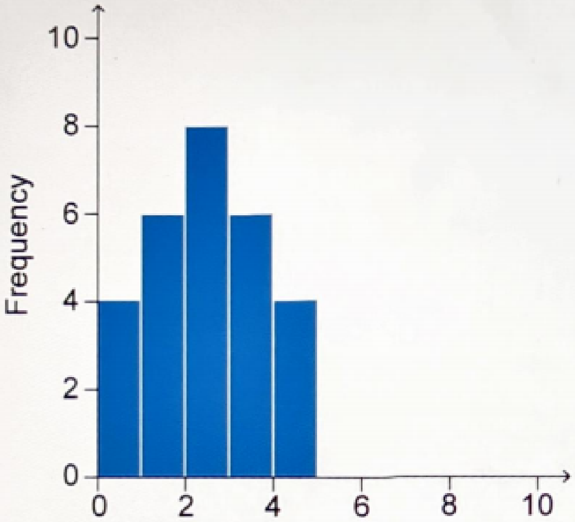
Select
Zero
Large

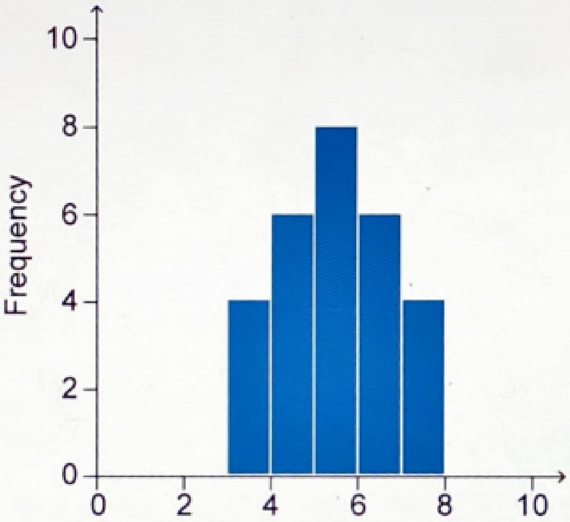
Select standard deviation



Select standard deviation

Select
Zero
Large

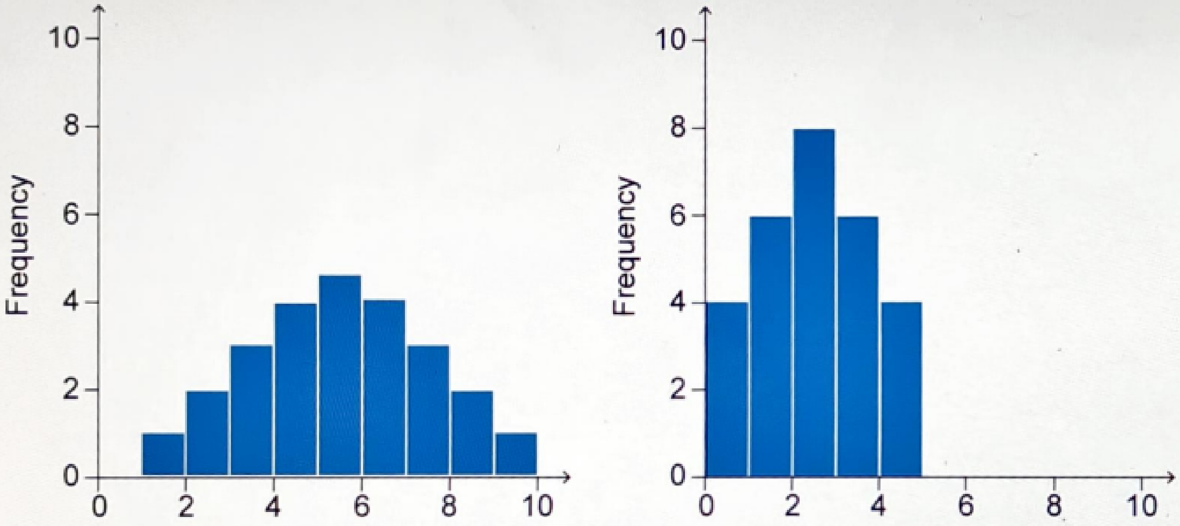




Select mean

Select standard deviation

Select
Same
Different



Select mean

Select

Same

Different

standard deviation

Question 2 (8 marks)

Two events, A and B, are such that

$P(A) = \frac{18}{25}$, $P(A \mid B) = \frac{2}{3}$ and $P(A \cap B) = \frac{8}{25}$.

Question 2a (3 marks)

Find P(B).

B I U x₂ x² Ω Σ

Styles

Two events, A and B, are such that

$P(A) = \frac{18}{25}$, $P(A|B) = \frac{2}{3}$ and $P(A \cap B) = \frac{8}{25}$.

Question 2b (3 marks)

Show that events A and B are not independent.

B I U x₂ x² Ω Σ

Styles

Two events, A and B, are such that

$P(A) = \frac{18}{25}$, $P(A \mid B) = \frac{2}{3}$ and $P(A \cap B) = \frac{8}{25}$.

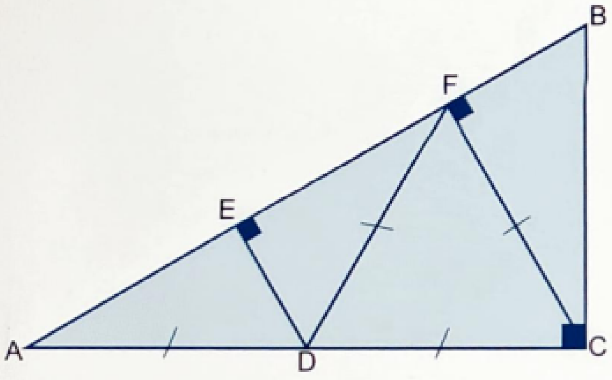
Question 2c (2 marks)

Find $P(A \cup B)$.

B I U Ω Σ

Styles

Question 3 (7 marks)

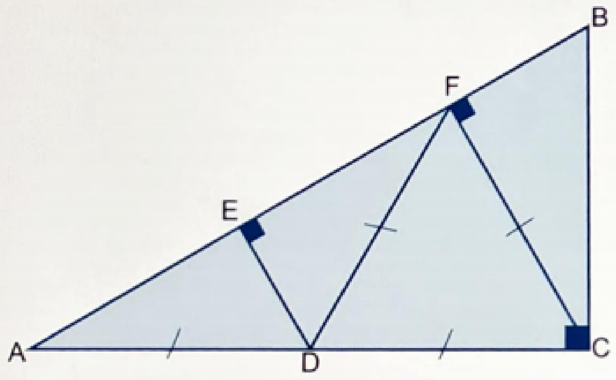


Given that AD = DC = DF = FC = 5 m:

Question 3a (2 marks)

Determine the length of AF.

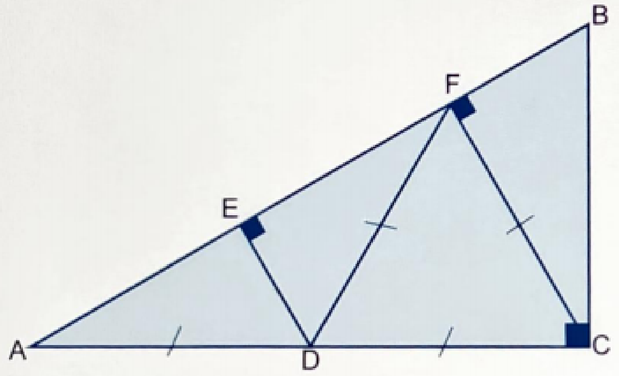
Styles



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

Question 3b (2 marks)

Show that triangle AFC is similar to triangle ACB.



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

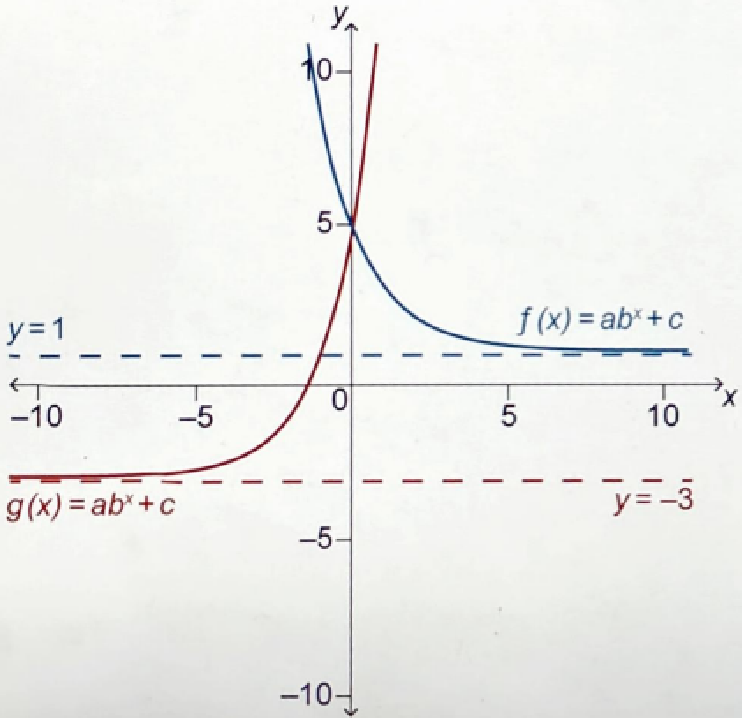
Question 3c (3 marks)

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

B I U x_2 x^2 Ω Σ
Styles

Question 4 (4 marks)

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



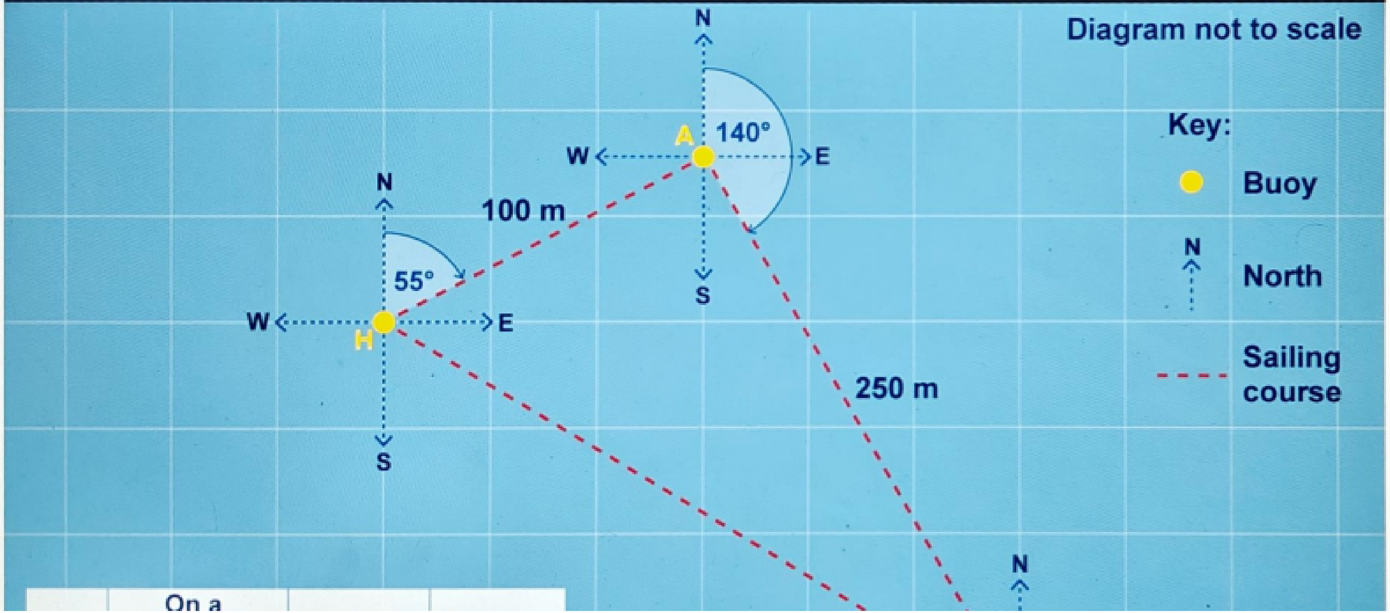
The values of a, b and c are different for $f(x)$ and $g(x)$.

Select the correct values to complete the table. Use the draggable values provided.

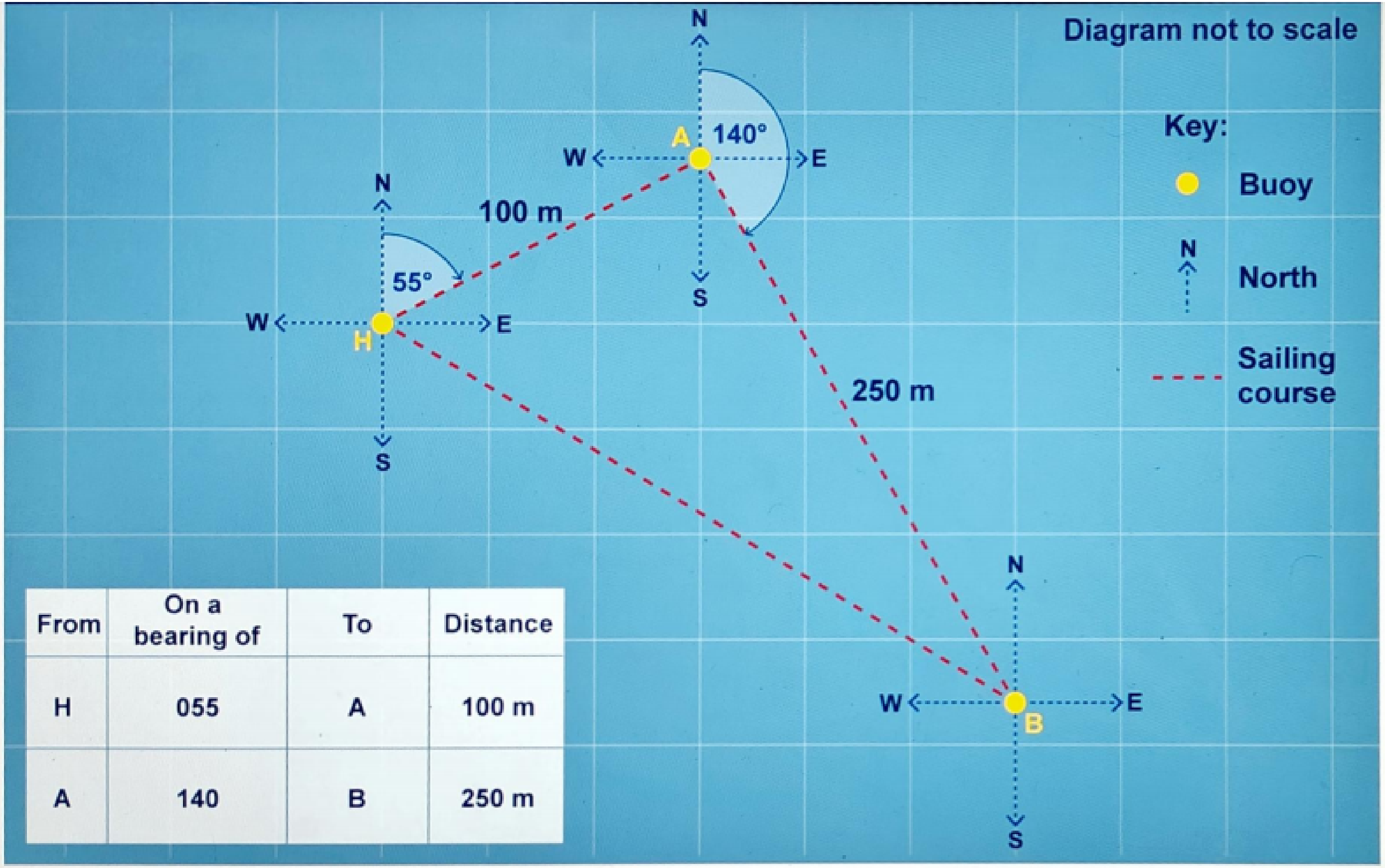
Draggable items:		a	b	c
–3, 0.5, 1	$f(x)$			
4, 8	$g(x)$		2	

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.



On a



From	On a bearing of	To	Distance
H	055	A	100 m
A	140	B	250 m

Question 5a (2 marks)

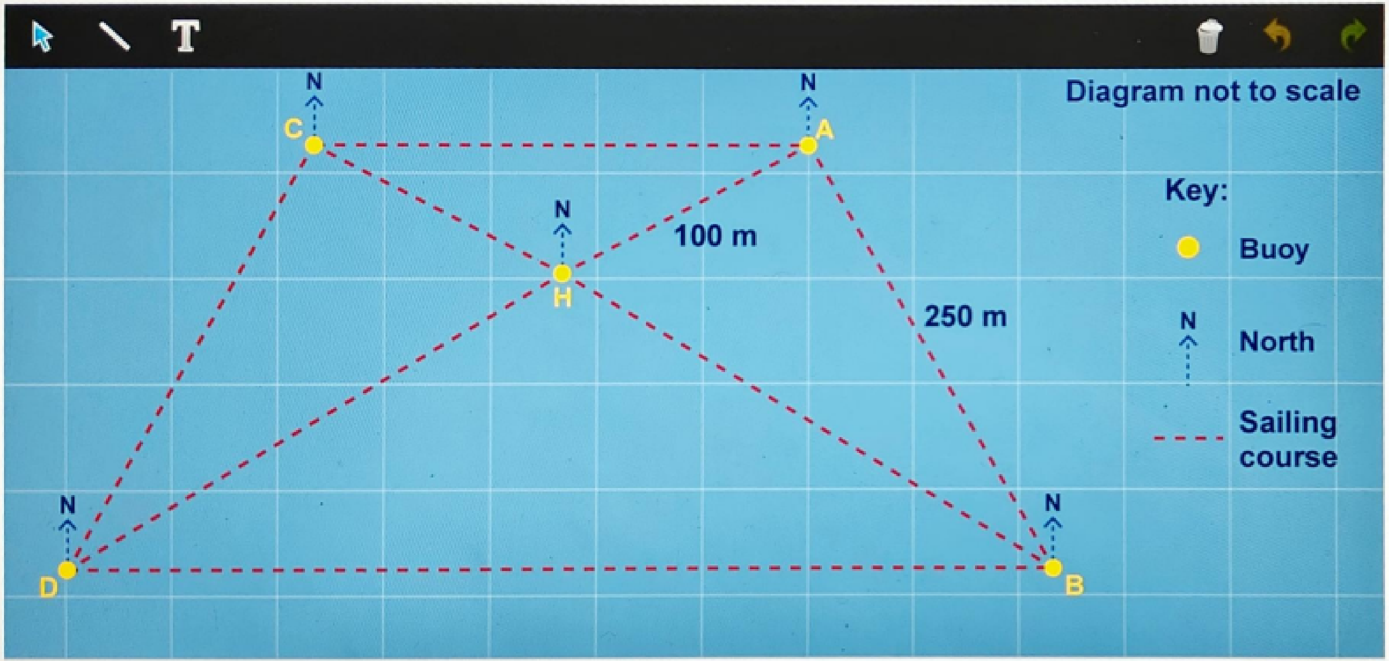
Show that the size of the angle HAB is 95 degrees.

Question 5b (3 marks)

Calculate the distance from B to H.

Question 5c (1 mark)

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 buoy H.



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

Question 5c (1 mark)

Write down the route with the minimum total distance.

B I U Ω Σ
Styles

Question 5d (5 marks)

Hence, **find** this minimum total distance.

B I U Ω Σ
Styles

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."

Question 6a (4 marks)

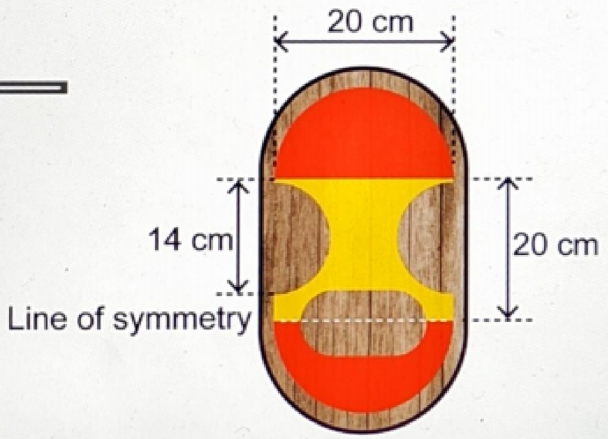
A designer is creating two masks, Mask A and Mask B. They are created using geometrical shapes and symmetrical properties. Interact with the stage control to see how Mask A is created.

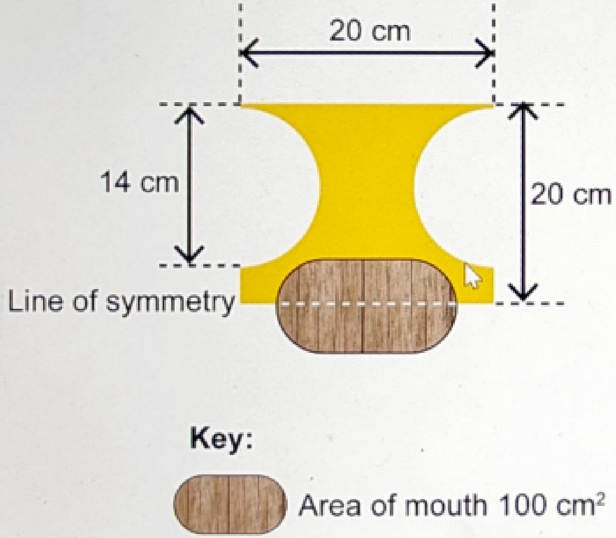
Mask A

Diagram not to scale

Stage 3

Stage control





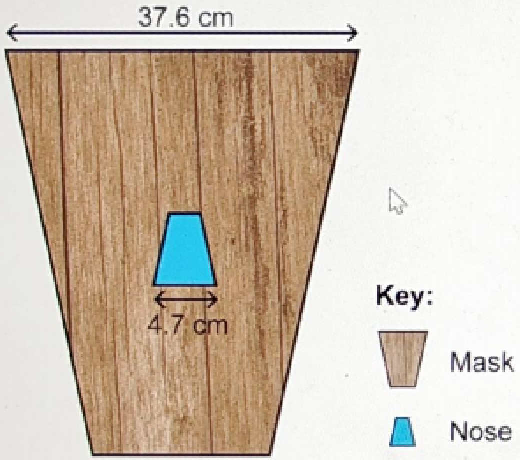
Show that the area in yellow is 196 cm^2 to the nearest whole number.

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 mask and nose to be in the shape of similar trapeziums

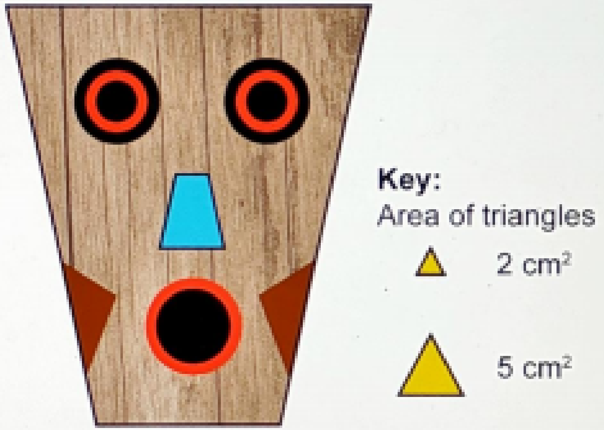
The area of the mask is 1184 cm^2. **Show that** the area of the nose is 18.5 cm^2.

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



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.

Video Script

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.

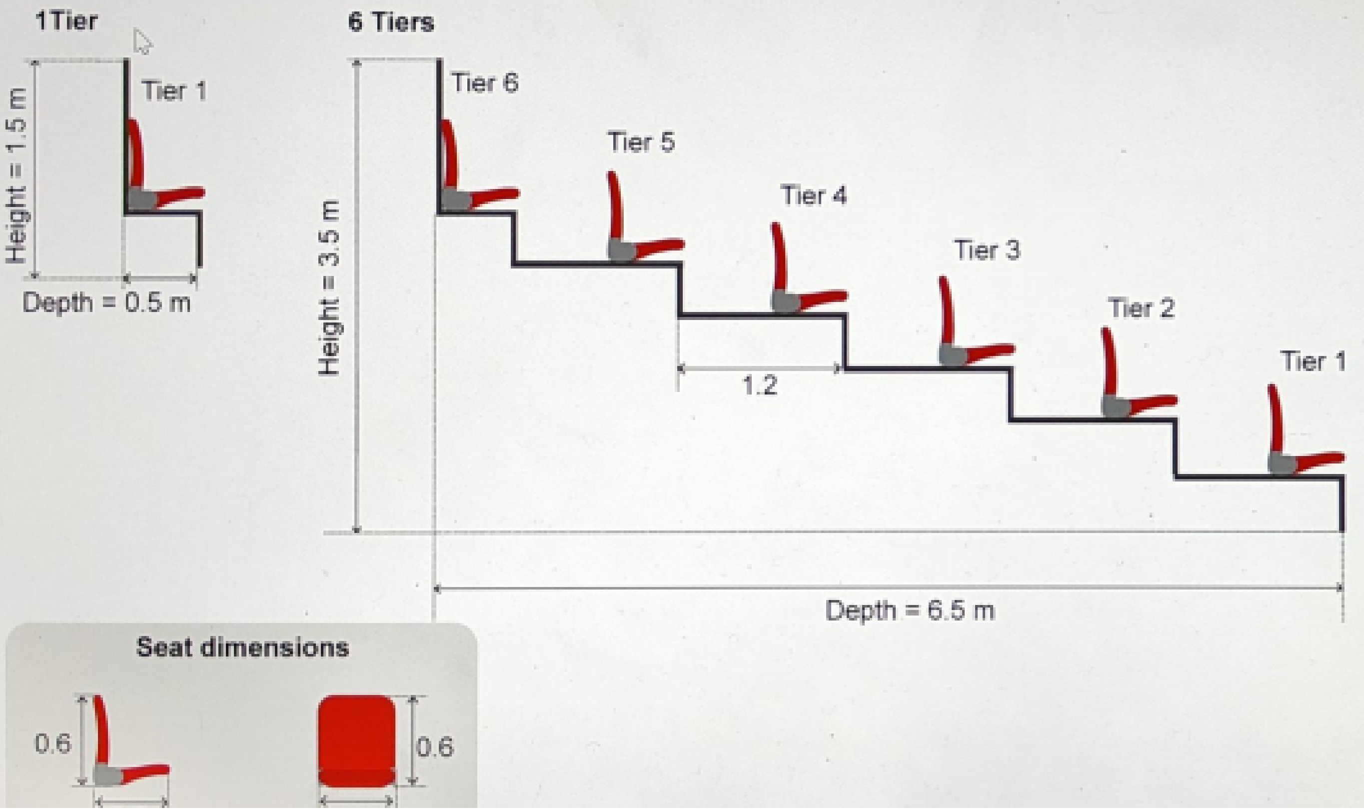
Many small theatres use mobile tiered seating that can be folded away when not in use. Here we have an example of a tiered seating design.

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

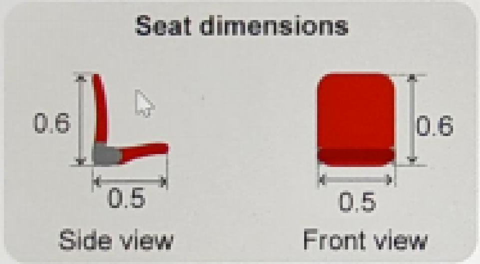
- there must be safety barriers on the side and back of the seating
- the tiered seating must not be above 6 metres high.
- six seats are connected to create sections of seats.
- there must be a gap of 1.5 metres between sections of seats.
- and there must be exit spaces of at least 2 metres on each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



Depth = 6.5 m



Question 7a (2 marks)

In the tiered seating illustrated above, the height of the first tier is 1.5 m, the height of the sixth tier is 3.5 m. The heights of the tiers form an arithmetic sequence.

Determine the value of the common difference between heights of tiers.

B I U x_2 x^2 Ω Σ Styles

Question 7b (1 mark)

Write down the general term to determine the height (H_n) of the tiered seating in the nth row.

B *I* U x_2 x^2 Ω Σ Styles

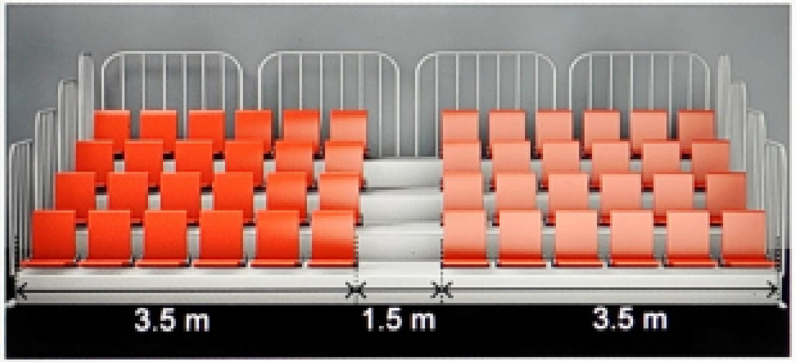
Question 7c (2 marks)

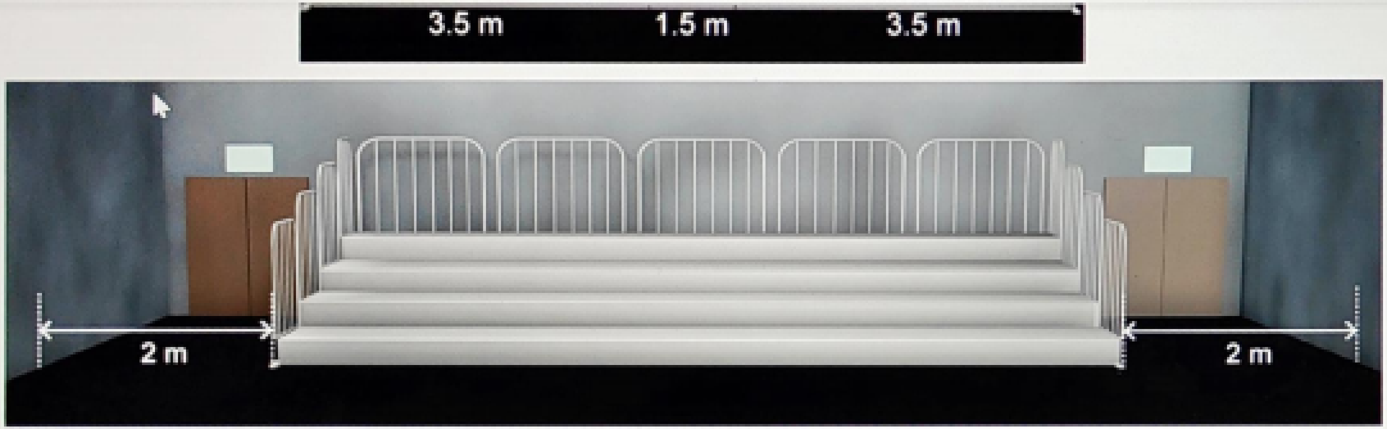
Determine the height of **twelve** tiers.

B I U x₂ x² Ω Σ Styles

Question 7d (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 $x = 5$.

Question 7e (3 marks)

x represents the number of sections of seating per row

y represents the number of tiers

Below are the constraints for the theatre

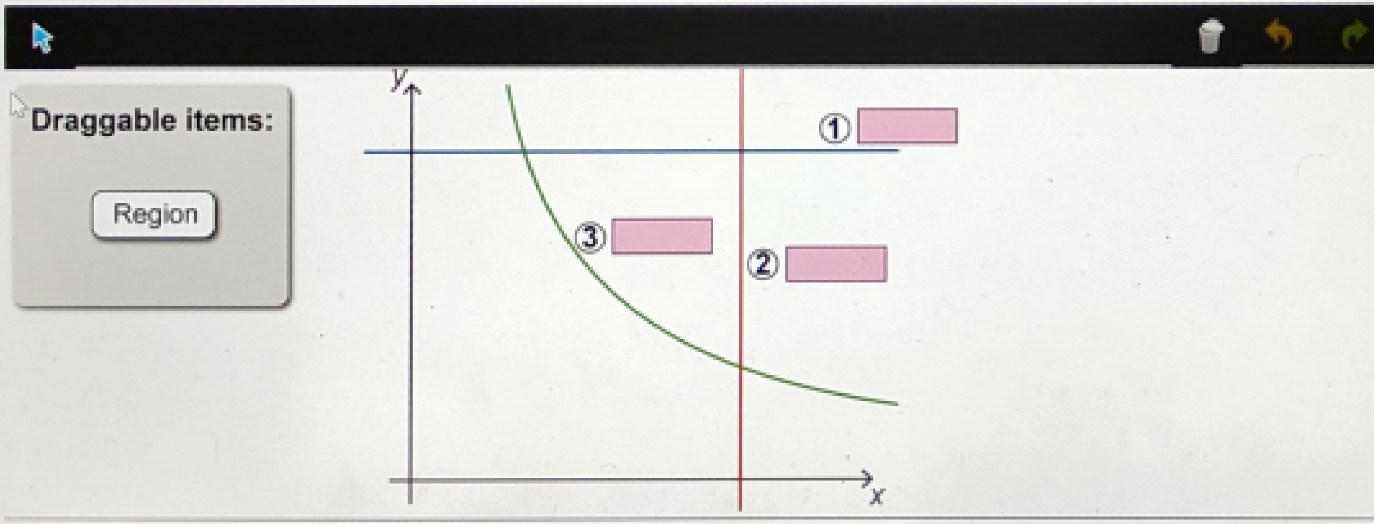
Constraint 1: The horizontal width of the theatre is 30 m
Constraint 2: The vertical height of the tiers must be at most 6 m
Constraint 3: The maximum seating capacity for the theatre is 348

Using your answers from previous parts:

- **label** the equations of line ①, line ② and line ③
- **identify** the region that satisfies all constraints.

Using your answers from previous parts:

- **label** the equations of line ①, line ② and line ③
- **identify** the region that satisfies all constraints.



Question 7f (10 marks)

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

Calculations and justification

Draggable items:
Key:
6 seats per
section of seats
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
Scale
2 m
17 m

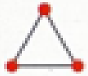

0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
7 m
Scale
2 m
30 m
Stage

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 1



1 triangle

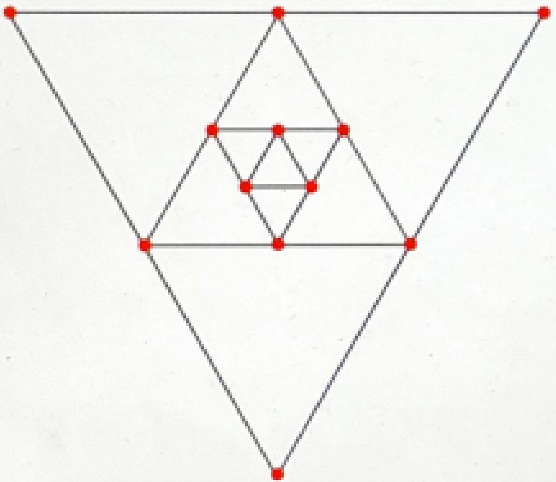
Question 8 (33 marks)

In this task you will investigate triangles.

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

Stage control

Stage 4



13 triangles

The table below shows number of triangles in each stage.

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

Question 8a (2 marks)

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

B I U x_2 x^2 Ω Σ

Styles

The table below shows number of triangles in each stage.

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

Question 8b (2 marks)

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

Question 8c (3 marks)

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

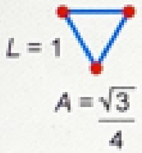
Verify your general rule for T.

Question 8d (3 marks)

Interact with the stage contol to see how the area (A) of the outer triangle increases.

Stage control

Stage 1

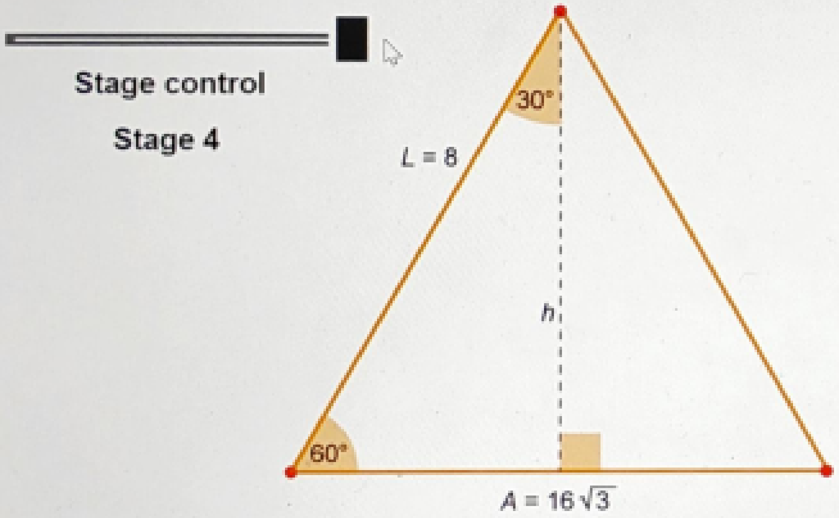


Stage (n)	Side length of outer triangle (L)	Area (A)
1	1	$\frac{\sqrt{3}}{4}$
2		
3		
4		

Show that the area of the outer triangle in stage 4 is $16\sqrt{3}$.

Question 8d (3 marks)

Interact with the stage contol to see how the area (A) of the outer triangle increases.



Stage (n)	Side length of outer triangle (L)	Area (A)
1	1	$\frac{\sqrt{3}}{4}$
2	2	$\sqrt{3}$
3	4	$4\sqrt{3}$
4	8	$16\sqrt{3}$

Show that the area of the outer triangle in stage 4 is $16\sqrt{3}$.

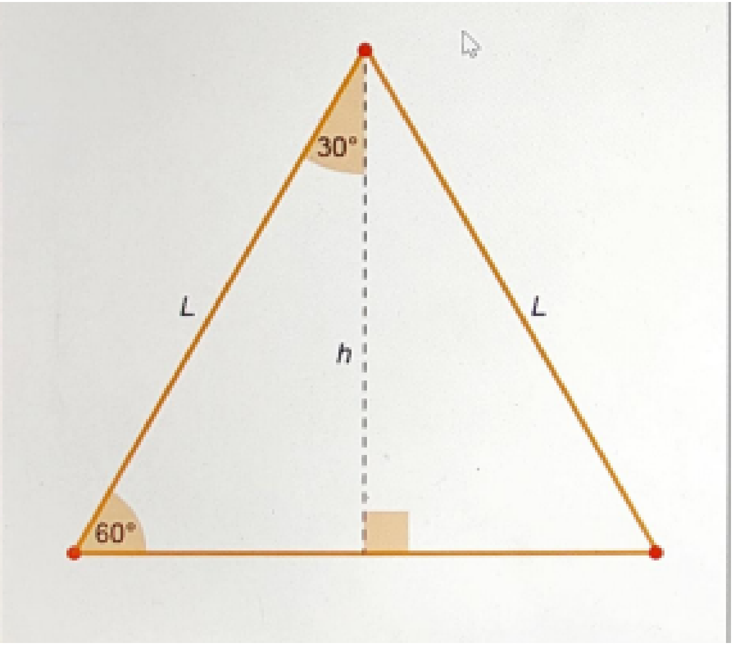
Question 8e (23 marks)

Investigate the values in the table to find a relationship for the area (*A*) 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 area (*A*)
- write down a general rule for *A* in terms of *n*
- test and verify your general rule for *A*
- justify your general rule for *A* in relation to the triangles.

Stage (n)	Side length of outer triangle (L)	Area (A)
1	1	$\frac{\sqrt{3}}{4}$
2	2	$\sqrt{3}$
3	4	$4\sqrt{3}$
4	8	$16\sqrt{3}$
5		
6		


30°
L
L
h
60°