

Class/ Index Number	Centre Number/ 'O' Level Index Number	Name
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新加坡海星中学
MARIS STELLA HIGH SCHOOL
PRELIMINARY EXAMINATION
SECONDARY FOUR

MATHEMATICS	4052/2
Paper 2	19 August 2026
Candidates answer on the Question Paper.	2 hours 15 minutes

READ THESE INSTRUCTIONS FIRST

Write your class, index number and name on all the work you hand in.

Write in dark blue or black pen.

You may use an HB pencil for any diagrams or graphs.

Do not use staples, paper clips, glue or correction fluid.

Answer **all** the questions.

The number of marks is given in brackets [] at the end of each question or part question.

If working is needed for any question it must be shown with the answer.

Omission of essential working will result in loss of marks.

The total of the marks for this paper is 90.

The use of an approved scientific calculator is expected, where appropriate.

If the degree of accuracy is not specified in the question and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.

For π , use either your calculator value or 3.142.

For Examiners' Use

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
/ 10	/ 10	/ 9	/ 11	/ 10	/ 10	/ 11	/ 9	/ 10
						SUBTOTAL		90
						Statement		
						Presentation		
						Units		
						Rounding Off		

Mathematical Formulae*Compound interest*

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

Mensuration

$$\text{Curved surface area of a cone} = \pi r l$$

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

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

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

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

$$\text{Arc length} = r\theta, \text{ where } \theta \text{ is in radians}$$

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

Trigonometry

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

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

Statistics

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

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

1 (a) It is given that $a = \frac{2b+c}{b-c}$.

(i) Find a when $b = 5$ and $c = -3$.

Answer $a = \dots\dots\dots$ [1]

(ii) Rearrange the formula to make b the subject.

Answer $b = \dots\dots\dots$ [2]

(b) Solve the inequality $\frac{(3x-1)}{4} - \frac{(x+2)}{3} > 1$.

Answer $\dots\dots\dots$ [2]

(c) Simplify $\left(\frac{y^4}{36x^{14}}\right)^{-\frac{1}{2}}$.

Answer [2]

(d) Simplify $\frac{4x^2 - 12ax - 5x + 15a}{2x^2 - 18a^2}$.

Answer [3]

2 **(a)** A is the point $(-2, 4)$ and B is the point $(4, 1)$.

(i) Find the length of the line AB .

Answer units [1]

(ii) Find the equation of the line AB .

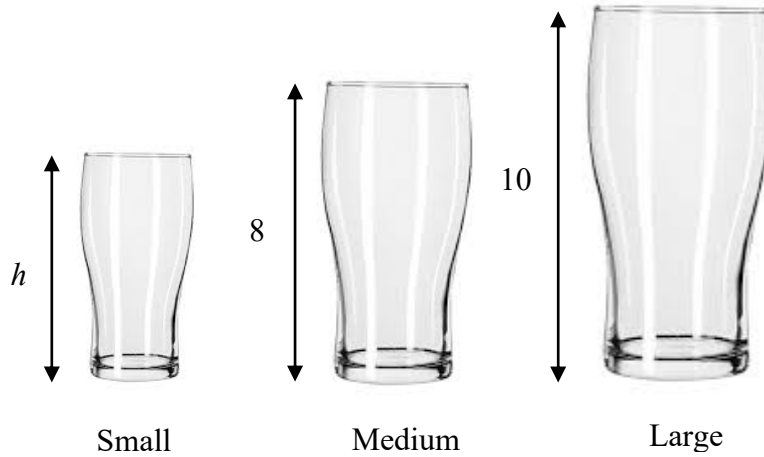
Answer [2]

(iii) The line AB cuts the x -axis at P and the y -axis at Q .

Find the area of triangle OPQ where O is the origin.

Answer units² [2]

(b)



A company manufactures three sizes of glass which are geometrically similar. The height of the small, medium and large glasses are h cm, 8 cm and 10 cm respectively.

- (i) The top of the large glass has a circumference of 30 cm.

Find the circumference of the top of the medium glass.

Answer..... cm [1]

- (ii) The surface area of the small glass is $\frac{9}{16}$ of the surface area of the medium glass.

Show that $h = 6$.

Answer

- (iii) Calculate the ratio of the volume of the small glass to the volume of the large glass.

Answer : [2]

- 3 60 students were each asked how many hours of screen time they had in a day.

The results are shown in the table.

Screen time (t , hours)	$0 \leq t < 2$	$2 \leq t < 4$	$4 \leq t < 6$	$6 \leq t < 8$	$8 \leq t < 10$	$10 \leq t < 12$
Frequency	4	7	15	19	11	4

- (a) Find the interval that contains the median screen time.

Answer $\leq t <$ [1]

- (b) Calculate an estimate of the mean daily screen time.

Answer hours [1]

- (c) Calculate an estimate of the standard deviation of the screen time.

Answer hours [1]

- (d) Three students are selected at random from the survey.
Find the probability that two of them have less than 6 hours of screen time and the other has at least 8 hours of screen time.

Answer [3]

- (e) 60 adults were also asked how many hours of screen time they had in day.
The results are summarised in the table.

Mean	5.23
Standard deviation	1.89

Make two comparisons between the number of hours of screen time by the adults and by the students.

1.
.....
2.
..... [2]

- (f) Another 10 adults were asked how many hours of screen time they had in a day.
The data was added to the study.
The estimated mean hours of screen time by the adults is now 5.4 hours.

Explain what this tells you about the number of hours of screen time of the adults added to the study.

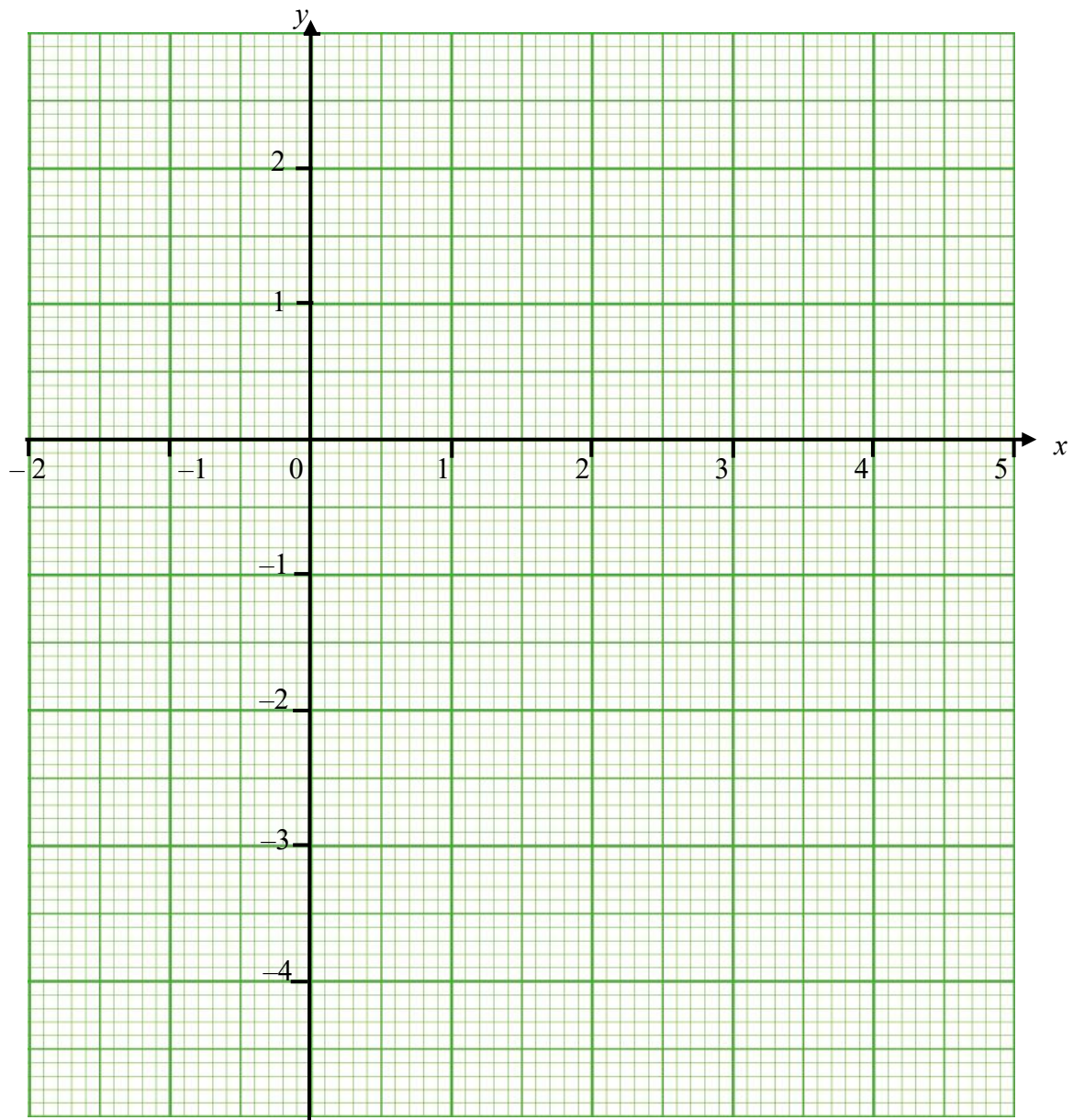
.....
..... [1]

- 4 (a) Complete the table of values for $y = \frac{1}{5}x^3 - x^2 + 1$.

x	-2	-1	0	1	2	3	4	5
y	-4.6	-0.2	1	0.2		-2.6	-2.2	1

[1]

- (b) On the grid provided, draw the graph of $y = \frac{1}{5}x^3 - x^2 + 1$ for $-2 \leq x \leq 5$.



[3]

- (c) (i) On the same grid, draw the line $y = \frac{1}{2}x - 1$ for $-2 \leq x \leq 5$. [1]

- (ii) Write down the x -coordinates of the points where the line intersects the curve.

Answer $x = \dots\dots\dots$ or $\dots\dots\dots$ [2]

- (iii) Show that these x -values are the solutions of the equation $2x^3 - 10x^2 - 5x + 20 = 0$.

Answer

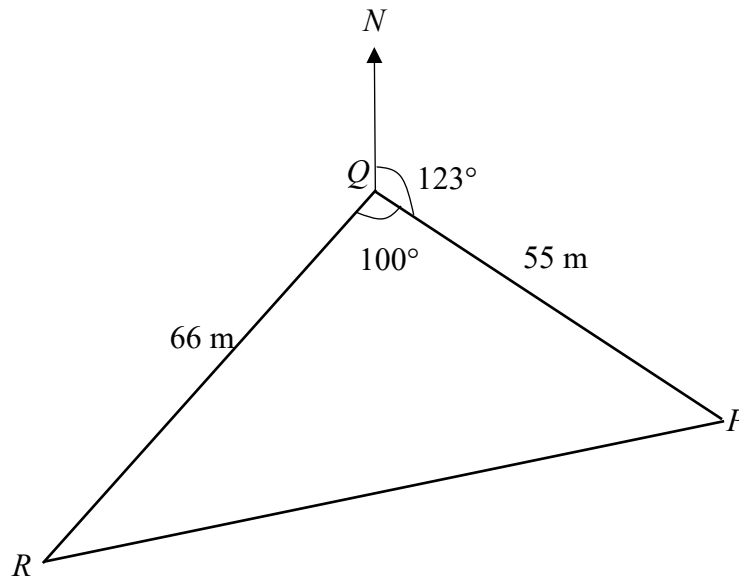
[2]

- (d) The equation $\frac{1}{5}x^3 - x^2 + 1 = k$ has two solutions.

Use your graph to find the two possible values of k .

Answer $k = \dots\dots\dots$ or $\dots\dots\dots$ [2]

- 5 Points P , Q and R are on a horizontal ground.
 $RQ = 66$ m and the bearing of P from Q is 123° .
 $PQ = 55$ m and the angle $PQR = 100^\circ$.



- (a) Find the bearing of Q from R .

Answer [1]

- (b) Calculate PR .

Answer m [3]

- (c) Find the bearing of R from P .

Answer [3]

- (d) A drone flies along the line PR at a vertical height of 10 m.

Find the greatest angle of elevation of the drone from Q .

Answer [3]

- 6** A rectangular piece of land has a length of $(x + 5)$ m and a width of $(2x - 3)$ m.
A straight concrete path runs diagonally across the land from one corner to the opposite corner.
The length of this diagonal path is exactly 20 m.

- (a)** Show that $5x^2 - 2x - 366 = 0$.

Answer

[3]

- (b)** Solve the equation $5x^2 - 2x - 366 = 0$.

Answer $x = \dots\dots\dots$ or $\dots\dots\dots$ [3]

- (c) Hence find the perimeter of the rectangular piece of land, giving your answer correct to 1 decimal place.

Answer m [3]

- (d) A contractor claims that if the diagonal path is increased to 40 m while keeping the exact same algebraic expressions for the length and width, the new value of x will be exactly double the positive value found in part (b).

Without solving the new equation, explain mathematically why the contractor's claim is incorrect.

Answer

.....

[1]

- 7 (a) The first four terms of a sequence are shown below.

$$T_1 = 1^2 + 3 = 4$$

$$T_2 = 2^2 + 6 = 10$$

$$T_3 = 3^2 + 9 = 18$$

$$T_4 = 4^2 + 12 = 28$$

- (i) Write down T_5 in similar form

Answer $T_5 = \dots\dots\dots = \dots\dots [1]$

- (ii) Find an expression, in terms of n , for T_n .

Answer $T_n = \dots\dots\dots [1]$

- (iii) Explain why T_n is always even for all positive integer values of n .

Answer

.....
 [2]

- (iv) Show that $T_n = 2T_{n-1} - T_{n-2} + 2$ for all integers n .

Answer

(b) The n^{th} term of another sequence is given by $T_n = \frac{n^2 + 4}{4n - 1}$.

The term $T_k = \frac{8}{3}$.

Find the value of T_{k+2} .

Answer $T_{k+2} = \dots\dots\dots$ [4]

- 8** An online shopping platform, Maobao, ships two types of parcels: Standard and Express. They utilise two courier services: Speedy (S) and Timely (T).

The shipping costs (in dollars) per parcel for each courier are represented by the cost matrix **C**.

$$\mathbf{C} = \begin{matrix} & \begin{matrix} \text{S} & \text{T} \end{matrix} \\ \begin{pmatrix} 5 & 6 \\ 12 & x \end{pmatrix} & \begin{matrix} \text{Standard} \\ \text{Express} \end{matrix} \end{matrix}$$

Maobao has a shipment of 80 Standard parcels and 50 Express parcels on Monday and a shipment of 100 Standard parcels and 40 Express parcels on Tuesday.

- (a)** Write down a 2×2 matrix, **A**, to represent the parcel quantities, where the rows represent the days (Monday and Tuesday respectively) and the columns represent the parcel types (Standard and Express respectively).

Answer **A** = [1]

- (b)** Find, in terms of x , the matrix **M** = **AC**.

Answer **M** = [2]

- (c)** Explain what the element in the second row and first column of your answer in part (b) represents.

.....

..... [1]

- (d) The elements of the matrix $\mathbf{B}$, where $\mathbf{B} = \mathbf{MD}$, represent the cost differences of the two courier services for Monday and Tuesday respectively.

Write down the matrix $\mathbf{D}$.

Answer $\mathbf{D} =$ [1]

- (e) Find, in terms of x , the matrix $\mathbf{B} = \mathbf{MD}$.

Answer $\mathbf{B} =$ [1]

- (f) The cost of courier service for Tuesday is \$20 cheaper if Maobao engage Speedy's courier service.

Find the value of x .

Answer $x = \dots\dots\dots$ [2]

- (g) The operations manager states:

“Our total shipping bill will be exactly the same for the two days for either courier services.”

Justify whether the manager's claim is correct.

Answer

.....

..... [1]

- 9 The Wong family consists of two working parents and two school-going children living in an HDB flat.

Their current 10-year-old petrol car has reached the end of its Certificate of Entitlement (COE). The COE needs to be renewed based on the latest prices if they wish to extend the use of their current car.

Mr Wong is considering the two following options:

- **Option A:** Renew the COE of their existing petrol car for 10 years. No other upfront cost for this option.
- **Option B:** Buy a brand-new Electric Vehicle (EV), the BYD Atto 3.

The fuel/energy consumption costs of his current car and the EV he is considering are given in the table below.

	Current Petrol Car	EV (BYD Atto 3)
Capacity (Petrol Car) Max Power (EV)	1800cc	100kW
Energy Consumption Rate	12km per litre	16kWh per 100km
Energy Unit Cost	\$3.00 per litre of petrol	\$0.65 per kWh of charging

- (a) Calculate the total annual cost of petrol for his current car and the total annual charging cost for the EV, assuming that the family drives 15,000 km a year.

Answer Petrol Cost \$..... [1]

EV Charging Cost \$..... [1]

(b) In addition to the two options indicated above, Mr Wong's cousin recommends him to consider a third option as given below.

- **Option C:** Switch entirely to a mixture of public transport (bus and train) and limited Grab rides per week.

- **Public Transport (MRT & Bus):** The family will take a combined total of 40 standard trips per week. The average cost per trip is **\$1.70**.
- **Grab / Ride-Hailing:** The family estimates taking a total of **10 Grab trips per week**.
 - 6 trips are during Peak Hours at an average of **\$24.00** per trip.
 - 4 trips are during Off-Peak Hours at an average of **\$14.00** per trip.

(Assume there are exactly 52 weeks per year.)

Taking into account the relevant information given above, calculate the family's total transport cost if they adopt Option C **over a full 10-year period**.

Answer \$..... [2]

- (c) Mr Wong has put aside a family transport budget of \$200,000 for the next 10 years if he continues to maintain his petrol car or change to a new car. Taking into account the inconvenience of giving up driving if he chooses to, he is willing to consider Option C (public transport option) **only if** the total transport cost is less than 70% of his allocated budget for use of a car.

Evaluate each of **Options A, B and C** defined above to determine the option(s) which are financially feasible for Mr Wong, given his budget of \$200,000 and his condition regarding Option C. You must show full calculations for each option.

Latest COE Prices		
Category A	Cars $\leq 1600\text{cc}$ or $\leq 110\text{kW}$	\$121,847
Category B	Cars $>1600\text{cc}$ or $>110\text{kW}$	\$121,502
Category C	Goods Vehicles & Buses	\$93,001
Category D	Motorcycles	\$9,989

	Option A: Renew COE (Petrol)	Option B: Buy new EV (BYD Atto 3)
Upfront cost	COE Renewal Only	Price of car \$61,000 (COE to be bought separately)
Annual Road Tax & Insurance	\$2,200	\$1,500
Annual Maintenance and Inspection	\$1,800	\$600

Answer

[5]

- (d) State one non-financial disadvantage for one of the feasible option(s) you have identified.

Answer

.....

..... [1]

End of Paper

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2026 Secondary Mathematics
Prelim Examination Paper 2 Answer Keys

Qn	Answer Key
1	a)i) $\frac{7}{8}$ ii) $b = \frac{c+ac}{a-2}$ b) $x > 4\frac{3}{5}$ c) $\frac{6x^7}{y^2}$ d) $\frac{4x-5}{2(x+3a)}$
2	a) i) 6.71 units ii) $y = -\frac{1}{2}x + 3$ iii) 9 units b)i) 24 cm iii) 27: 125
3	a) $6 \leq t < 8$ b) $6\frac{4}{15}$ or 6.27 hrs c) 2.56 hrs d) $\frac{975}{6844}$ or 0.142
4	a) -1.4 c) ii) -1.45 or 1.35 (± 0.05) d) $k = 1$ or -2.7 (± 0.05)
5	a) 043° b) 93.0 m c) 258.6° d) 14.6°
6	b) 8.76 or -8.36 c) 56.5 m
7	a)i) $5^2 + 15 = 40$ ii) $T_n = n^2 + 3n$ b) $3\frac{7}{47}$
8	a) $\begin{pmatrix} 80 & 50 \\ 100 & 40 \end{pmatrix}$ b) $\begin{pmatrix} 1000 & 480+50x \\ 980 & 600+40x \end{pmatrix}$ c) total cost of courier service of Speedy on Tuesday. d) $\begin{pmatrix} 1 \\ -1 \end{pmatrix}$ e) $\begin{pmatrix} 520-50x \\ 380-40x \end{pmatrix}$ f) 10
9	a) Petrol Cost = \$3750, EV Charging Cost = \$1560 b) \$139 360 c) Option A and C