WS09.02 Integration

Activity 1

For each function, write in its correct derivative.

$5x$	
$5x + 2$	
$5x - 10$	
$x^2 + \pi$	
x^2	
$\sin(x)$	
$\sin(x) - 1.3$	
$\sin(x) + 9$	
$\frac{1}{2}x^2$	
$\frac{1}{2}x^2 - 0.358$	

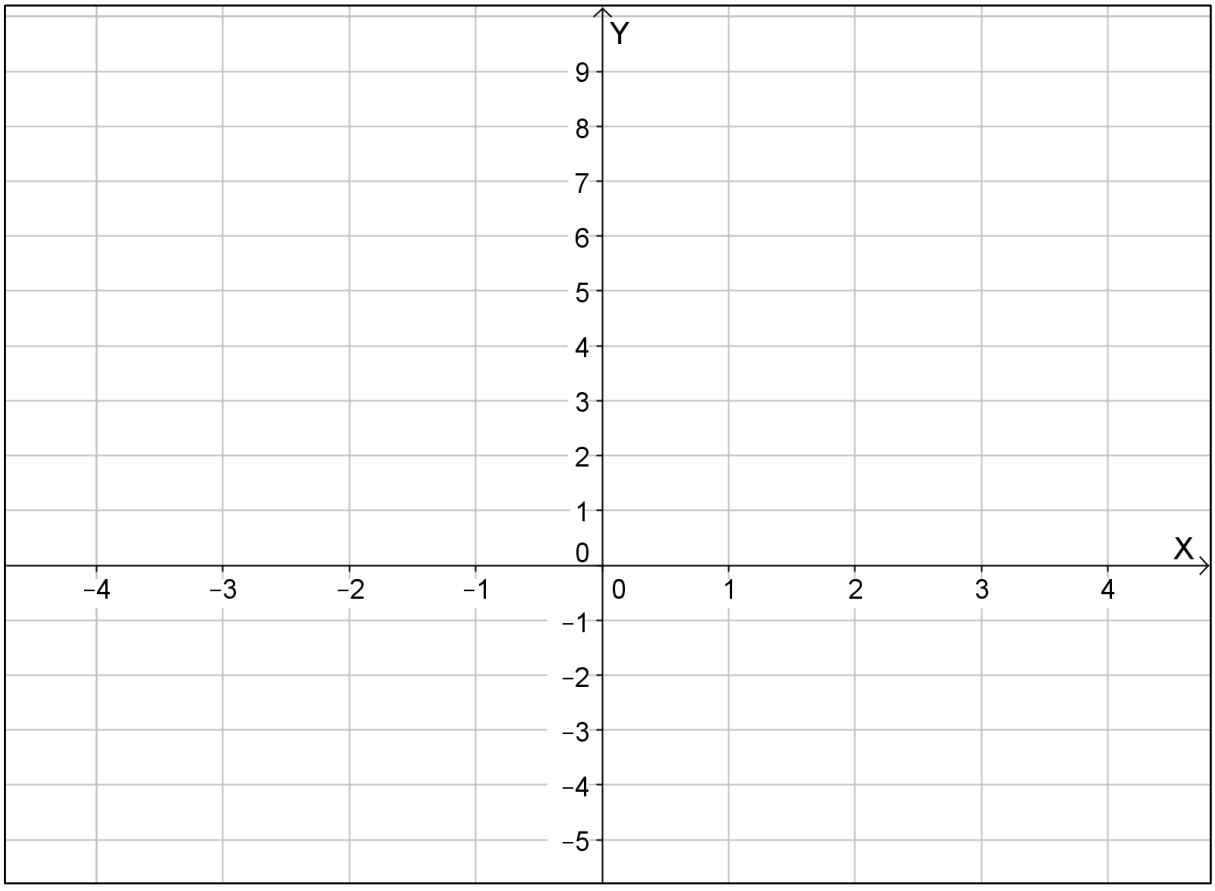
Activity 2

Find the anti-derivative of the function $f(x) = 3$ which passes through the point $(1, 5)$.

Q1. How is this question different to all the previous anti-derivative questions you have encountered?

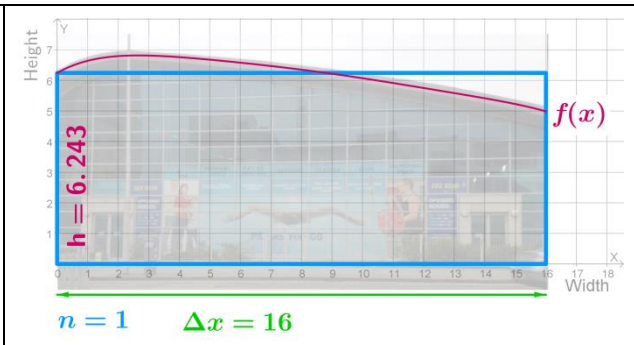
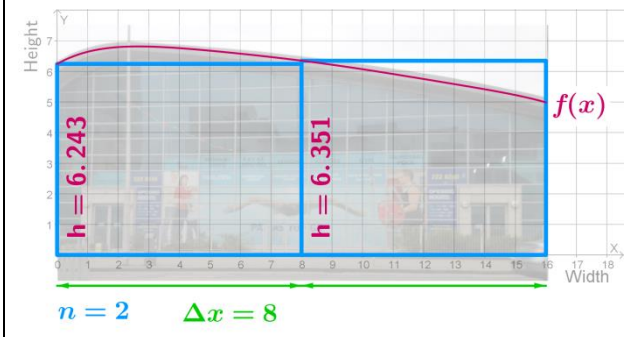
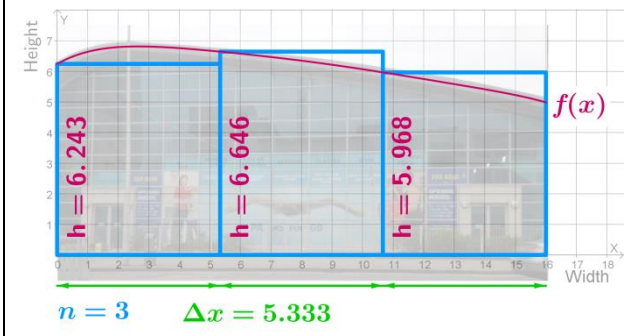
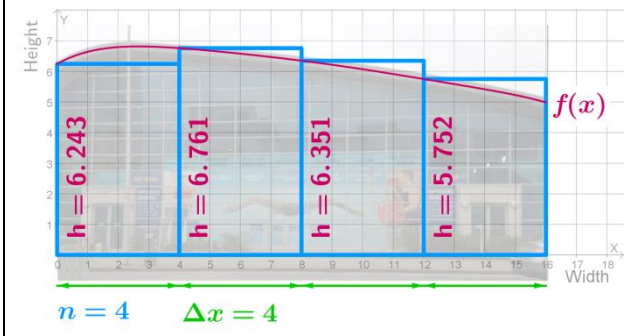
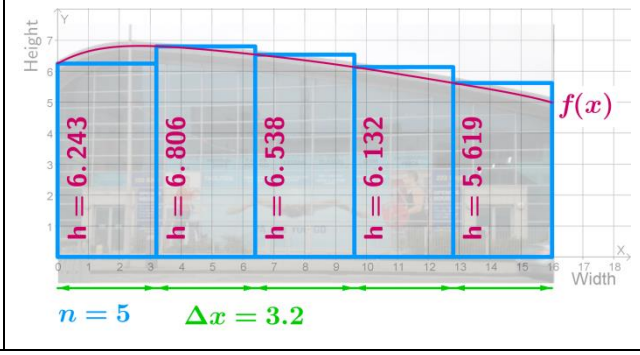
Q2. Find the indefinite form of the anti-derivative of $f(x) = 3$.

Q3. Represent the indefinite form of the anti-derivative graphically below by sketching the anti-derivatives for each of the following values of $C = \{-3, -2, -1, 0, 1, 2, 3\}$.



Q4. Identify the distinct anti-derivative you were asked to find.

Activity 3

		Area Calculation
(i)		
(ii)		
(iii)		
(iv)		
(v)		

Explain what happens to the width of the rectangles (Δx) as the number of rectangles (n) increases. Express this relationship using mathematical notation.

Description in words: As the number of rectangles increases, the width of the rectangles [ ]

As $n \rightarrow$ [ ] , $\Delta x \rightarrow$ [ ]

Activity 4

Calculate $\int_2^5 (2x+1)dx$.

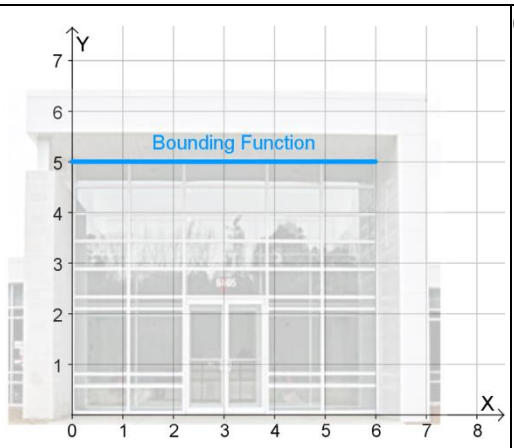
Q1.	In words describe what you are being asked to do.
Q2.	Using a suitable approach, complete the task.

Activity 5

Group A

Figure 1 shows the UCD Student Computer Centre.

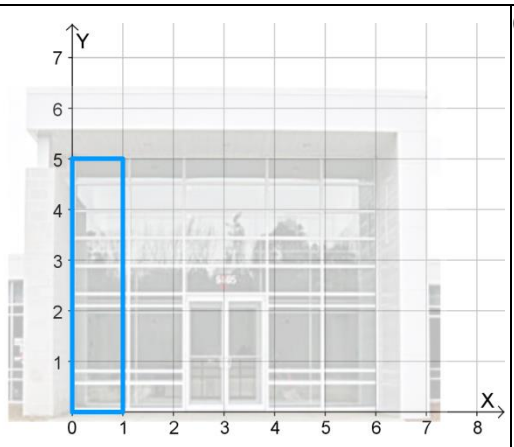
Figure 1 - The UCD Student Computer Centre.



Q1. Write down the function which describes the height of the building as we move from left ($x = 0$) to right ($x = 6$).

$h(x) =$

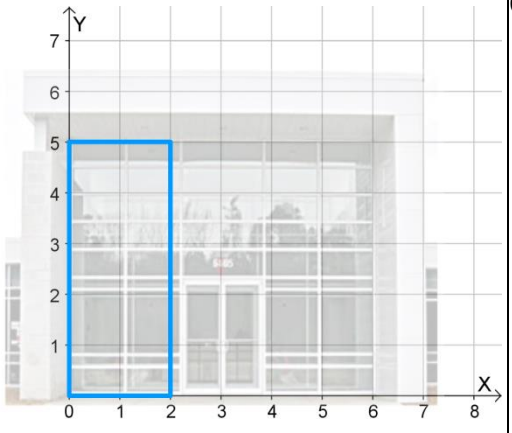
The area under the bounding function changes as we move from left to right. We will now investigate the relationship between the area of the building and its width.



Q2. By calculating the area of the rectangular piece of building shown, complete the statement:

When **the width of the rectangular piece is 1** unit, the area of the rectangle is:

$A =$



Q3. By calculating the area of the rectangular piece of building shown, complete the statement:

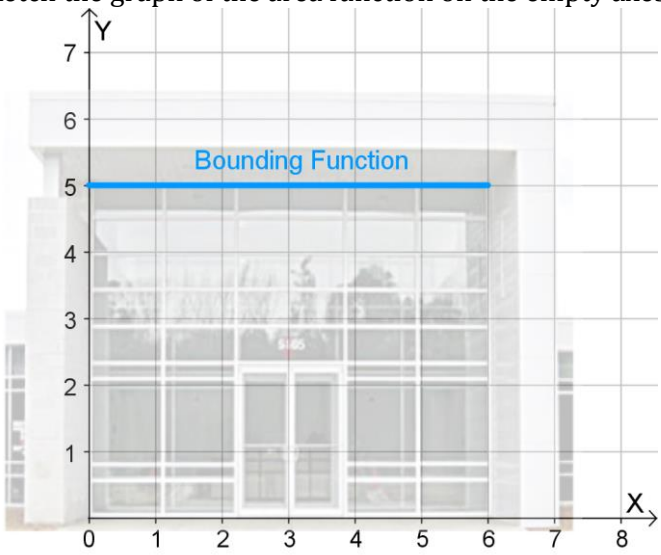
When **the width of the rectangular piece is 2** units, the area of the rectangle is:

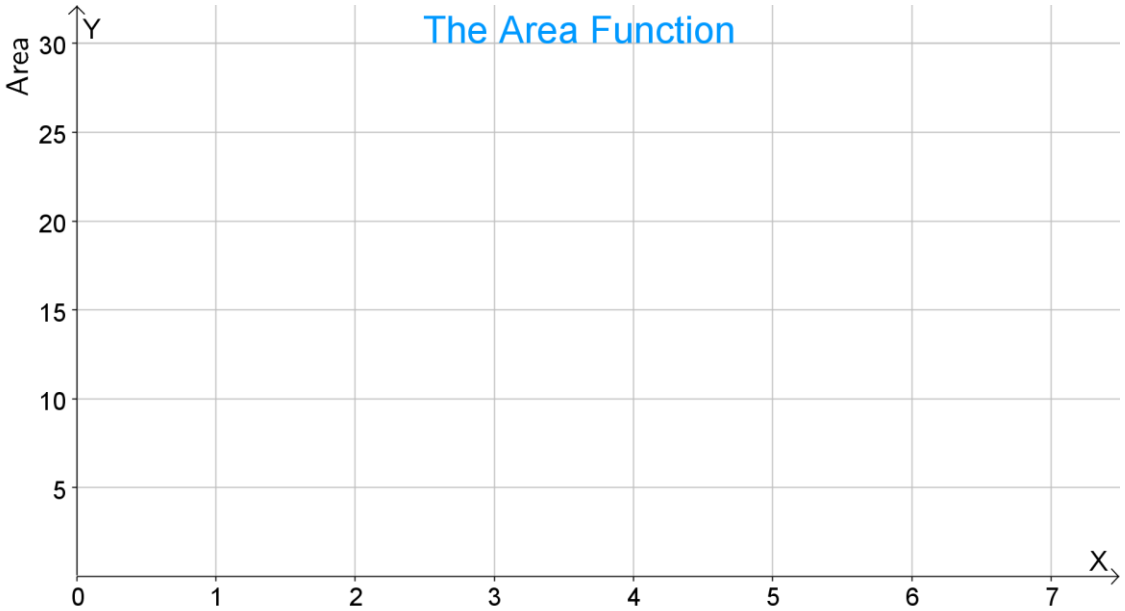
$A =$

Q4. Complete the table below using an approach similar to that used in Q2 and Q3.

x	Width	Height	Area	Pattern
0	0	5	0	$A = 5(0)$
1	1	5	5	$A = 5(1)$
2				$A =$
3				$A =$
4				$A =$
5				$A =$
6				$A =$
⋮	⋮	⋮	⋮	⋮
x			$A(x) =$	

Q5. Sketch the graph of the area function on the empty axes.



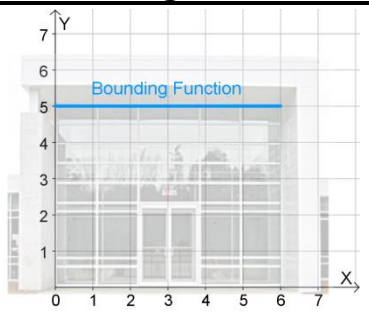
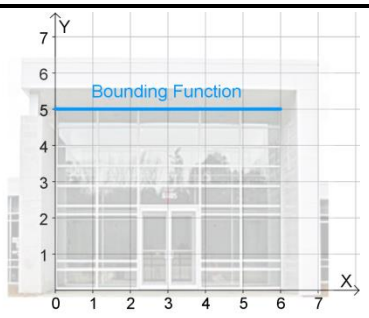
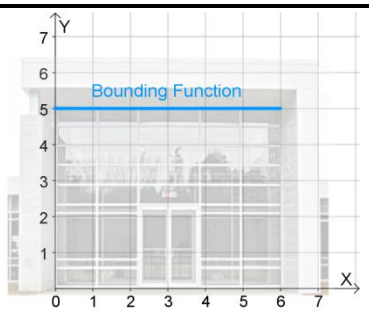


Q6. For each of the areas in the table below:

(a) Shade in the given area on the diagram.

(b) **<u>Use the area function</u>** to calculate the given area.

(c) Explain how the area function is used to calculate area.

Section of Building	Diagram	Area Calculation
From $x = 0$ up to $x = 2$.		
Explanation:		
From $x = 0$ up to $x = 5$.		
Explanation:		
From $x = 2$ up to $x = 5$.		
Explanation:		

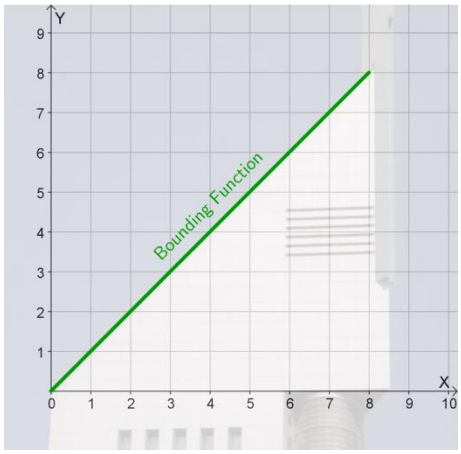
Q7. **(a)** In the space below write in the bounding function (from Q1 above) and the area function (from Q3 above).

Bounding Function	Area Function
$h(x) =$	$A(x) =$

(b) If you were presented only with the bounding function, is there a way in which you could determine the area function? Explain.

Group B
Figure 2 shows The Vu Bar in Dubai.

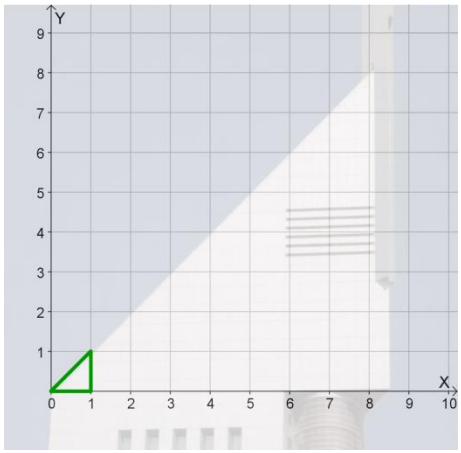
Figure 2 - The Vu Bar, Dubai.



Q1. The height of the building changes as we move from from left ($x = 0$) to right ($x = 8$). Write down the function which describes the changing height of the building.

$h(x) =$

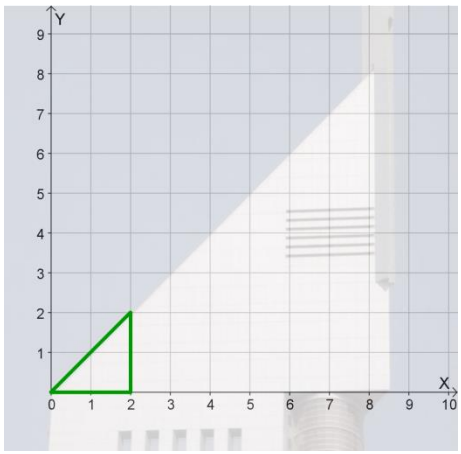
The area under the bounding function changes as we move from left to right. We will now investigate the relationship between the area of the building and its width.



Q2. By calculating the area of the triangular piece of building shown, complete the statement:

When **the width of the triangular piece is 1** unit, the area of the triangle is:

$A =$



Q3. By calculating the area of the triangular piece of building shown, complete the statement :

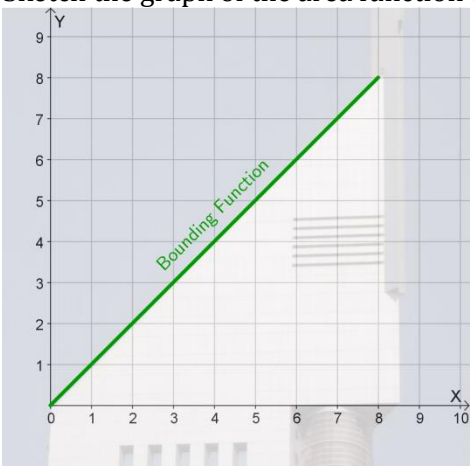
When **the width of the triangular piece is 2** units, the area of the rectangle is:

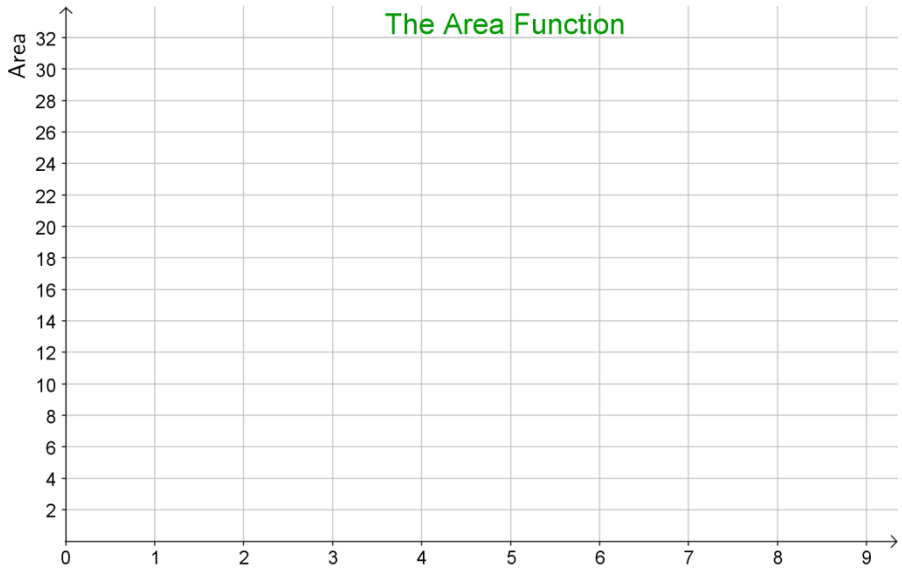
$A =$

Q4. Complete the table below using an approach similar to that used in Q2 and Q3.

x	Width	Height	Area	Pattern
0	0	0	0	$A = \frac{1}{2}(0)(0)$
1	1	1	0.5	$A = \frac{1}{2}(1)(1)$
2				$A =$
3				$A =$
4				$A =$
5				$A =$
6				$A =$
7				
8				
⋮	⋮	⋮	⋮	⋮
x			$A(x) =$	

Q5. Sketch the graph of the area function on the empty axes.



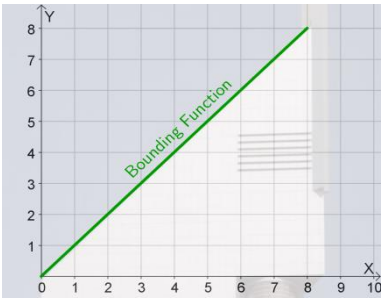
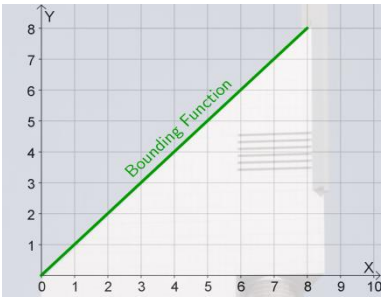
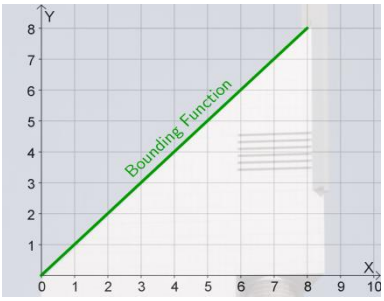


Q6. For each of the areas in the table below:

(a) Shade in the given area on the diagram.

(b) **<u>Use the area function</u>** to calculate the given area.

(c) Explain how the area function is used to calculate area.

Section of Building	Diagram	Area Calculation
From $x = 0$ up to $x = 3$.		
Explanation:		
From $x = 0$ up to $x = 5.5$.		
Explanation:		
From $x = 3$ up to $x = 5.5$.		
Explanation:		

Q7. **(a)** In the space below write in the bounding function (from Q1 above) and the area function (from Q3 above).

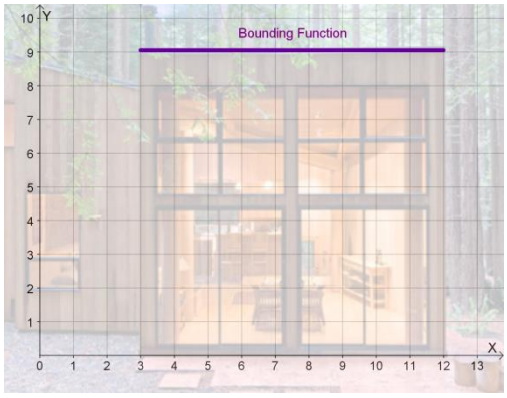
Bounding Function	Area Function
$h(x) =$	$A(x) =$

(b) If you were presented only with the bounding function, is there a way in which you could determine the area function? Explain.

Group C

Figure 3 shows a modern timber dwelling.

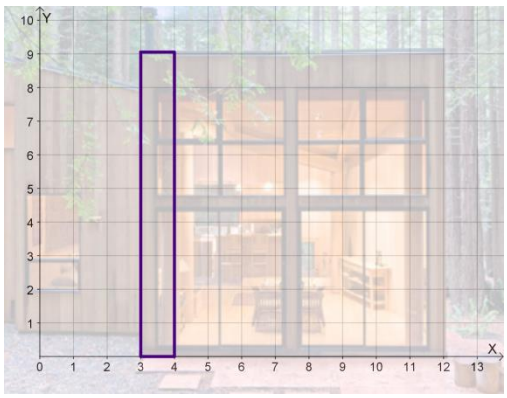
Figure 3 – Timber Dwelling.



Q1. Write down the function which describes the height of the building as we move from left ($x = 0$) to right ($x = 12$).

$h(x) =$

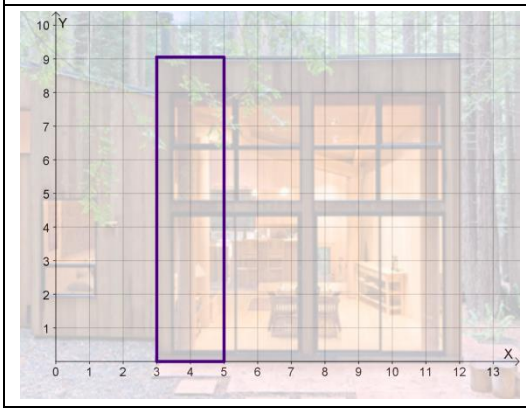
The area under the bounding function changes as we move from left to right. We will now investigate the relationship between the area of the building and its width.



Q2. By calculating the area of the rectangular piece of building shown, complete the statement:

When **the width of the rectangular piece is 1** unit, the area of the rectangle is:

$A =$



Q3. By calculating the area of the rectangular piece of building shown, complete the statement:

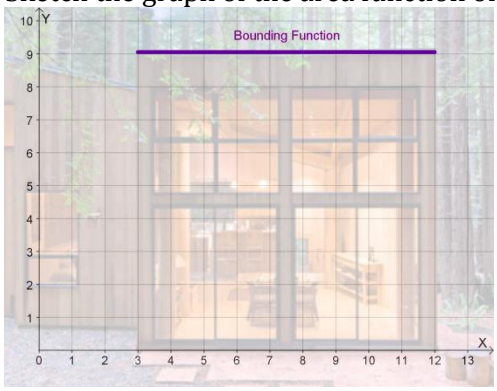
When **the width of the rectangular piece is 2** units, the area of the rectangle is:

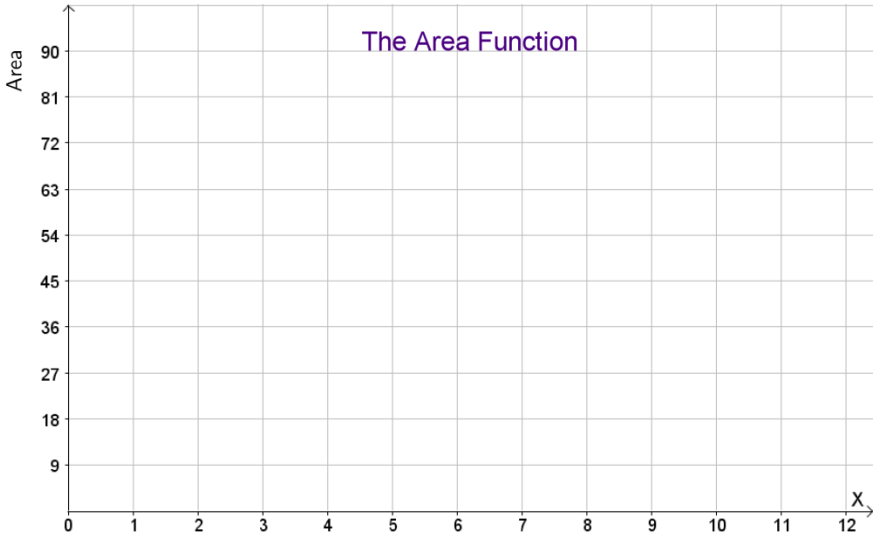
$A =$

Q4. Complete the table below using an approach similar to that used in Q2 and Q3.

x	Width	Height	Area	Pattern
3	0	9	0	$A = (9)(0)$
4	1	9	9	$A = (9)(1)$
5				$A =$
6				$A =$
7				$A =$
8				$A =$
9				$A =$
10				
11				
12				
⋮	⋮	⋮	⋮	⋮
x			$A(x) =$	

Q5. Sketch the graph of the area function on the empty axes.



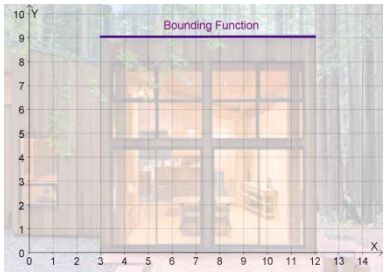
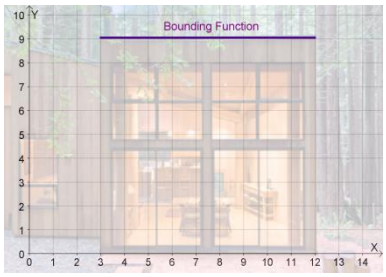
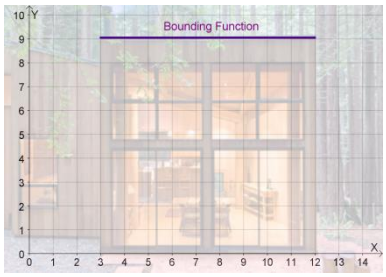


Q6. For each of the areas in the table below:

(a) Shade in the given area on the diagram.

(b) **<u>Use the area function</u>** to calculate the given area.

(c) Explain how the area function is used to calculate area.

Section of Building	Diagram	Area Calculation
From $x = 3$ up to $x = 11$.		
Explanation:		
From $x = 3$ up to $x = 6$.		
Explanation:		
From $x = 6$ up to $x = 11$.		
Explanation:		

Q7. **(a)** In the space below write in the bounding function (from Q1 above) and the area function (from Q3 above).

Bounding Function	Area Function
$h(x) =$	$A(x) =$

(b) If you were presented only with the bounding function, is there a way in which you could determine the area function? Explain.

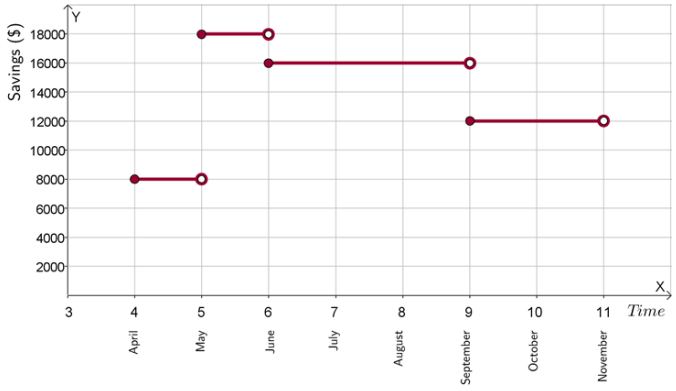
Activity 6

Question 1

Bernie has a savings account which she can use to lodge to or withdraw money. The table below shows the activity in the account over a 7 month period:

Time	Savings(€)
April	8000
May	18000
June	16000
July	16000
August	16000
September	12000
October	12000

Calculate the average amount of money in Bernie's account over the seven-month period.



Question 2

On a certain day in Cork, air temperature was described by the following function:

$T(t) = -0.2t^2 + 6.4t - 35.2$ where $9 \leq t \leq 16$,

where T is temperature in °C and t is time since midnight in hours.

Calculate the average air temperature between 9 am and 4 pm