2026

MATHEMATICS

Claude Specimen Paper 2

Paper 2 · 2 hours 15 minutes · **90 marks**

Name: _____

Class: _____ Date: _____

- Answer **all** questions. There are 10 questions of varying marks and length. The last question applies mathematics to a real-world situation.
- Write your answers and working in the spaces provided. Omission of essential working will result in loss of marks.
- An approved scientific calculator may be used. Use a ruler and geometrical instruments where needed.
- If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to 3 significant figures. Give answers in degrees to 1 decimal place.
- For π, use your calculator value or 3.142, unless the question says otherwise.
- The number of marks is given in brackets [ ] at the end of each question or part question. The total for this paper is 90.
- Diagrams are **not** drawn to scale unless stated. Relevant formulae are on the next page.

This is an original practice paper written to the 2026 O-Level Mathematics (4052) format. It is not an official examination paper and does not forecast exact questions.

Mathematical Formulae

Compound interest

Total amount = $P\left(1+\frac{r}{100}\right)^{n}$

Mensuration

Curved surface area of a cone = πrl

Surface area of a sphere = $4\pi r^{2}$

Volume of a cone = $\frac{1}{3}\pi r^{2}h$

Volume of a sphere = $\frac{4}{3}\pi r^{3}$

Area of triangle *ABC* = $\frac{1}{2}ab\sin C$

Arc length = $r\theta$, where θ is in radians

Sector area = $\frac{1}{2}r^{2}\theta$, where θ is in radians

Trigonometry

$$\frac{a}{\sin A}=\frac{b}{\sin B}=\frac{c}{\sin C}$$

$$a^{2}=b^{2}+c^{2}-2bc\cos A$$

Statistics

Mean = $\frac{\sum fx}{\sum f}$

Standard deviation = $\sqrt{\frac{\sum fx^{2}}{\sum f}-\left(\frac{\sum fx}{\sum f}\right)^{2}}$

1 A city's water network delivers 1.6×10^6 m^3 of water each day. The water is shared between households and non-domestic users in the ratio 9 : 11.

(a) Calculate the volume of water delivered to households each day. Give your answer in m^3, in standard form.

..... m^3 [2]

(b) 1 m^3 = 1000 litres.

(i) Express your answer to **(a)** in litres, in standard form.

..... litres [1]

(ii) The households have a total population of 5.6×10^6. Calculate the average volume of water, in litres, used by one person in a day.

..... litres [2]

(iii) A reservoir holds 2.4×10^7 m^3 of water. Assuming that the reservoir supplies only the households, calculate the number of days for which it could meet the households' daily demand.

..... days [1]

(c) The price of water was increased by 8%. The new price is \$3.78 per m^3. Calculate the price before the increase.

\$ ..... per m^3 [2]

2 The table summarises the times, t minutes, taken by 50 students at School A to travel to school one morning.

Time, t minutes	**$0 < t \leq 10$**	**$10 < t \leq 20$**	**$20 < t \leq 30$**	**$30 < t \leq 40$**	**$40 < t \leq 50$**
Number of students	6	14	17	9	4

(a) Calculate an estimate of the mean time.

..... minutes [2]

(b) Calculate an estimate of the standard deviation of the times.

..... minutes [2]

(c) The students at School B have a mean travelling time of 19.8 minutes and a standard deviation of 6.4 minutes. Make one valid comparison between the travelling times at the two schools. Give a reason for your comparison.

[1]

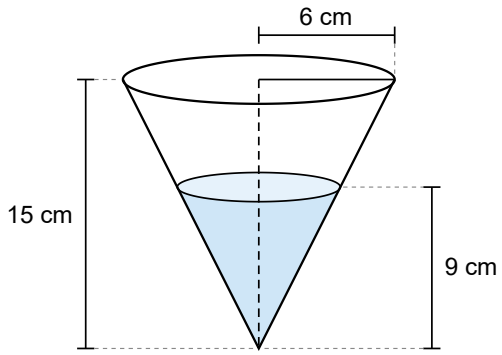
(d) One of the 50 students at School A is chosen at random. Find the probability that this student's journey took 20 minutes or less.

Answer ..... [1]

(e) Two of the 50 students at School A are chosen at random. Find the probability that both of them took more than 30 minutes.

Answer ..... [2]

3 A paper cup used at a water cooler is in the shape of an inverted right circular cone of base radius 6 cm and height 15 cm, as shown in the diagram. The cup is filled with orange juice to a depth of 9 cm, as shown. The surface of the juice is parallel to the open top of the cup.



(a) Calculate the volume of the cup when it is completely full.

..... cm^3 [2]

(b) (i) Show that the slant height of the cup is 16.2 cm, correct to 3 significant figures.

[2]

(ii) Calculate the curved surface area of the cup.

..... cm^2 [2]

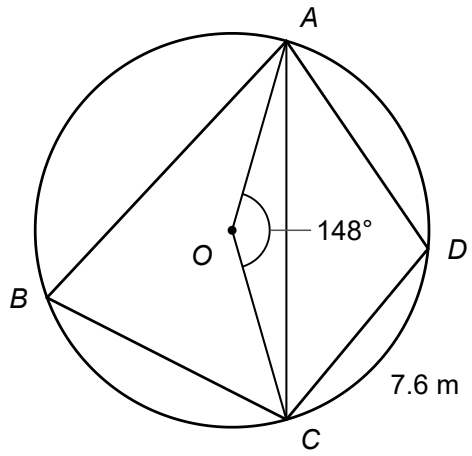
(c) (i) The surface of the juice is a circle. Write down the ratio
(area of the surface of the juice) : (area of the open top of the cup)
in the form a : b, where a and b are integers with no common factor.

Answer ..... [1]

(ii) Use similar figures to calculate the volume of the juice in the cup.

..... cm^3 [2]

4 The diagram shows a circular pond, with centre O and radius 6.74 m. The points A, B, C and D lie on the edge of the pond. chord CD = 7.6 m and angle AOC = 148°.



(a) Find angle ABC. Give a reason for your answer.

Angle ABC = ... ° [1]

(b) Calculate the length of AC.

AC = ... m [2]

(c) Find angle ADC. Give a reason for your answer.

Angle ADC = ... ° [1]

(d) Calculate angle CAD.

Angle CAD = ... ° [2]

(e) Calculate the area of triangle ACD.

..... m^2 [2]

(f) A boardwalk is built along the arc ADC of the pond. Calculate the length of the boardwalk.

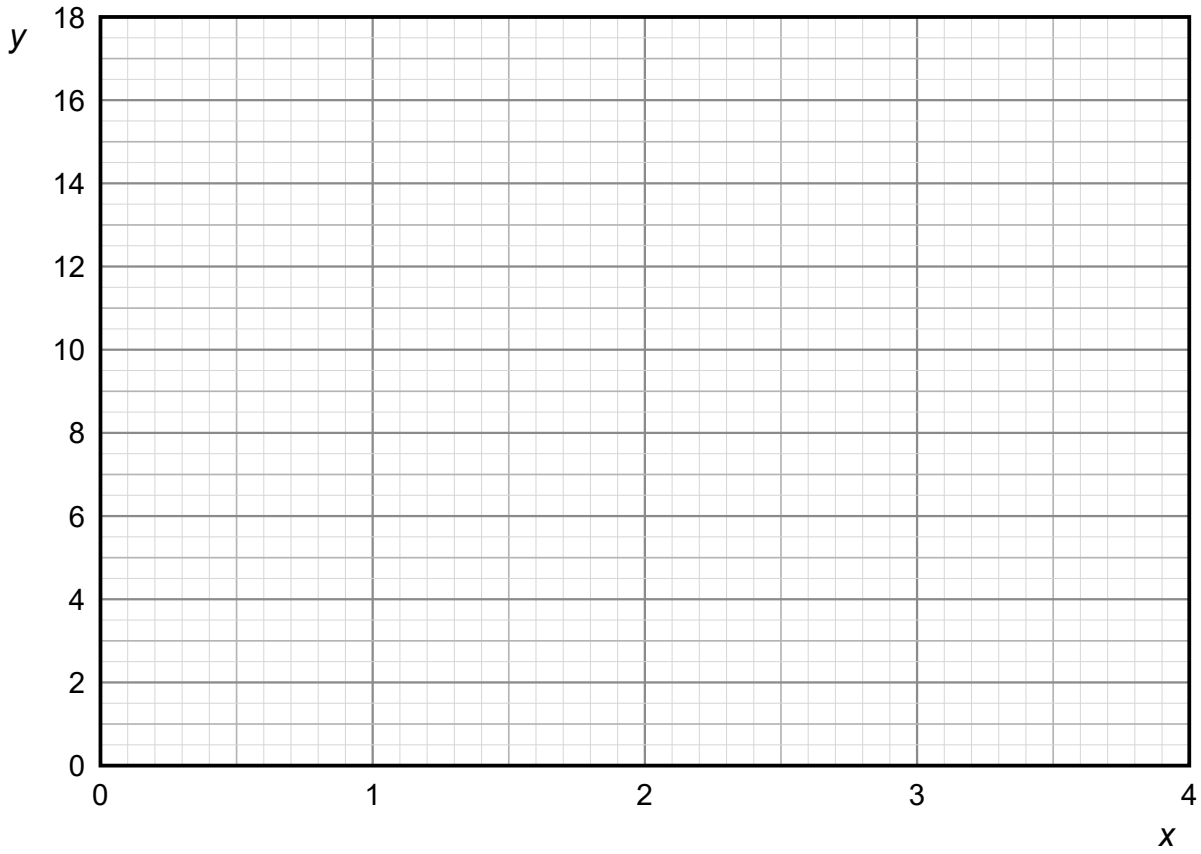
..... m [2]

5 The table shows some values of x and y for the curve $y = x^2 + \frac{4}{x}$, for $0.5 \leq x \leq 4$.

x	0.5	0.75	1	1.5	2	2.5	3	3.5	4
y	8.25	5.90	5.00		6.00	7.85	10.33		17.00

(a) Complete the table. Give the missing values correct to 2 decimal places. [2]

(b) On the grid, plot the points from the table and join them with a smooth curve. [3]



(c) By drawing a tangent, estimate the gradient of the curve at the point where $x = 3$.

Gradient = ... [2]

(d) (i) On the grid, draw the straight line $y = x + 7$. [1]

(ii) Use your graph to solve the equation $x^2 + \frac{4}{x} = x + 7$.

x = ... [1]

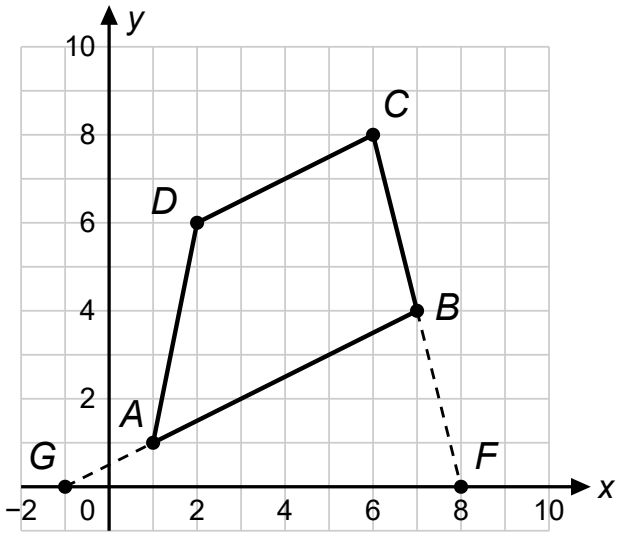
(e) Show that the equation in **(d)(ii)** can be written as $x^3 - x^2 - 7x + 4 = 0$.

[1]

(f) The graph can also be used to solve $x^3 - x^2 - 9x + 4 = 0$. Write down the equation of the straight line that should be drawn.

Answer ..... [1]

6 The diagram shows the quadrilateral *ABCD* with vertices *A*(1, 1), *B*(7, 4), *C*(6, 8) and *D*(2, 6). The line *AB* produced meets the *x*-axis at *G*(−1, 0). The line *BC* produced meets the *x*-axis at *F*.



(a) Find the gradient of *AB*.

Answer ..... [1]

(b) Calculate the length of *AD*.

Answer ..... units [2]

(c) Find the equation of the line *BC*.

Answer ..... [2]

(d) Find the area of triangle *GBF*.

Answer ..... units² [2]

(e) The side *DC* is parallel to *AB*.

(i) Write down the column vector $\overrightarrow{AB}$.

Answer ..... [1]

(ii) Given that $\overrightarrow{DC} = k\overrightarrow{AB}$, find the value of *k*.

k = ... [1]

7 Hui Min cycles from her home to Sembawang Park, a distance of 20 km, at an average speed of x km/h. She returns by the same route at an average speed of $(x + 3)$ km/h. The return journey takes 10 minutes less than the outward journey.

(a) Show that $x^2 + 3x - 360 = 0$.

[3]

(b) Solve the equation $x^2 + 3x - 360 = 0$, giving your answers correct to 2 decimal places.

$x =$ ..... [2]

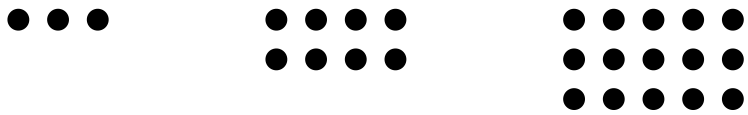
(c) Explain why one of the answers in (b) cannot be the average speed of Hui Min's outward journey.

[1]

(d) Calculate Hui Min's average speed for her whole journey.

Answer ..... km/h [3]

8 The diagrams show the first three patterns in a sequence. Each pattern is a rectangle of dots.



Pattern 1 Pattern 2 Pattern 3

(a) Complete the table.

Pattern number, *n*	1	2	3	4	5
Number of dots	3	8	15		

[1]

(b) Find an expression, in terms of *n*, for the number of dots in Pattern *n*.

Answer ..... [2]

(c) Pattern *N* has 575 dots. Find the value of *N*.

N = ... [2]

(d) Show that the number of dots in Pattern (*n* + 1) is $(2n + 3)$ more than the number of dots in Pattern *n*.

[2]

(e) The numbers of dots in Pattern *n* and in Pattern (*n* + 2) are added. Show that the total is $2(n + 2)^2$.

[2]

9 A bag at a school carnival contains 7 red balls and n yellow balls. The balls are identical except for colour. Hui Ying takes one ball from the bag at random.

(a) Write down, in terms of n, the probability that the ball is red.

Answer ..... [1]

(b) Hui Ying does not put the first ball back. She then takes a second ball at random. Show that the probability that both balls are red is $\frac{42}{(n+7)(n+6)}$.

[2]

(c) The probability that both balls are red is $\frac{7}{22}$. Show that $n^2 + 13n - 90 = 0$.

[2]

(d) Solve the equation in (c) to find the value of n.

n = ... [2]

10 Aisha bakes cupcakes to sell at a school bazaar. She bakes them in batches of 24 cupcakes. Each batch takes 40 minutes in an oven rated at 2.4 kW. Electricity costs \$0.30 per kilowatt-hour (kWh). The ingredients for one batch cost \$9.60.

(a) Show that the cost of electricity for one batch is \$0.48.

[2]

(b) Show that the total cost of making one cupcake is \$0.42.

[1]

Aisha pays \$60 to rent a stall for the day. She has time to bake at most 5 batches. Cupcakes that are not sold bring no income. A survey suggests how many cupcakes customers would buy at each price.

Selling price per cupcake (\$)	1.00	1.50	2.00	2.50
Number of cupcakes customers would buy	220	160	110	70

Aisha bakes only as many whole batches as she needs to meet the demand, up to a maximum of 5 batches. Her profit is her sales income minus the cost of the batches she bakes and the stall rent.

(c) Calculate her profit if she sells the cupcakes at \$2.00 each.

Answer \$ ..... [3]

(d) Calculate her profit if she sells the cupcakes at \$1.50 each.

Answer \$ ..... [2]

(e) Aisha finds that her profit would be \$9.60 at \$1.00 each and \$84.76 at \$2.50 each. Which selling price should she choose? Give a reason for your choice.

[2]