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Mathematics: applications and interpretation

Standard level

Paper 1

14 May 2026

Zone A afternoon | Zone B afternoon | Zone C afternoon

Session number

1 hour 30 minutes

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Instructions to students

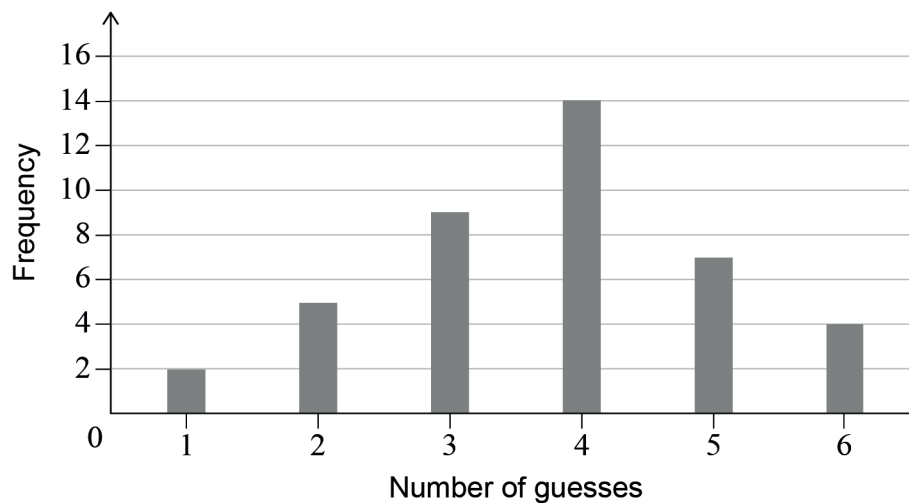
- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- A graphic display calculator is required for this paper.
- Answer all questions.
- Answers must be written within the answer boxes provided.
- Unless otherwise stated in the question, all numerical answers should be given exactly or correct to three significant figures.
- A clean copy of the **mathematics: applications and interpretation SL formula booklet** is required for this paper.
- The maximum mark for this examination paper is **[80 marks]**.



Answers must be written within the answer boxes provided. Full marks are not necessarily awarded for a correct answer with no working. Answers must be supported by working and/or explanations. Solutions found from a graphic display calculator should be supported by suitable working. For example, if graphs are used to find a solution, you should sketch these as part of your answer. Where an answer is incorrect, some marks may be given for a correct method, provided this is shown by written working. You are therefore advised to show all working.

1. [Maximum mark: 9]

Kyle plays a daily word game where players identify a five-letter word in the fewest guesses possible. He plays the game a total of 41 times and identifies the word within 6 guesses each time. His guess distribution is shown in the following graph.



- (a) State whether the data are discrete or continuous. [1]
- (b) Calculate Kyle's mean number of guesses from this sample. [2]

Kyle's friend Hansol also plays the game 41 times. Hansol's guess distribution is shown in the box and whisker plot in the following diagram.



(This question continues on the following page)



(Question 1 continued)

(c) Complete the following table:

[3]

	Kyle	Hansol
Q_1 (lower quartile)		
Q_2 (median)		
Q_3 (upper quartile)		

(d) On the graph in part (b), draw a box and whisker plot to represent Kyle's scores.

[1]

Kyle claims that he is a better player than Hansol.

(e) With reference to the box and whisker plots, state a reason

(i) to support his claim.

(ii) to counter his claim.

[2]

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2. [Maximum mark: 7]

Carboys are containers used to hold chemical waste in laboratories. Shaud wants to buy some carboys for his laboratory. He finds one on a store's website, shown in the following diagram.

diagram not to scale



The store states that the carboy has height 299 mm, length 218 mm and width 318 mm. Shaud models the shape of this carboy as a cuboid and uses these dimensions to find the volume of one container.

- (a) Calculate the volume that Shaud finds, to the nearest cubic millimetre. [2]

The store states that the actual volume of the container is 20 litres.

- (b) Given that 1 mm^3 is equal to 0.001 ml, calculate the percentage error in Shaud's calculation. [4]
- (c) State one reason why Shaud's calculation might overestimate the volume. [1]

(This question continues on the following page)



(Question 2 continued)

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24EP05

Turn over

3. [Maximum mark: 6]

A mathematics teacher surveys her 200 students. She asks each student if they are left-handed or right-handed and whether they prefer geometry or algebra. The results are shown in the following table.

	Geometry	Algebra
Left-handed	16	6
Right-handed	67	111

A student is randomly selected from this group.

- (a) Write down the probability that the student is left-handed and prefers geometry. [1]
- (b) Find the probability that the student prefers geometry, given that they are left-handed. [2]

The teacher randomly selects two students from the 200 students to be the class leaders.

- (c) Find the probability that at least one of the selected students is left-handed. [3]

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4. [Maximum mark: 5]

Myles is on his school's basketball team. The probability that he scores a point on any free throw attempt is 73%, independent of any other free throws he has made.

- (a) Given that Myles has 2 free throw attempts, find the probability that he scores a point both times. [2]

During a particular game, Myles attempts a total of 5 free throws.

- (b) Find the probability that Myles scores a point on at least 3 of these free throw attempts. [3]

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5. [Maximum mark: 6]

A group of friends want to rent a beach house for their vacation. The cost per person, c , varies inversely with the total number of people, n , who will be sharing the cost.

If four people share the cost equally, then the cost per person is \$187.50.

- (a) Determine an equation for c in terms of n . [2]

The group wants the cost per person to be less than \$100.00.

- (b) (i) Find the minimum number of people needed to share the cost to meet this requirement.

- (ii) Find the cost per person for this number of people. [4]

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6. [Maximum mark: 4]

Consider the function $g(x) = \log_{10}(x + 1) + 3$, where $x > -1$.

(a) Find $g^{-1}(3)$. [2]

(b) $g^{-1}(x)$ has a horizontal asymptote at $y = a$. Find the value of a . [2]

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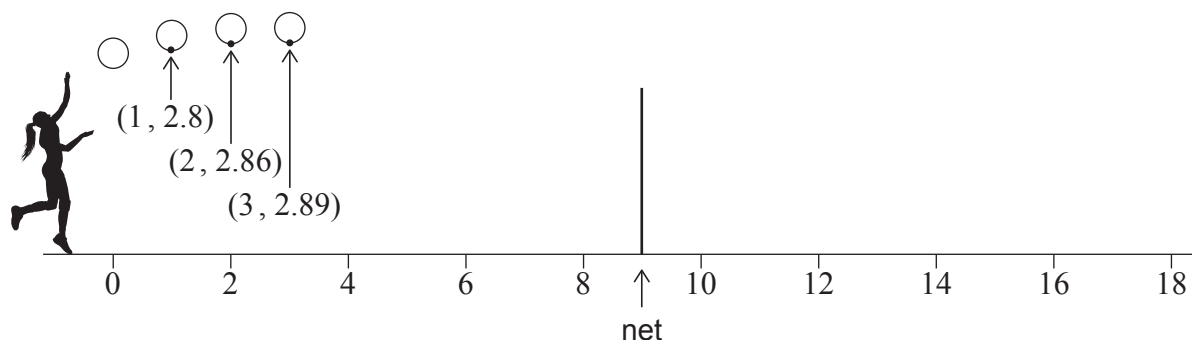


7. [Maximum mark: 10]

Emily practices serving a volleyball directly towards the net. A high-speed camera is positioned on the side of the volleyball court. After Emily hits the ball, the camera records that the lowest point of the ball passes through the points $(1, 2.8)$, $(2, 2.86)$ and $(3, 2.89)$.

The x -coordinate represents the ball's horizontal distance, in metres (m), from the point at which Emily hits the ball. The y -coordinate represents the height, h metres, of the lowest point of the ball above the ground.

diagram not to scale



The height, h , can be modelled with an equation in the form $h(x) = ax^2 + bx + c$.

- Use the coordinates of the points to write down three equations in terms of a , b and c . [2]
- Find the equation of $h(x)$. [2]
- Comment on the meaning of the value of c in context. [1]

For the serve to be in play, the ball must pass over the net, which is 9 m horizontally from where Emily hits the ball and 2.24 m in height. The ball must also hit the court on the other side before the end line, which is 18 m horizontally from where Emily hits the ball.

- Determine whether Emily's serve will be in play. [5]

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(Question 7 continued)

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24EP11

Turn over

8. [Maximum mark: 5]

Cindy is investigating the skills required to be a good climber. She decides to determine whether there is a difference in the mean climbing times between students on the swim team and students on the gymnastics team. She randomly selects six swimmers and six gymnasts and records the time it takes for each of them to reach the top of a climbing wall.

Her data are shown in the following table.

Times for swimmers (seconds)	61	74	69	71	58	70
Times for gymnasts (seconds)	63	71	59	67	69	65

Cindy performs a two-tailed t -test at a 5 % level of significance. She assumes that the samples are taken from normal distributions with equal variance. The null hypothesis is $\mu_S = \mu_G$, where μ_S is the mean climbing time for swimmers and μ_G is the mean climbing time for gymnasts.

- (a) Write down the alternative hypothesis. [1]
- (b) Calculate the p -value for this test. [2]
- (c) State the conclusion of the test in the context of the question. Justify your answer. [2]

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(Question 8 continued)

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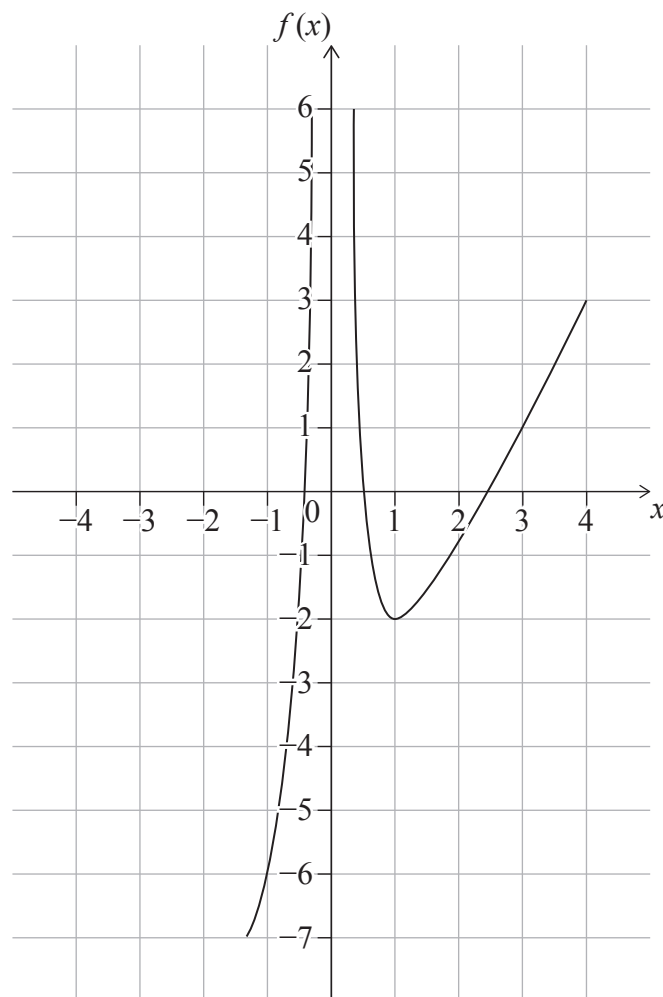


24EP13

Turn over

9. [Maximum mark: 5]

The following graph shows the function $f(x) = \frac{1}{x^2} + 2x - 5$.



(a) Find $f'(x)$.

[2]

(This question continues on the following page)



(Question 9 continued)

- (b) Identify whether each statement must be true or false according to the graph.

Indicate your choices by placing tick marks in the appropriate columns.

[3]

Statement	True (✓)	False (✓)
There is a horizontal asymptote at $f(x) = 0$		
$f^{-1}(1) = -2$		
$f'(0) = 0$		
$f(3) > 0$		
$f'(3) > 0$		

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10. [Maximum mark: 8]

To make a wastewater treatment plant fully functional, the flow rate of wastewater into the plant must be increased each day until the flow rate is set to a value greater than 25 cubic metres per minute ($\text{m}^3 \text{min}^{-1}$). The flow rate is set by the plant manager at the start of each day, and remains constant for the following 24 hours.

On day 1, the flow rate is set to $2.5 \text{ m}^3 \text{min}^{-1}$. The following table shows the flow rate for each of the first three days.

Day	1	2	3
Flow rate ($\text{m}^3 \text{min}^{-1}$)	2.5	3.5	4.9

- (a) Show that these flow rates form a geometric sequence. [2]

This geometric sequence continues until day n , when the flow rate is first set to a value greater than $25 \text{ m}^3 \text{min}^{-1}$.

- (b) Find the value of n . [2]

The plant manager is required to report the total volume of wastewater that flows into the plant from the start of day 1 until the end of day n .

- (c) (i) Find the sum of the flow rates for the first n days, in $\text{m}^3 \text{min}^{-1}$.
 (ii) Hence, or otherwise, find the total volume of wastewater in m^3 that flows into the plant during this time. [4]

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(Question 10 continued)

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24EP17

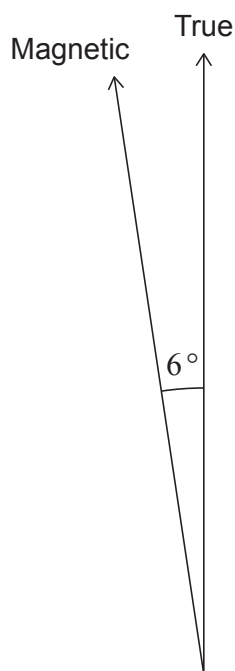
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11. [Maximum mark: 8]

Bearings are measured from true north, which is the direction towards the geographic North Pole. A compass points to magnetic north. There is a small difference between true north and magnetic north.

Scotty is hiking in a location where magnetic north is 6 degrees from true north, as shown in the following diagram.

diagram not to scale



He is at a point, A, and wants to hike to a second point, B, which is 5 kilometres (km) away in the direction of true north. Scotty uses his compass as a guide and travels in the direction of magnetic north.

- (a) Write down the bearing on which Scotty is travelling towards magnetic north. [1]

Scotty hikes a straight path on this bearing for 5 km and stops at a point, C, to check his position.

- (b) Find angle $\hat{ACB}$. [2]

- (c) Calculate the distance from point C to point B. [3]

Scotty hikes a straight path from point C to point B. In total, he hikes for 2 hours and 15 minutes.

- (d) Calculate Scotty's average speed for the total hike, in km h^{-1} . [2]

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(Question 11 continued)

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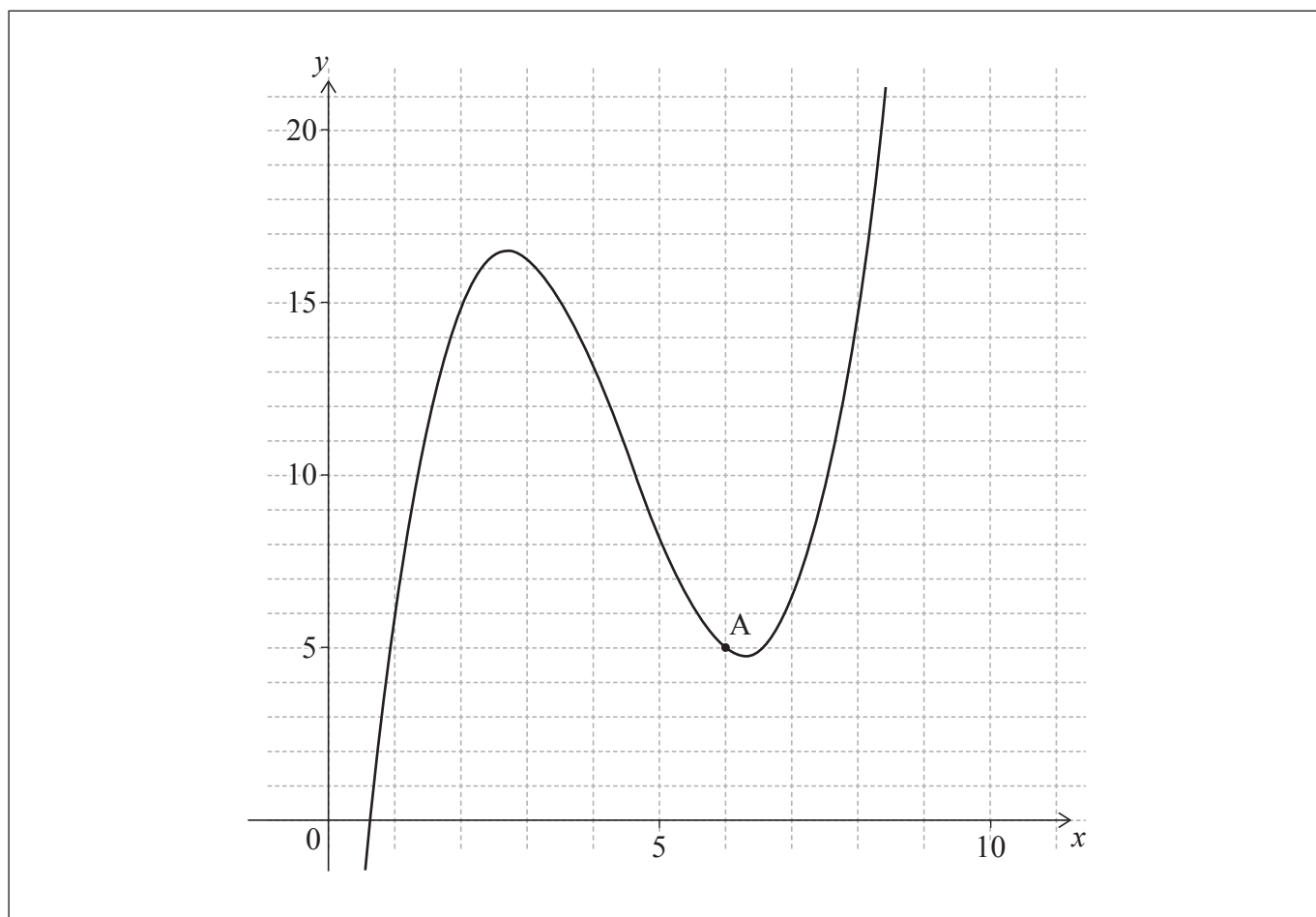
24EP19

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12. [Maximum mark: 7]

The graph of $f(x) = \frac{1}{2}x^3 - \frac{27}{4}x^2 + \frac{51}{2}x - 13$ is shown on the following axes.

Point A is on the curve and has coordinates (6, 5).



- (a) Find the gradient of the normal to $f(x)$ at point A. [2]
- (b) Write down the equation of the normal to $f(x)$ at point A. [1]
- (c) Draw the normal line on the axes given above. [2]
- (d) Find the coordinates of the point(s), other than point A, where the normal line intersects the graph of $f(x)$. [2]

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(Question 12 continued)

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References:

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7. KeithBishop, 2012. *Volleyball players – girls*. [image online] Available at: <https://www.gettyimages.co.uk/detail/illustration/volleyball-players-girls-royalty-free-illustration/455440103?adppopup=true> [Accessed 8 August 2025]. Source adapted.



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24EP23

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24EP24