Name:	Index Number:	Class:

YIO CHU KANG SECONDARY SCHOOL
O-LEVEL PRELIMINARY EXAMINATION 2025
SECONDARY FOUR EXPRESS
SECONDARY FIVE NORMAL (ACADEMIC)

MATHEMATICS 4052/02

Paper 2 2 hours 15 minutes

Additional Materials: Nil 1 September 2025 (Monday)

READ THESE INSTRUCTIONS FIRST

Do not open this booklet until you are told to do so.

Candidates answer on Question Paper.

Write your name, class and index number on the cover sheet.
Write in dark blue or black pen.
You may use a soft pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.
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 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 the calculator value or 3.142, unless the question requires the answer in terms of π.

The number of marks is given in brackets [ ] at the end of each question or part question.
The total of the marks for this paper is 90.

For Examiner's Use
90

Setter: Mdm Annie Mathews

Mathematical Formulae

Compound interest

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

Mensuration

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

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

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

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

$$\text{Area of } \Delta ABC = \frac{1}{2}bc\sin A$$

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

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

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)** Find all the prime numbers that satisfy the inequality $-5 \leq 2x-3 \leq 7$.

Answer ..... [3]

(b) Simplify $\dfrac{18c^3d^3}{5f^3} \div \dfrac{3c^5d^2}{10f}$.

Answer ..... [2]

(c) Simplify $\left(\dfrac{16y^8}{81x^{12}}\right)^{-\frac{3}{4}}$.

Answer ..... [2]

(d) Write as a single fraction in its simplest form $\dfrac{3x}{(2x-1)^2} - \dfrac{2}{2x-1}$.

Answer ..... [2]

2 **(a)** On average, fruit seller *A* is able to sell 20 mangoes, 32 apples and 15 oranges in a day.
On average, fruit seller *B* is able to sell 15 mangoes, 35 apples and 18 oranges in a day.

The information can be represented by the matrix $\mathbf{F} = \begin{pmatrix} 20 & 32 & 15 \\ 15 & 35 & 18 \end{pmatrix}$.

(i) Evaluate the matrix $\mathbf{T} = 5\mathbf{F}\begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix}$.

Answer **T** = [2]

(ii) State what each of the elements of **T** represents.

……

…… [1]

(b) Seller *A* sells a mango for 80 cents, an apple for 50 cents and an orange for 60 cents.
Seller *B* sells a mango for 70 cents, an apple for 40 cents and an orange for 50 cents.

(i) Represent this information in a 3×2 matrix **C**.

Answer **C** = [1]

(ii) Evaluate the matrix **P = FC**.

Answer **P** = [2]

(iii) The cost price of all the fruits sold is \$10 for each seller.

Explain which seller made a higher profit.

……

……

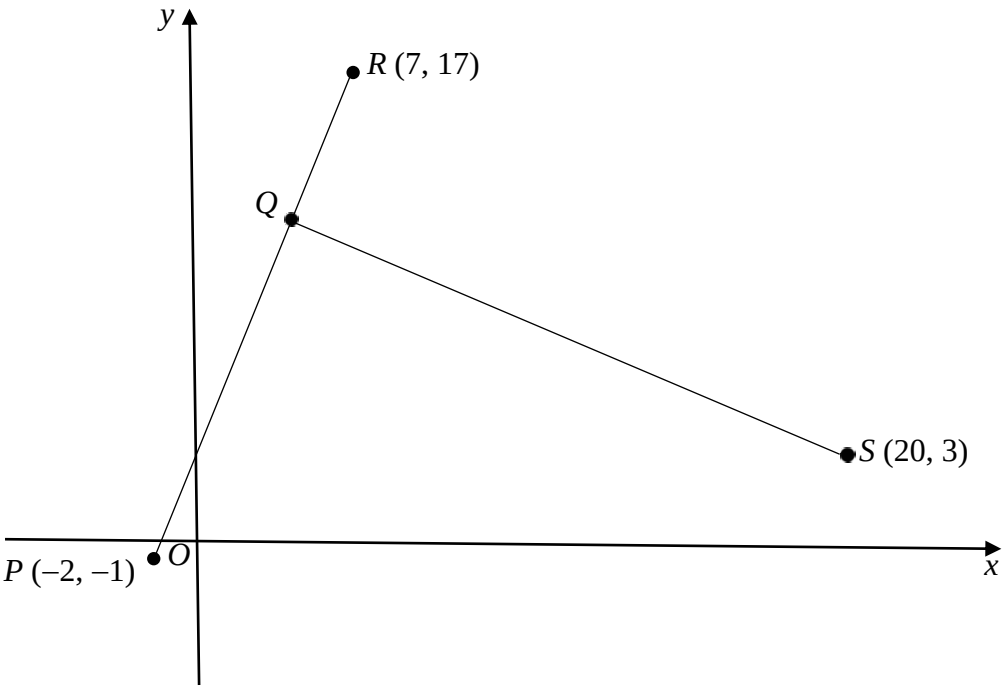
……..……... [1]

(c) In a promotion, both seller *A* and *B* decide to give a discount of 20% for each mango and 10% for each apple.

With the use of matrix multiplication, find a 3×2 matrix **N** where each element represents the new selling price of a mango, an apple and an orange by seller *A* and *B* respectively.

Answer **N** = [2]

3 (a)



The diagram shows the points $P(-2, -1)$, $R(7, 17)$ and $S(20, 3)$.
Q is a point on PR such that SQ is perpendicular to PR.
The product $(\text{gradient of } SQ) \times (\text{gradient of } PR) = -1$.

Use this information to find the equation of SQ.

Answer ..... [4]

(b) G is the point (5, 3).
H is the point (-4, h), where $h > 0$.
The length of line GH is 15 units.

Find the value of h.

Answer h = ... [3]

(c) The y-intercept of the line $2x + ky - 6 = 0$ is -2.

Find the value of k.

Answer k = ... [2]

4 **(a)** Complete the table of values for $y = \frac{x}{4}\left(8 - 6x + x^2\right)$.

Give your answer correct to 2 decimal places.

x	–1	0	0.5	1	1.5	2	2.5	3	4	5
y	–3.75	0		0.75	0.47	0	–0.47	–0.75	0	3.75

[1]

(b) On the grid opposite, draw the graph of $y = \frac{x}{4}\left(8 - 6x + x^2\right)$ for $-1 \le x \le 5$. [3]

(c) Use your graph to find the solution to the equation $x^3 - 6x^2 + 8x = 12$ for $-1 \le x \le 5$.

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

(d) **(i)** Line L has gradient – 0.5 and passes through the point (3, 1).

Draw line L on the same axes for $-1 \le x \le 5$. [2]

(ii) Write down the x-coordinate of the point where line L intersects the curve.

Answer $x =$ ..... [1]

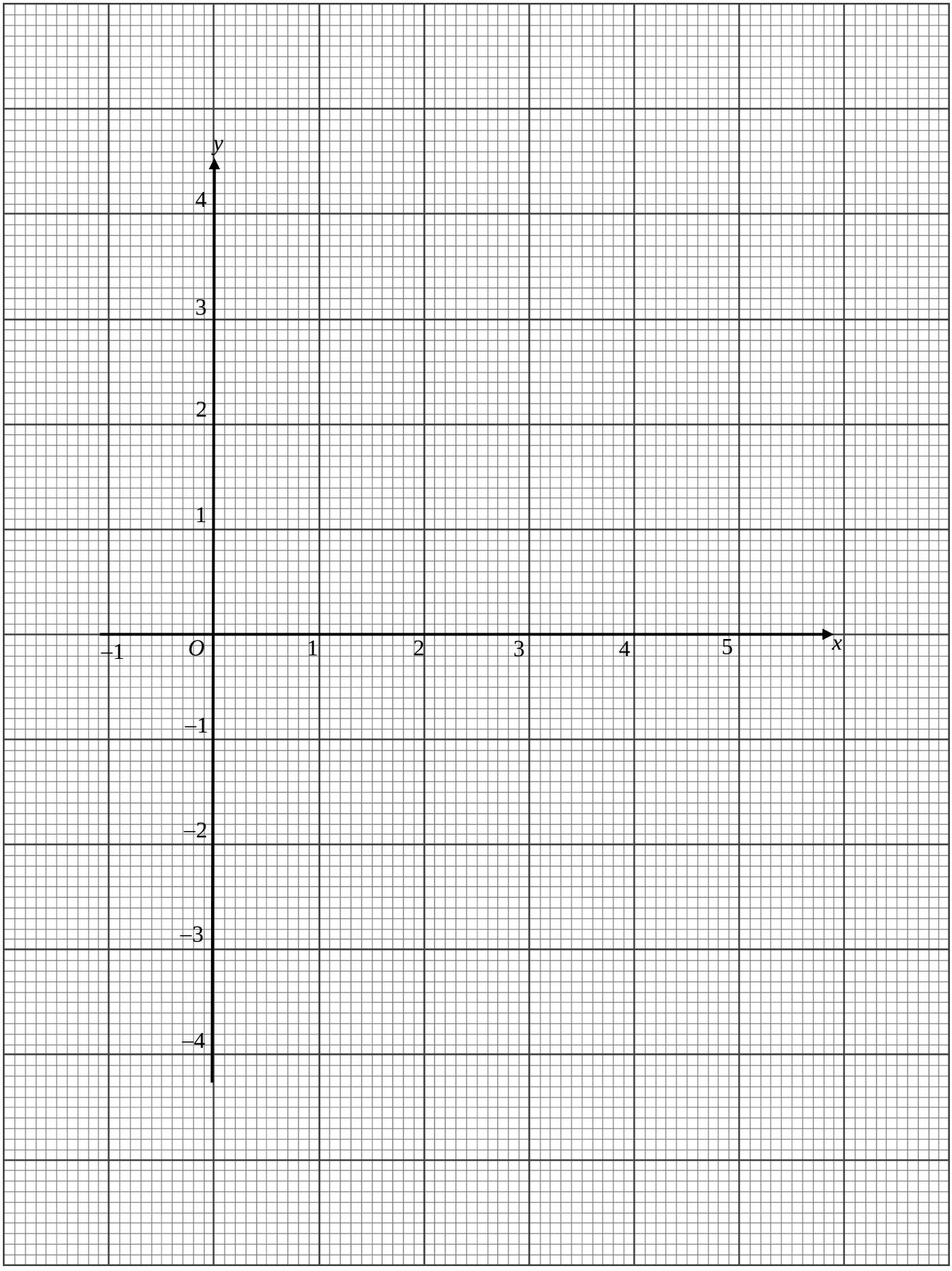
(iii) This value of x is the solution of the equation $x^3 + Ax^2 + Bx + C = 0$.

Find the value of A, B and C.

Answer $A =$ .....

$B =$ .....

$C =$ ..... [3]


y
x
O
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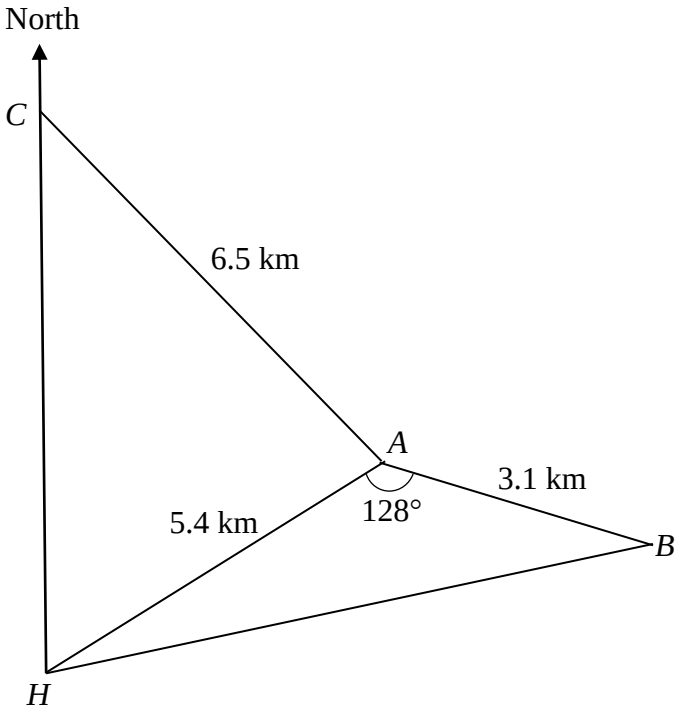

The diagram shows the position of a harbour, *H*, and three islands, *A*, *B* and *C*.
HA = 5.4 km, *AB* = 3.1 km and *AC* = 6.5 km.
The bearing of *A* from *C* is 133° and angle *HAB* = 128°.
C is due north of *H*.

(a) Calculate *HB*.

Answer ..... km [2]

(b) Show that angle $CAH = 71.3°$, correct to one decimal place.

Answer

[3]

(c) Find the bearing of *B* from *A*.

Answer .....° [2]

(d) A vertical tower is located on island *A*.
The angle of elevation of the top of the tower from *B* is 14^o.

Calculate the angle of elevation of the top of the tower from *C*.

Answer .....° [3]

6 A motorboat can sail at a constant speed of x km/h in still water.
When the motorboat sails with the current in a river, its speed is increased by 3 km/h and when it sails against the current, its speed is decreased by 3 km/h.
The boat sails from Village A to Village B against the current and from Village B to Village C with the current.
Village A and Village B are 12 km apart. Village B and Village C are 9 km apart.
The total time taken for the whole journey is 1 hour and 15 minutes.

(a) Show that $5x^2 - 84x - 81 = 0$.

Answer

[5]

(b) Solve the equation $5x^2 - 84x - 81 = 0$.
Give your answers correct to two decimal places.

Answer x = ... or x = ... [3]

(c) Explain why one of the answers in **part (b)** must be rejected.

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…….. [1]

(d) Calculate the difference between the times taken for the boat to travel from Village A to Village B and from Village B to Village C.
Give your answer in minutes and seconds, correct to the nearest second.

Answer ..... minutes ..... seconds [2]

7 **(a)** A group of 50 patients had their blood pressures taken.
The results are shown in the table.

Blood pressure (mmHg)	$100 < p \leq 120$	$120 < p \leq 140$	$140 < p \leq 160$	$160 < p \leq 180$
Frequency	27	12	6	5

(i) Find the interval that contains the median blood pressure.

Answer ..... $< p \leq$ ..... [1]

(ii) Calculate an estimate of the mean blood pressure.

Answer ..... mmHg [1]

(iii) Calculate an estimate of the standard deviation of the blood pressures.

Answer ..... mmHg [1]

(iv) The standard deviation of the blood pressures taken by a second group of patients was 22.1 mmHg.

Use this information to comment on one difference between the two distributions.

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……..…… [1]

(b) The heights of two groups of students are measured.
Their heights are shown in the stem-and-leaf diagram.

Group A					Group B			
			1	14	2			
9	8	8	2	15	3	*x*	7	8
	4	3	3	16	0	2	4	
		3	0	17	8			

Key: 1 | 14 | 2 means a height of 141 cm in group A and a height of 142 cm in group B

(i) The interquartile range for Group B is 10 cm.

Show that the value of x is 3.

Answer

[3]

(ii) One of the students from Group A is selected at random.

Find the probability that the student has a height between 152 cm and 164 cm.

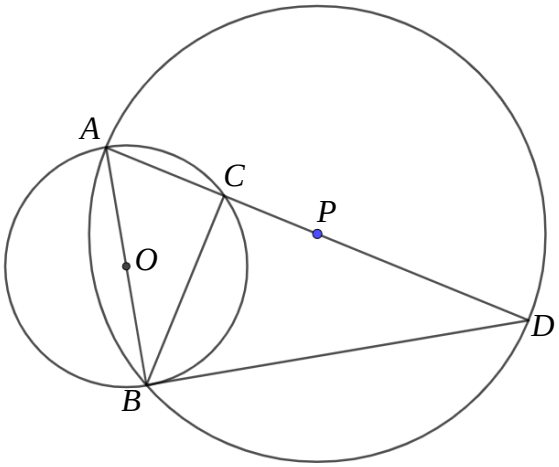
Answer ..... [1]

(iii) Two students are selected at random, one from Group A and the other from Group B.

Find the probability that one has a height above 160 cm and the other has a height below 155 cm.

Answer ..... [2]

8 (a)



A, *B* and *C* are points on the circle with centre *O*.
A, *B* and *D* are points on the circle with centre *P*.

(i) Show that triangle *ABC* is similar to triangle *ADB*.
Give a reason for each statement you make.

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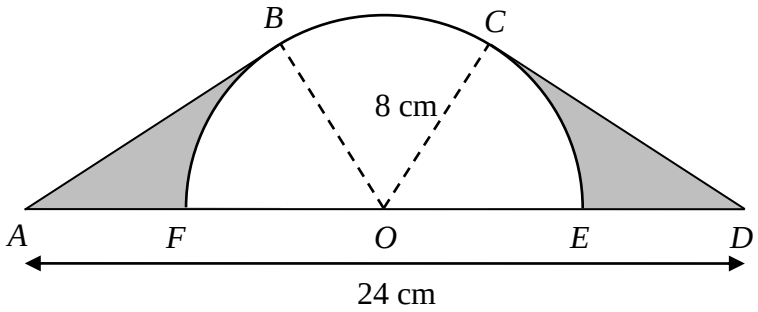
…….. [2]

(ii) *AC* = 6 cm and *CD* = 12 cm.

Calculate the length of *AB*.

Answer ..... cm [2]

(b)



The diagram shows a semicircle *FBCE* with centre *O* and radius 8 cm.
AB is a tangent to the semicircle at *B* and *CD* is a tangent to the semicircle at *C*.
AFOED is a straight line of length 24 cm.
AF = ED.

Calculate the shaded area.

Answer ..... cm^2 [5]

9 Chan is considering installing solar panels at his house and wants to determine if it would be worthwhile.

The tables below show information Chan needs to make his decision.

Electricity usage for 2025 (kWh)					
January	February	March	April	May	June
1007.8	1166.3	1133.6	1249	1248.5	1282.6

Charges for electricity usage
Electricity tariff: 28.12 cents per kWh (excluding GST) (charges are subjected to 9% Goods and Services Tax)

Installation of solar panels	
Dimensions of roof area of Chan's house	9 m by 4 m
Dimensions of 1 solar panel	1.65 m by 1 m
Cost of installing 10 solar panels (this cost is not subjected to 9% GST)	$10 250
Average amount of electricity generated by 1 solar panel	45 kWh per month
Lifespan of solar panels	25 years

(a) For the first six months of 2025, calculate the

(i) average monthly amount of electricity, in kWh, used by Chan.

Answer ..... kWh [2]

(ii) average monthly cost that Chan paid for electricity usage.

Answer $ ..... [2]

(b) Calculate the maximum number of solar panels that can be installed on the roof of Chan's house.

Answer ..... [2]

(c) Should Chan go ahead to install solar panels at his house?
Justify the decisions you make and show your calculations clearly.

Answer

……..…….….

……..… [5]

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