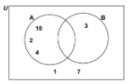
2019 May Maths eAssessment

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 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.

Question 2 (6 marks)

Complete an addition and a multiplication grid.

Question 3 (8 marks)

Find the intersection of a line and a parabola.

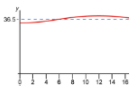
Question 4 (7 marks)

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.

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.

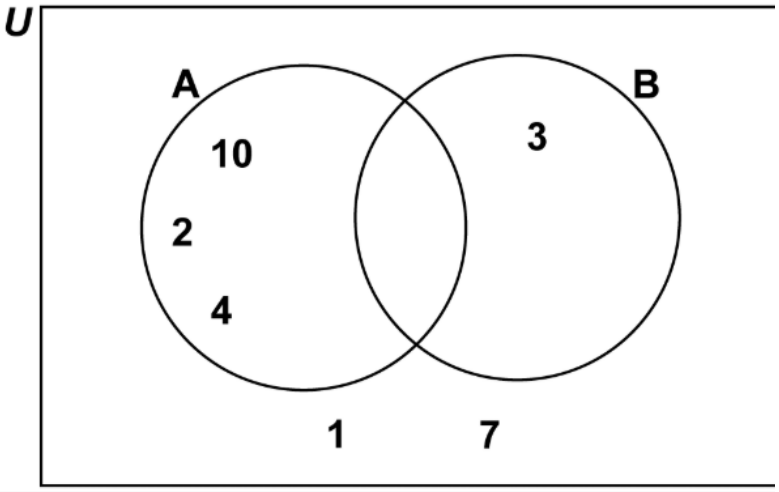
Draggable numbers:

5

6

8

9



Question 1b (2 marks)

Describe the region A ∩ B' in context.

Question 1c (2 marks)

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

Question 1d (3 marks)

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

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.

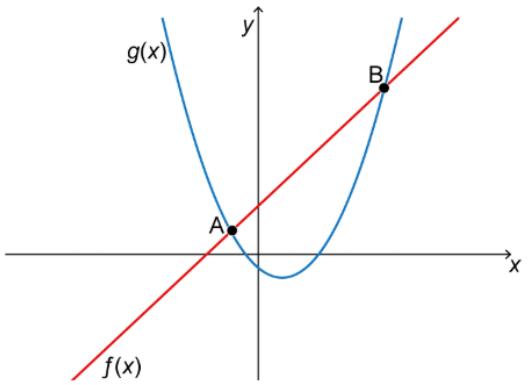
Multiplication grid	×	4	5
	3	12	15
	10	40	50

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.



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Question 3a (2 marks)

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

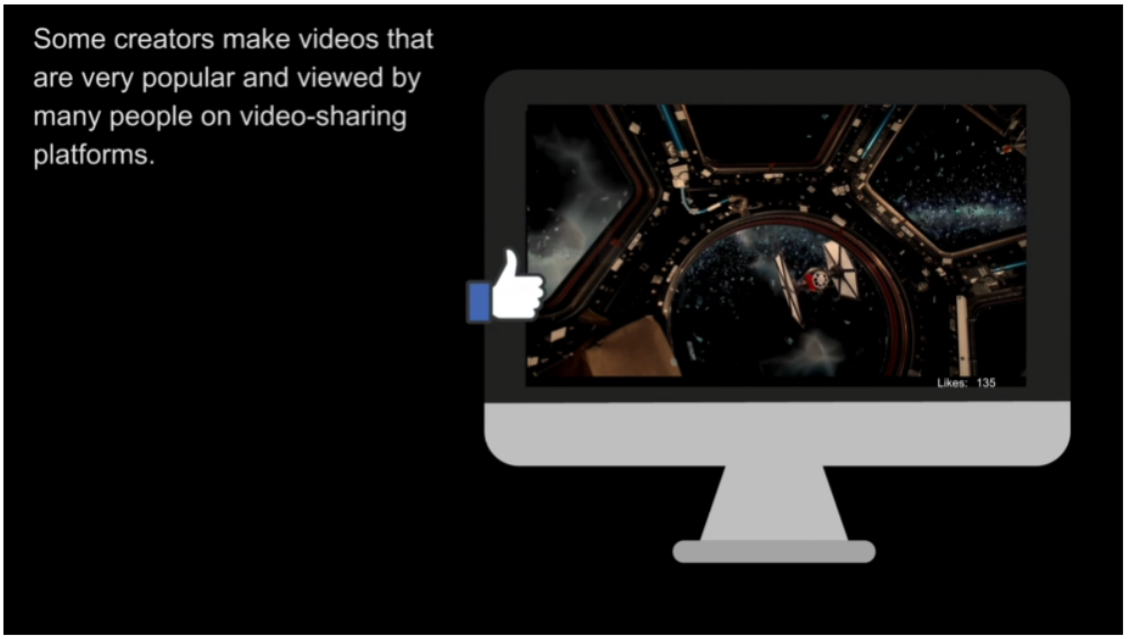
Question 3b (4 marks)

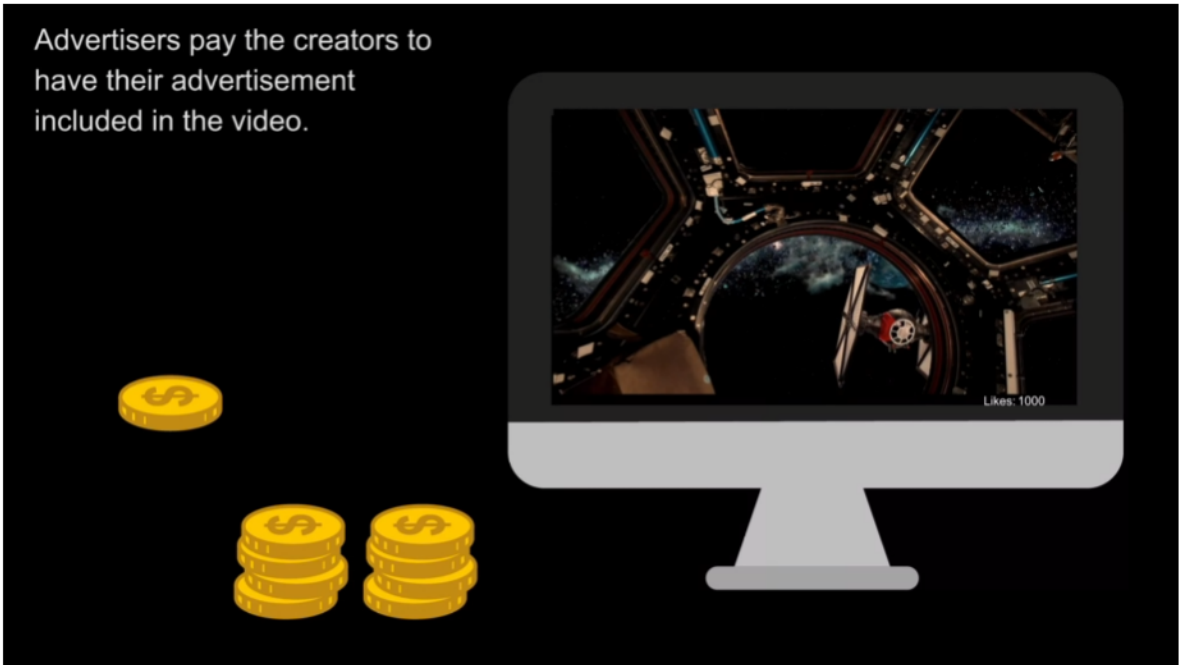
Hence, **find** the coordinates (x, y) of points A and B.

Question 3c (2 marks)

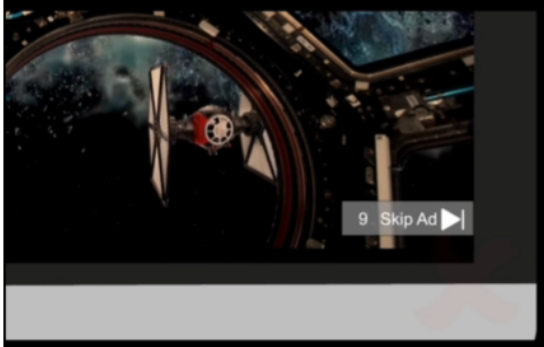
Determine the distance AB.

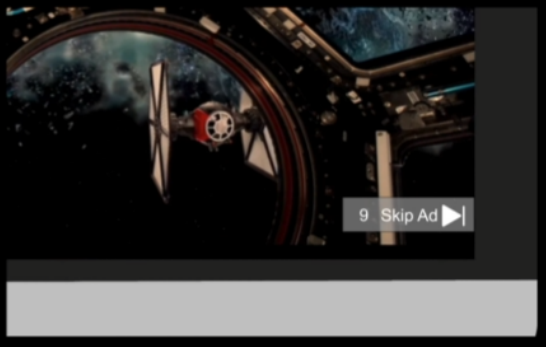
Question 4 (7 marks)





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

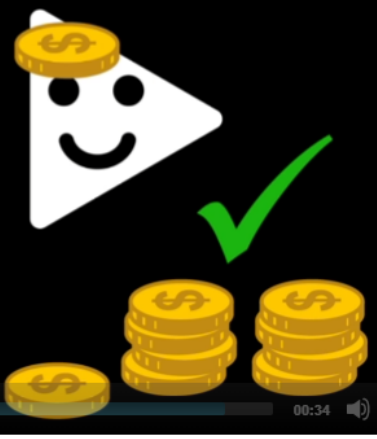


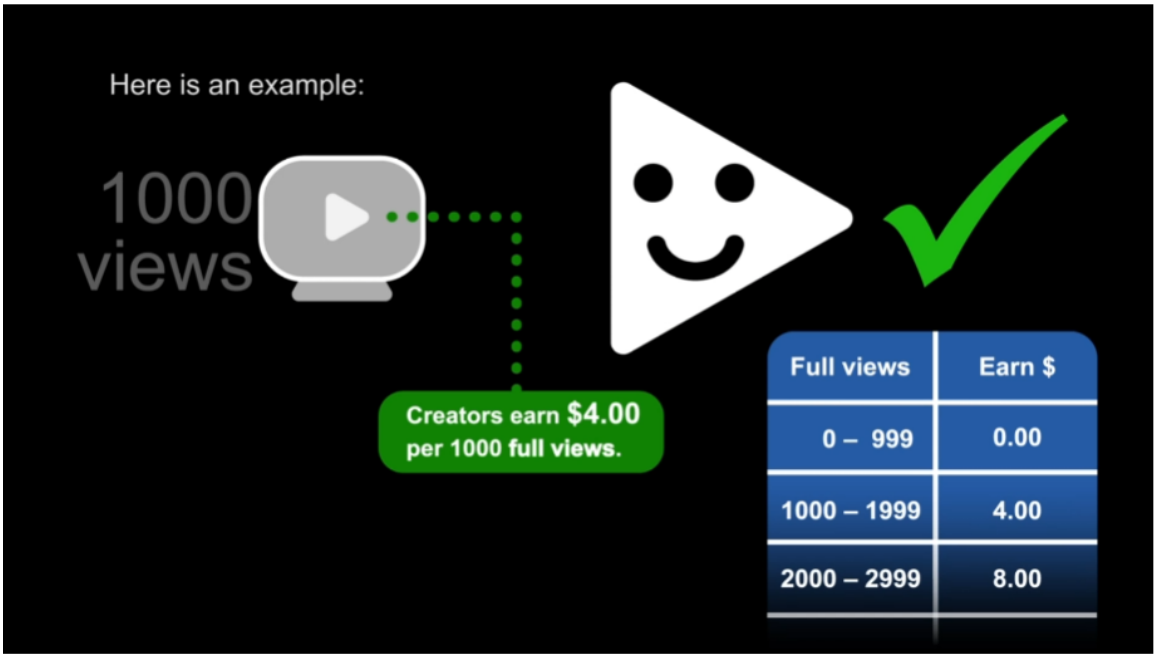


A **full view** is only counted if the viewer watches the whole advertisement.

Skip advertisment

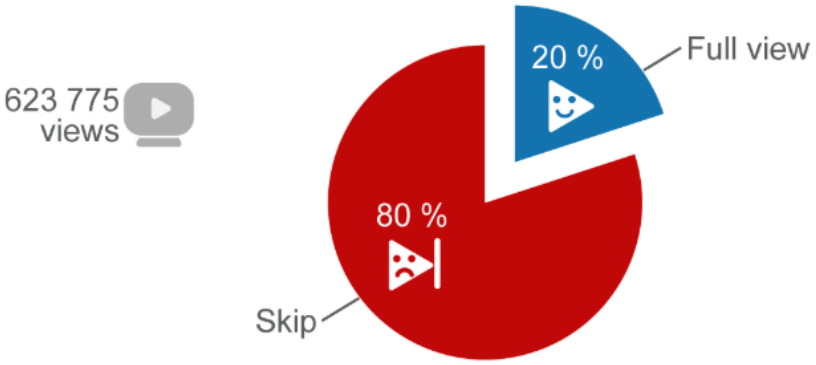
Full view





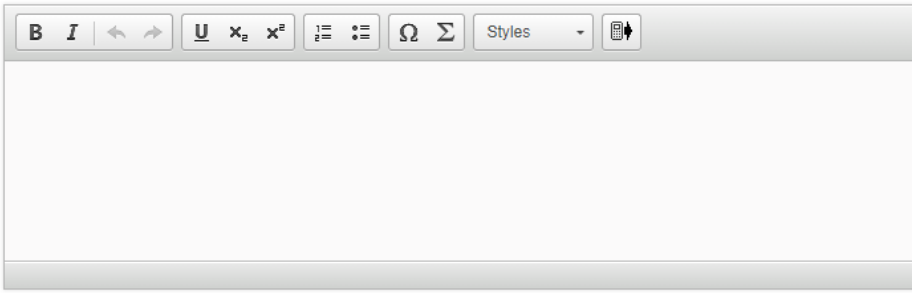
A creator uploaded a video and received 623 775 views.

The pie chart shows the views of the advertisements.

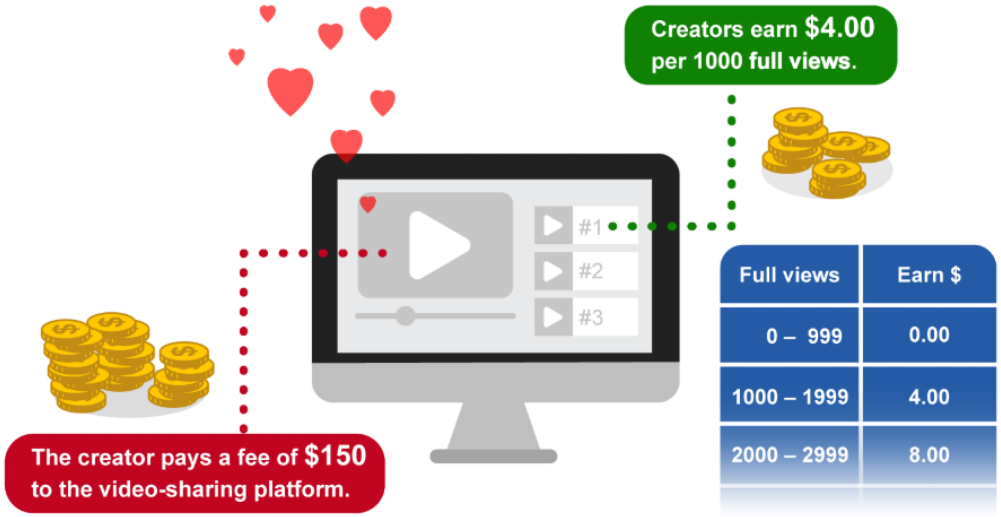


Question 4a (1 mark)

Determine the number of full views.



Question 4b (3 marks)

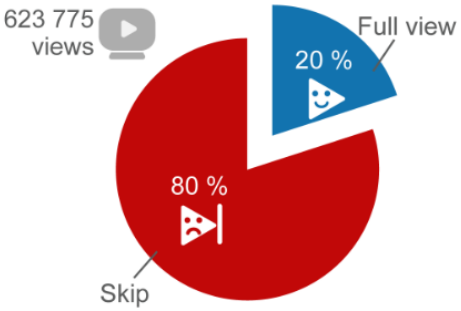


Full views	Earn $
0 – 999	0.00
1000 – 1999	4.00
2000 – 2999	8.00

©

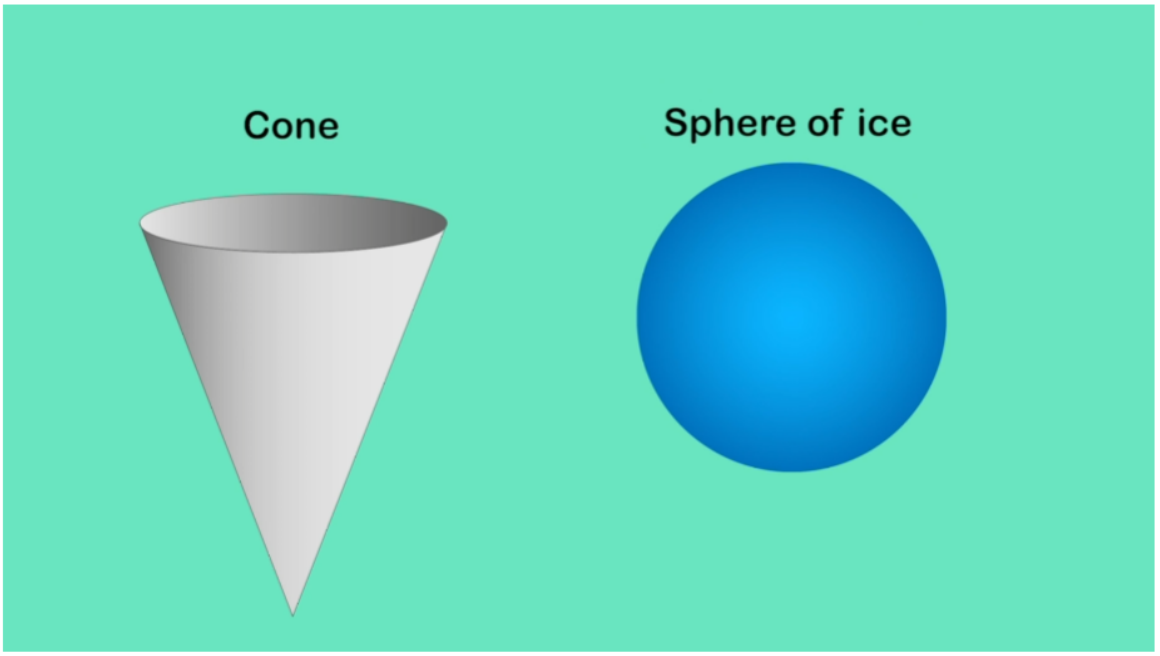
Calculate the profit made by the creator.

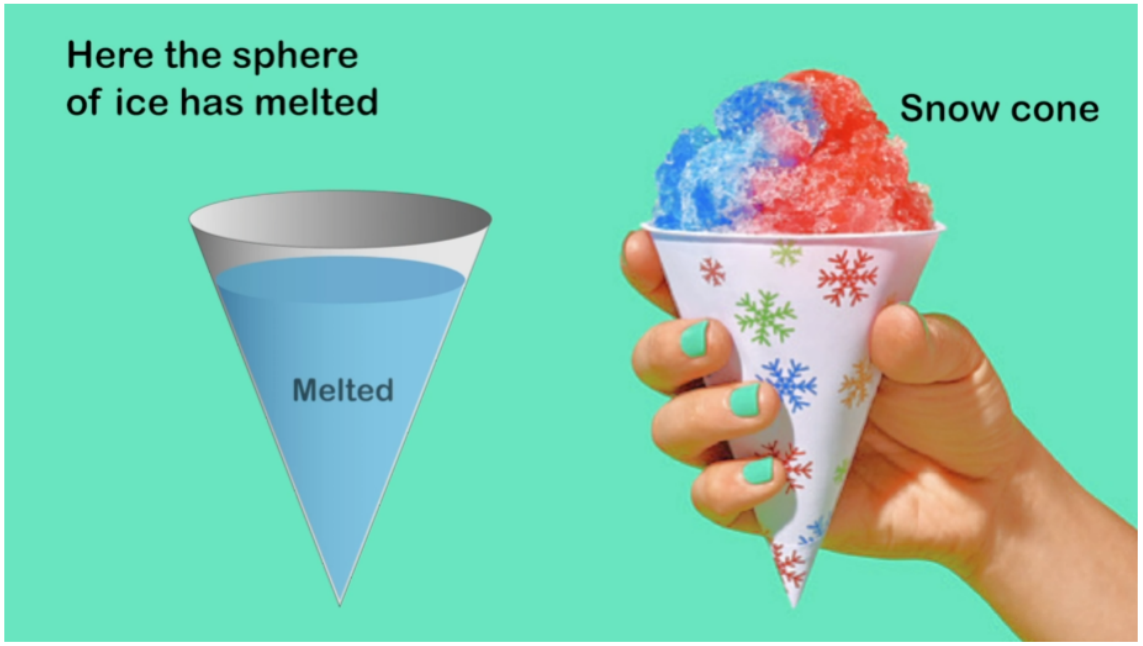
Question 4c (3 marks)



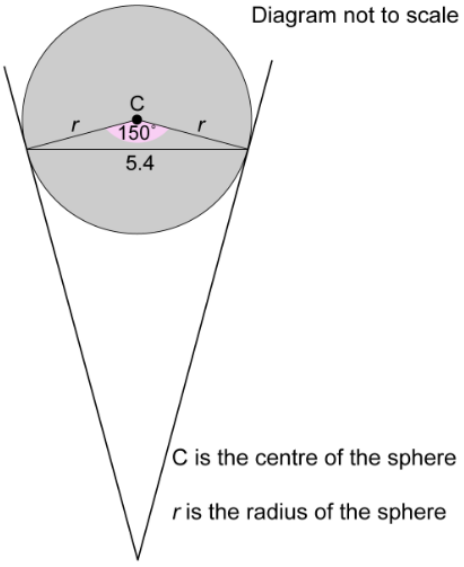
For this video, **find** the minimum number of views required, to make a profit of $500.

Question 5 (7 marks)





Question 5a (3 marks)



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

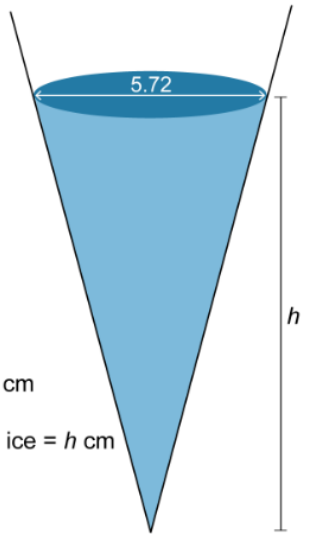
B I U x_2 x^2 Ω Σ

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.

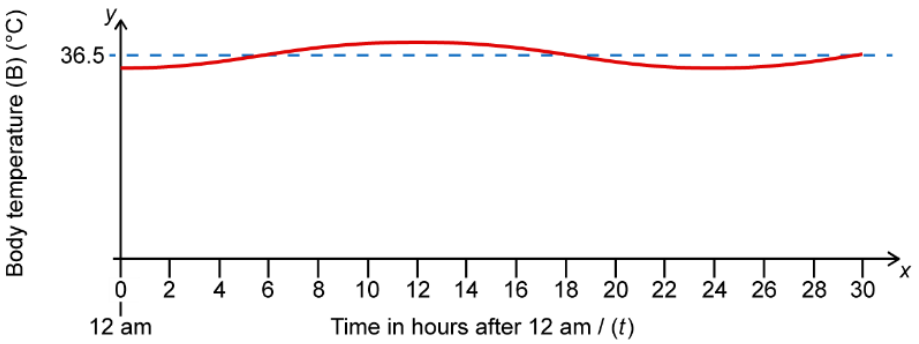
Question 6 (15 marks)

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 (°C)

t is the time in hours after midnight.

This media is interactive



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Ingrid knows it is best to sleep for 8 to 10 hours when her body temperature is 36.5 °C or below.

Question 6a (1 mark)

Suggest a sleeping schedule for Ingrid.

Sleep time: : Select

Wake up time: : Select

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.

Scroll down to continue

Question 6b (2 marks)

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

Maximum: : Select

Minimum: : Select

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

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

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

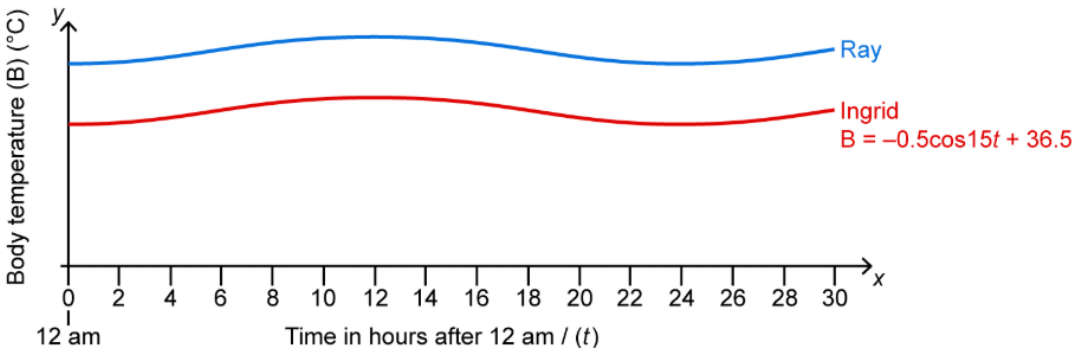
where t is the time in hours after 12 am. Angles are in degrees.

Question 6e (3 marks)

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

Styles

Ray's body temperature is 0.25 °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 °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.

Video | Script

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.

©

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)

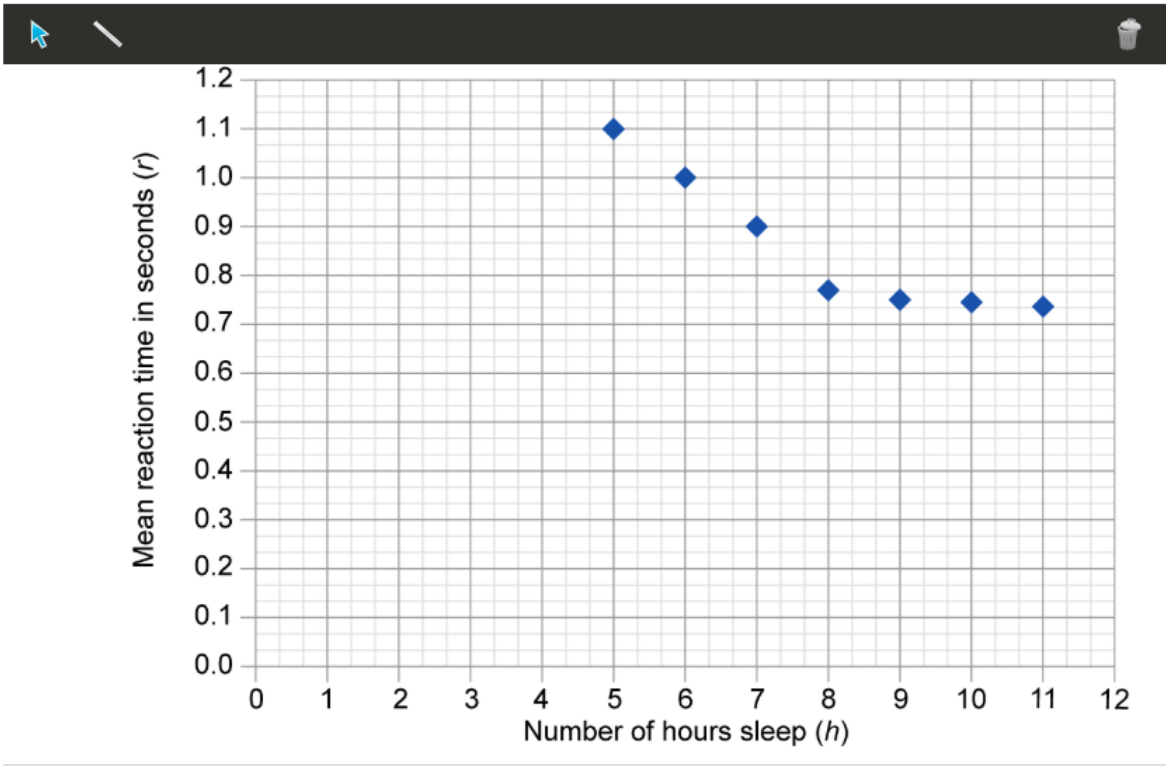
Show that the mean reaction time is 0.77 s, for this group of sprinters.

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)

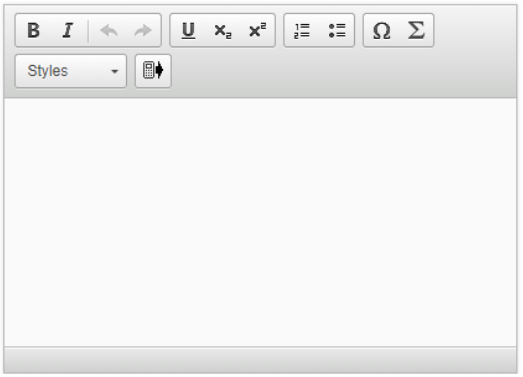
$w = 24\,(100)^{-r}$

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.



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_2 x^2 Ω Σ Styles

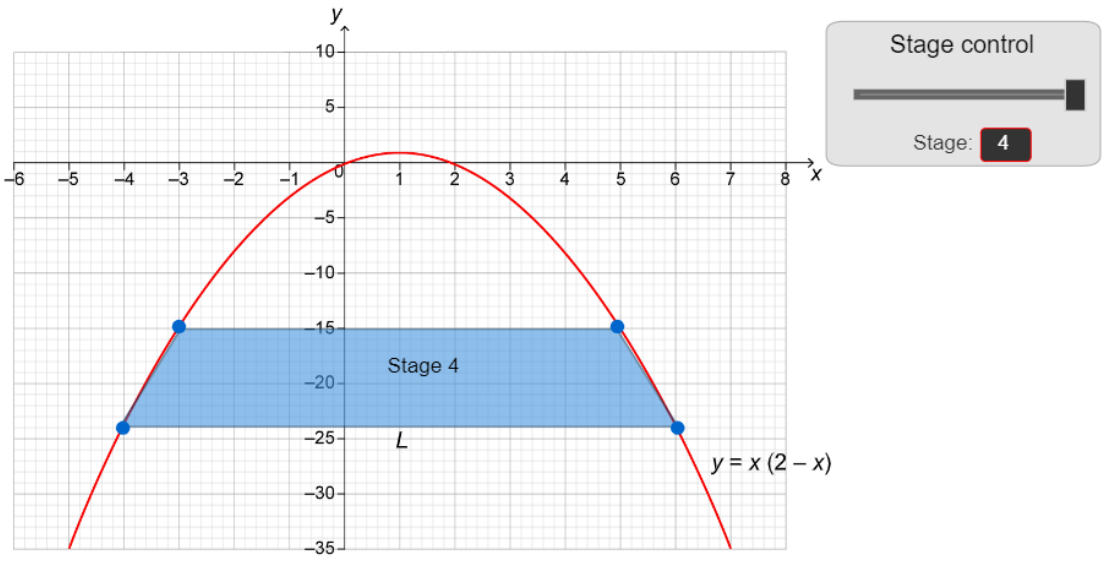
Question 8 (30 marks)

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



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 Ω Σ Styles

Question 8c (2 marks)

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

B I U x_2 x^2 Ω Σ 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_2 x^2 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					