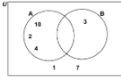


# 2021 May Maths eAssessment



## Question 1 (8 marks)



### Knowing and understanding

In this task (questions 1 to 5), you will interact with different aspects of **form** using a variety of related concepts. This task focuses on **criterion A** (Knowing and understanding) and **criterion C** (Communication).

Use a Venn diagram to find probabilities.

- 1 (8 marks) ▾
- 2 (6 marks) ▾
- 3 (8 marks) ▾
- 4 (7 marks) ▾
- 5 (7 marks) ▾
- 6 (15 marks) ▾
- 7 (19 marks) ▾
- 8 (30 marks) ▾



## Question 2 (6 marks)

Complete an addition and a multiplication grid.



## Question 3 (8 marks)

Find the intersection of a line and a parabola.



## Question 4 (7 marks)

Use percentages to find the amount earned by creators of videos.

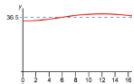


## Question 5 (7 marks)

Find missing values in a sphere and cone.



## Question 6 (15 marks)



### Applying mathematics in real-life contexts

In this task (questions 6 and 7), you will use **relationships** to apply mathematics within the global context of **identities and relationships**. This task focuses on **criterion D** (Applying mathematics in real-life contexts) and **criterion C** (Communication).

Examine the relationship between body temperature and time.

- 1 (8 marks) ▾
- 2 (6 marks) ▾
- 3 (8 marks) ▾
- 4 (7 marks) ▾
- 5 (7 marks) ▾
- 6 (15 marks) ▾
- 7 (19 marks) ▾
- 8 (30 marks) ▾



## Question 7 (19 marks)

Explore relationships between sleep and reaction times.



## Question 8 (30 marks)



### Investigating patterns

In this task (question 8), you will use **logic** to investigate the creation of trapeziums contained in a parabola. You will be assessed using **criterion B** (Investigating patterns) and **criterion C** (Communication).

Describe patterns and find general rules for trapeziums contained in a parabola.

**Question 1** (8 marks)

The elements of the universal set  $U$  are  $\{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$ .

Consider two subsets of  $U$

Set A contains the multiples of 2.

Set B contains the multiples of 3.



**Question 1a** (1 mark)

**Organize** the given numbers in the Venn diagram. Drag the numbers to the correct place.

Draggable numbers:

- 5
- 6
- 8
- 9

$U$

A Venn diagram with two overlapping circles, A and B, within a universal set U. Circle A is on the left and contains the numbers 10, 2, and 4. Circle B is on the right and contains the number 3. The intersection of circles A and B is empty. The region outside both circles contains the numbers 1 and 7.



Question 1b (2 marks)

**Describe** the region  $A \cap B'$  in context.

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



Question 1c (2 marks)

Two numbers are selected at random from  $U$ . **Determine** the probability that they are both elements of  $A \cap B'$ .

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

Styles



Question 1d (3 marks)

Two numbers are selected at random from  $U$ . **Calculate** the probability that only one is an element of  $A \cap B'$ .

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

Styles

Question 2 (6 marks)

Question 2a (3 marks)

The table below shows an example of a completed addition grid.

Addition grid	+	4	5
	3	7	8
	10	14	15

In the addition grid below, **write down** the missing values, in a simplified exact form.

Addition grid	+	$\sqrt{5}$	
	$\sqrt{20}$		$\sqrt{5}$
	$\sqrt{45}$		$2\sqrt{5}$

Question 2b (3 marks)

The table below shows an example of a completed multiplication grid.

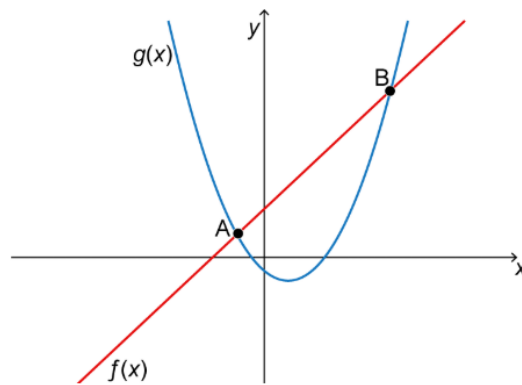
Multiplication grid	×	4	5
	3	12	15
	10	40	50

In the multiplication grid below, **write down** the missing values, in a simplified index form.

Multiplication grid	×	$2b$	
	$\frac{7}{2}a$		$14a^2b^{-2}$
			$12a^5b^{-1}$

Question 3 (8 marks)

In the graph below, the function  $f(x) = 2x + 4$  intersects  $g(x) = (x - 1)^2 - 2$  at points A and B.



©

Question 3a (2 marks)

Show that when the two graphs intersect,  $x^2 - 4x - 5 = 0$ .

Rich text editor toolbar with buttons for Bold (B), Italic (I), Undo, Redo, Underline (U), Subscript (x<sub>2</sub>), Superscript (x<sup>2</sup>), Bulleted List, Numbered List, Link (Ω), and Unlink (Σ). Below the toolbar is a text input area.

Question 3b (4 marks)

Hence, find the coordinates  $(x, y)$  of points A and B.

Rich text editor toolbar with buttons for Bold (B), Italic (I), Undo, Redo, Underline (U), Subscript (x<sub>2</sub>), Superscript (x<sup>2</sup>), Bulleted List, Numbered List, Link (Ω), and Unlink (Σ). Below the toolbar is a text input area.

Question 3c (2 marks)

Determine the distance AB.

Rich text editor toolbar with buttons for Bold (B), Italic (I), Undo, Redo, Underline (U), Subscript (x<sub>2</sub>), Superscript (x<sup>2</sup>), Bulleted List, Numbered List, Link (Ω), Unlink (Σ), and a Styles dropdown menu. Below the toolbar is a text input area.



Question 4 (7 marks)

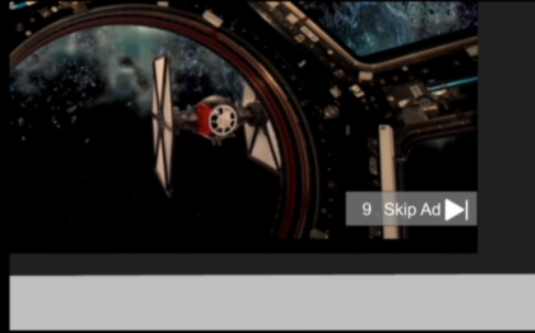
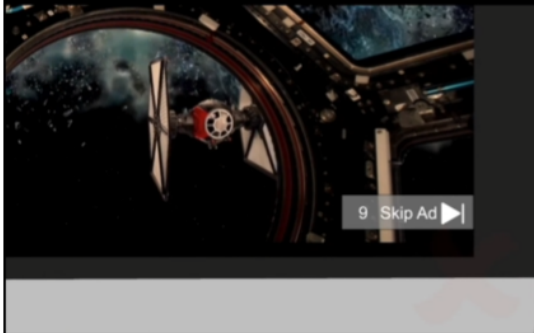
Some creators make videos that are very popular and viewed by many people on video-sharing platforms.



Advertisers pay the creators to have their advertisement included in the video.



Some viewers prefer to **skip** advertisements and some prefer to watch the **full view**.



A **full view** is only counted if the viewer watches the whole advertisement.


Skip advertisement





Full view



Here is an example:

1000 views 

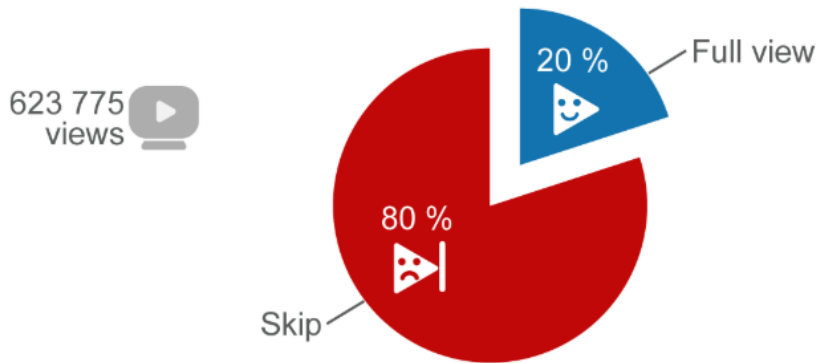
Creators earn \$4.00 per 1000 full views.

Full views	Earn \$
0 – 999	0.00
1000 – 1999	4.00
2000 – 2999	8.00

A creator uploaded a video and received 623 775 views.











The pie chart shows the views of the advertisements.



©

**Question 4a (1 mark)**

**Determine** the number of full views.

**B I**   **U**       Styles  



Question 4b (3 marks)

The creator pays a fee of \$150 to the video-sharing platform.

Creators earn \$4.00 per 1000 full views.

Full views	Earn \$
0 – 999	0.00
1000 – 1999	4.00
2000 – 2999	8.00

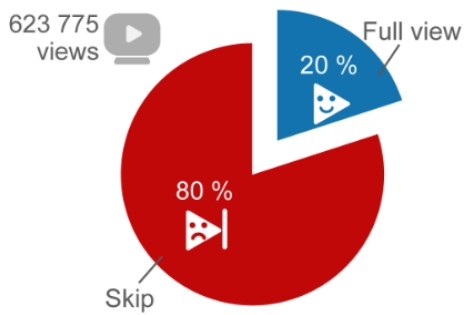
©

Calculate the profit made by the creator.

Rich text editor toolbar with buttons for Bold (B), Italic (I), Undo, Redo, Underline (U), Text color, Background color, Bulleted list, Numbered list, Link, Unlink, Styles, and a document icon.



Question 4c (3 marks)



For this video, find the minimum number of views required, to make a profit of \$500.

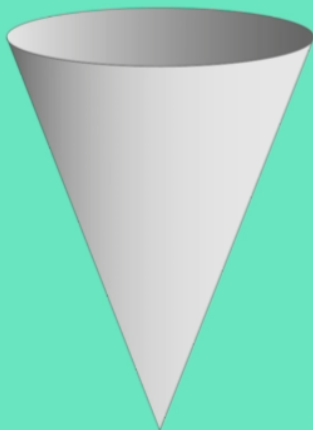
Rich text editor toolbar with buttons for Bold (B), Italic (I), Undo, Redo, Underline (U), Text color, Background color, Bulleted list, Numbered list, Link, Unlink, Styles, and a document icon.

**Question 5 (7 marks)**

**Here is a snow cone**



**Cone**



**Sphere of ice**



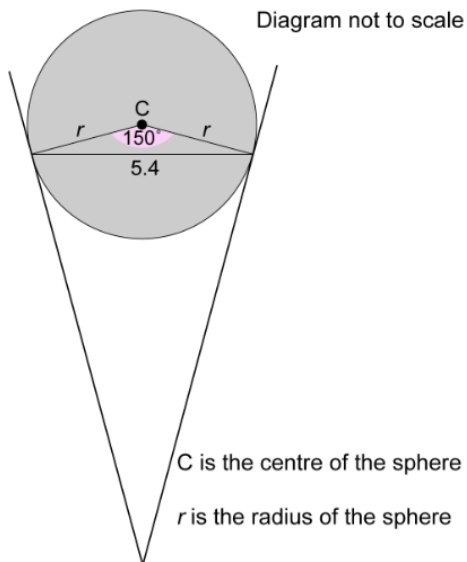
Here the sphere  
of ice has melted



Snow cone



Question 5a (3 marks)



Show that  $r = 2.80$  cm, correct to three significant figures.

**B** *I* ← → U  $\times_e$   $\times^2$   $\int$   $\frac{\square}{\square}$   $\Omega$   $\Sigma$

Styles

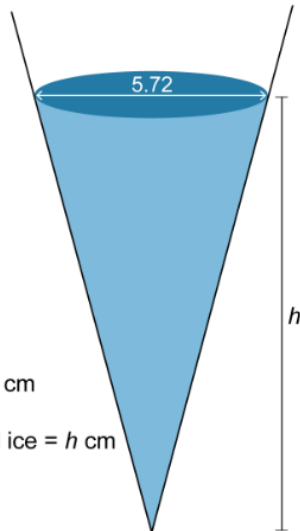


The whole sphere of ice melted in the cone, as shown in the diagram below.



Question 5b (4 marks)

Diagram not to scale



Diameter = 5.72 cm

Height of melted ice =  $h$  cm

Find the value of  $h$ .

Rich text editor interface with a toolbar containing icons for bold (B), italic (I), undo, redo, underline (U), subscript ( $x_e$ ), superscript ( $x^2$ ), bulleted list, numbered list, link, unlink, and insert link. Below the toolbar is a text input area.



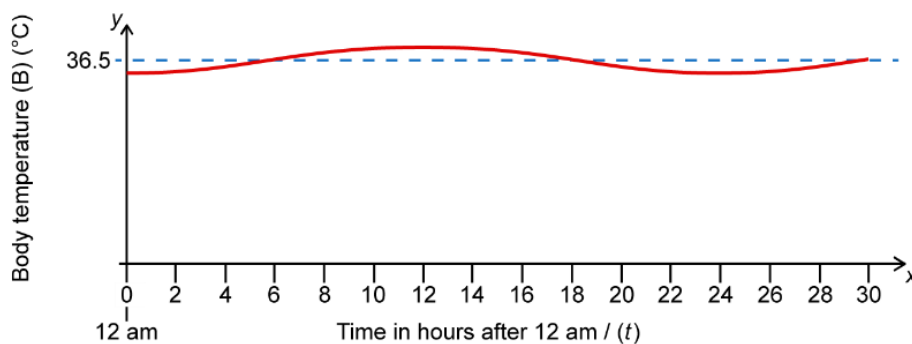
Question 6 (15 marks)

Body temperature changes during the day. The graph below shows a cosine curve modelling the body temperature for Ingrid.

$B$  is the temperature in degrees Celsius ( $^{\circ}\text{C}$ )

$t$  is the time in hours after midnight.

This media is interactive



©

Ingrid knows it is best to sleep for 8 to 10 hours when her body temperature is  $36.5^{\circ}\text{C}$  or below.

**Question 6a** (1 mark)

**Suggest** a sleeping schedule for Ingrid.

Sleep time:  :

Wake up time:  :



**Question 6b** (2 marks)

**Write down** the time when Ingrid's body temperature is at a maximum and a minimum.

Maximum:  :

Minimum:  :



During the day, Ingrid's body temperature (B) can be modelled using the equation

$$B = -0.5\cos 15t + 36.5$$

where  $t$  is the time in hours after 12 am.  
Angles are in degrees.

**Question 6c** (2 marks)

**Write down** the amplitude and period.

Amplitude:

Period:



**Question 6d** (2 marks)

**Determine** the values of the maximum and minimum temperatures.

Maximum:  °C

Minimum:  °C



Scroll down to continue

**Question 6e** (3 marks)

**Calculate** Ingrid's body temperature at 7:15 am, to the nearest **one** decimal place.

**B** *I* ← → U  $\times_2$   $\times^2$   $\frac{\square}{\square}$   $\frac{\square}{\square}$   $\Omega$   $\Sigma$

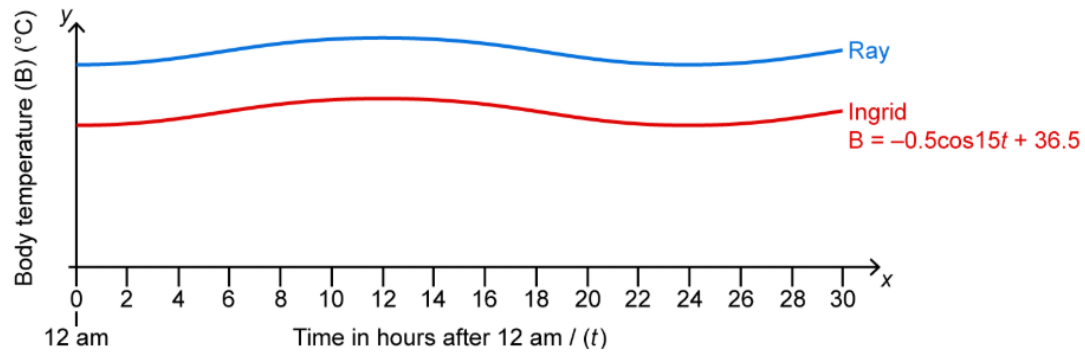
Styles

During the day, Ingrid's body temperature (B) can be modelled using the equation

$$B = -0.5\cos 15t + 36.5$$

where  $t$  is the time in hours after 12 am.  
Angles are in degrees.

Ray's body temperature is  $0.25\text{ }^{\circ}\text{C}$  higher than Ingrid's. The graph below shows two cosine curves modelling the body temperatures for Ingrid and Ray.



©

**Question 6f** (1 mark)

**Write down** the equation modelling Ray's body temperature.

**Question 6g** (4 marks)

Hence, **calculate** the first time when Ray's body temperature will reach  $36.5\text{ }^{\circ}\text{C}$

**Question 7** (19 marks)

In this question you will predict the reaction times of sprinters based on previously acquired data and their sleep pattern.

Sprinters competing in a 100 metre race should ensure they are well rested before competitions.

Studies have shown that a good sleeping habit can improve reaction time.

The start of the race is one of the most important factors for an overall fast time. Sprinters need to react as quickly as possible to the start signal.

In this question you will explore the reaction times of sprinters with different sleeping habits and how this affects their probability of winning a race.

These sprinters take a test that records their reaction time. The table below shows the results.

## 8 hours sleeping habit 20 SPRINTERS

©

Reaction time in seconds (s)	0.75	0.76	0.77	0.78	0.79	0.80
Number of sprinters	4	3	5	6	1	1

**Question 7a** (2 marks)

**Write down** the mode and median reaction times.

Mode:  seconds

Median:  seconds

**Question 7b** (2 marks)

**Show that** the mean reaction time is 0.77 s, for this group of sprinters.

B I   $x_2$   $x^2$   $\frac{1}{x}$   $\frac{1}{x^2}$   $\Omega$   $\Sigma$

Styles

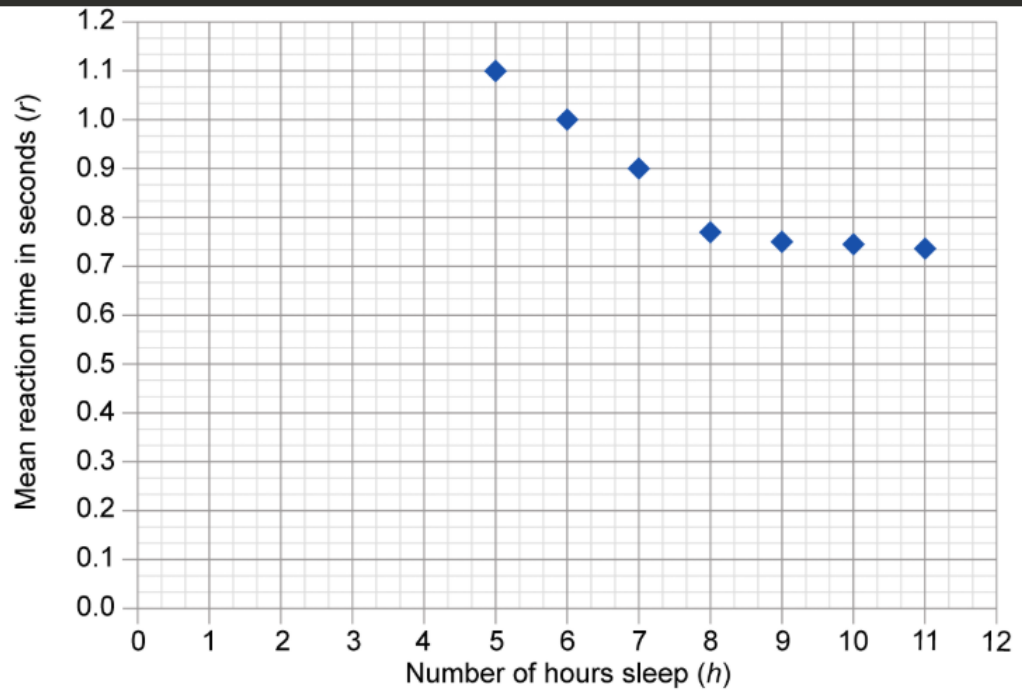
Groups of sprinters with different sleeping habits take the same test. The graph below shows the mean reaction time of each group.





Question 7c (2 marks)

Draw a line of best fit.





Question 7d (2 marks)

Using your line of best fit from (c), **write down** the value of  $r$  for  $h = 4$  hours and  $h = 7.5$  hours.

$h = 4$  hours  $r =$   seconds

$h = 7.5$  hours  $r =$   seconds



Question 7e (3 marks)

$$w = 24(100)^{-r}$$

Where:

$w$  is the probability of winning a race.

$r$  is the mean reaction time in seconds.



**Calculate** the value of  $w$  when  $r = 0.77$  s.  
Give your answer correct to **two** significant figures.

Rich text editor toolbar with buttons for Bold (B), Italic (I), Undo, Redo, Underline (U), Strikethrough (x), Superscript (x<sup>a</sup>), Bulleted List, Numbered List, Link (Ω), and Unlink (Σ). Below the toolbar is a text input area.



### Question 7f (8 marks)

**Explore** the probability of winning a race for sprinters with different sleeping habits. In your answer you must:

- identify the **two** relevant factors affecting the probability of winning
- calculate the probability of winning for sprinters with different sleeping habits
- comment on the relationship between the probability of winning and sleeping habits
- justify the accuracy of your findings.

$$w = 24(100)^{-r}$$

Where:

$w$  is the probability of winning a race.

$r$  is the mean reaction time in seconds.

$h$	4	7.5	8	
$r$			0.77	
$w$				

B I ← → U x<sub>a</sub> x<sup>a</sup> ≡ ≡ Ω Σ

Styles ↕



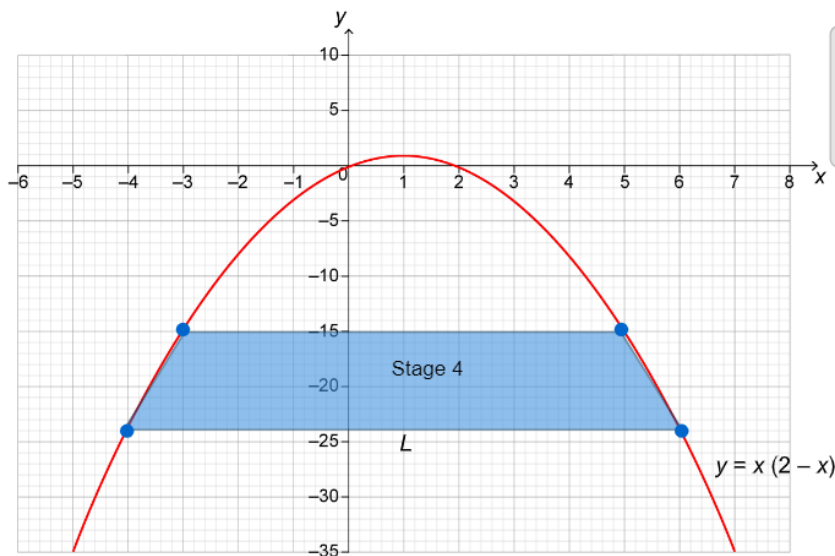
### Question 8 (30 marks)

In this question, you will investigate areas of trapeziums.

The parabola  $y = x(2 - x)$  is shown in the graph below. Different sized isosceles trapeziums are drawn inside the parabola.

Drag the slider to see how the trapeziums are formed.

This media is interactive



Stage control



Stage: 4

**Question 8a** (1 mark)

**Write down** the missing values in the table.

Stage ( $n$ )	Longer base of trapezium ( $L$ )
1	4
2	6
3	8
4	10
5	
6	

Reset



**Question 8b** (2 marks)

**Describe**, in words, **two** patterns for  $L$ .

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

Styles



**Question 8c** (2 marks)

**Write down** a general rule for  $L$  in terms of  $n$ .

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

Styles

**Question 8a (1 mark)**

**Write down** the missing values in the table.

Stage ( $n$ )	Longer base of trapezium ( $L$ )
1	4
2	6
3	8
4	10
5	
6	

Reset

**Question 8d (3 marks)**

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

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

Styles ↓ ↕

**Question 8e (22 marks)**

**Investigate** the values in the table to find a relationship for the area ( $A$ ) of trapeziums in terms of  $n$ . In your answer, you should:

- predict more values and record these in the table
- describe in words **one** pattern for column  $A$
- determine a general rule for  $A$  in terms of  $n$
- test your general rule for  $A$
- verify and justify your general rule for  $A$
- ensure that you communicate all your working appropriately.

$n$	Longer base of trapezium ( $L$ )	Smaller base of trapezium ( $S$ )	Height ( $H$ )	Area ( $A$ )	
1	4	2	3	9	
2	6	4	5	25	
3	8	6	7	49	
4	10	8	9	81	
5					
6					