Name:	Index Number:	Class:

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

MATHEMATICS
Paper 1

4052/01
2 hours 15 minutes

1 September 2025 (Monday)

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.
DO **NOT** WRITE ON ANY BARCODES.

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. Gives answers in degrees to one decimal place.
For π, use either your calculator value or 3.142.

For Examiner's Use
90

Mathematical Formulae

Compound interest

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

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

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

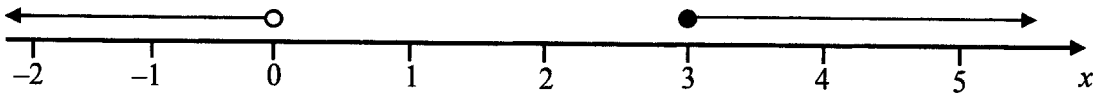
$$\text{Standard deviation} = \sqrt{\frac{\sum fx^2}{\sum f} - [\frac{\sum fx}{\sum f}]^2}$$

Answer **all** the questions.

1 Simplify $5p-4-(3+2p)+p-6$.

Answer ..... [2]

2



(a) Write down the inequalities that represent the numbers indicated on the number line.

Answer ..... [1]

(b) State the smallest prime number that satisfies the number line shown.

Answer ..... [1]

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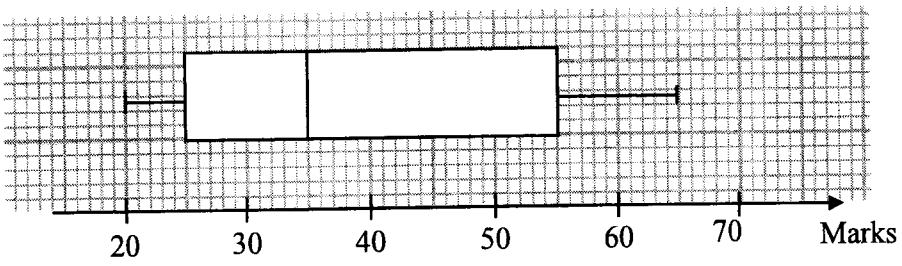
3 Express as a single fraction in its simplest form $\frac{3x-2}{12}-\frac{5x-3}{8}-\frac{7(x+1)}{6}$.

Answer ..... [3]

4



The box-and-whisker plot gives information about the marks of 40 students in a class who sat for a Mathematics examination.

(a) Use the box-and-whisker plot to find the median mark.

Answer ..... [1]

(b) Layla says, "There are twice as many students who scored more than 35 marks as those who scored less than 35 marks".

Is Layla correct?
Give a reason for your answer.

.....

.....

..... [1]

---

5 Factorise.

(a) $24pq^2 + 15pq - 9p^2q$

Answer ..... [1]

(b) $5 + 2a^2bc - 5ac - 2ab$

Answer ..... [2]

6 A map of Singapore has a scale of 1 : 125000.

(a) The length of the longest river in Singapore, Kallang River, is 10 km.
Calculate the length of Kallang River on the map.

Answer ..... cm [2]

(b) The area of Pulau Ubin island on the map is 6.56 cm^2.
Calculate the area, in square kilometres, of Pulau Ubin island.

Answer ..... km^2 [2]

---

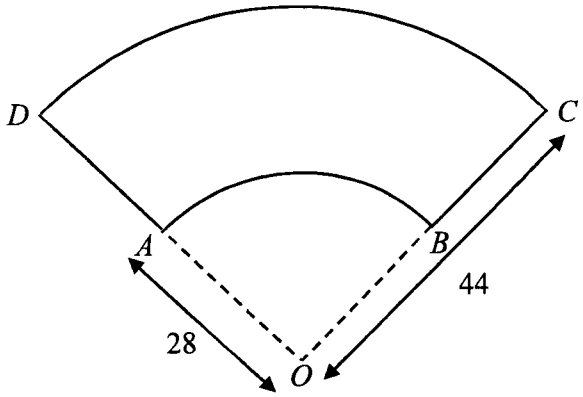
7 In this sequence, the difference between any two consecutive terms is the same number.

$w \quad x \quad y \quad 23 \quad z \quad \ldots$

The sum of the first five terms is 80. Find the values of w, x, y and z.

Answer $w =$ ..... $x =$ ..... $y =$ ..... $z =$ ..... [2]

8



The diagram shows the coverage of a car windscreen wiper $ABCD$. AB and DC are arcs of circles centre O with radii 28 cm and 44 cm respectively. The perimeter of $ABCD$ is $72\pi - 76$ cm.

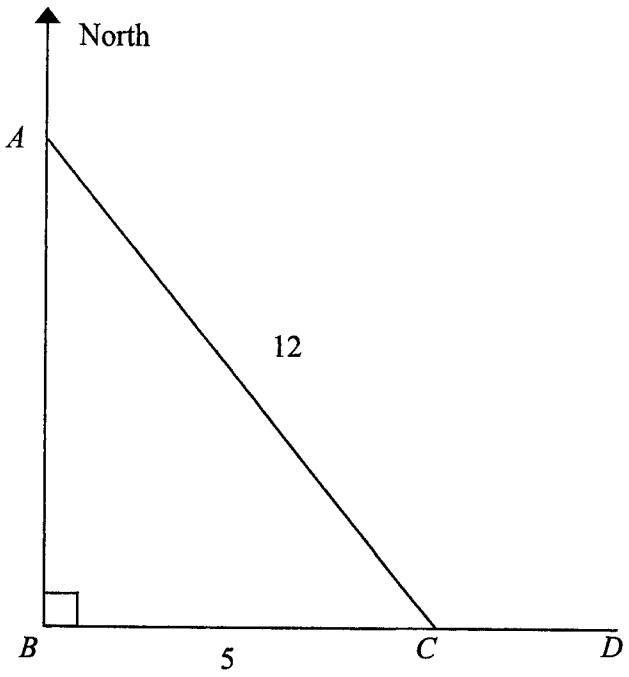
(a) Calculate angle AOB in radians, leaving your answer in terms of π.

Answer ..... [2]

(b) Calculate the area of the windscreen that the car wiper wipes through.

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

9



A, B, C and D are four points on horizontal ground.
$AC = 12$ km and $BC = 5$ km.

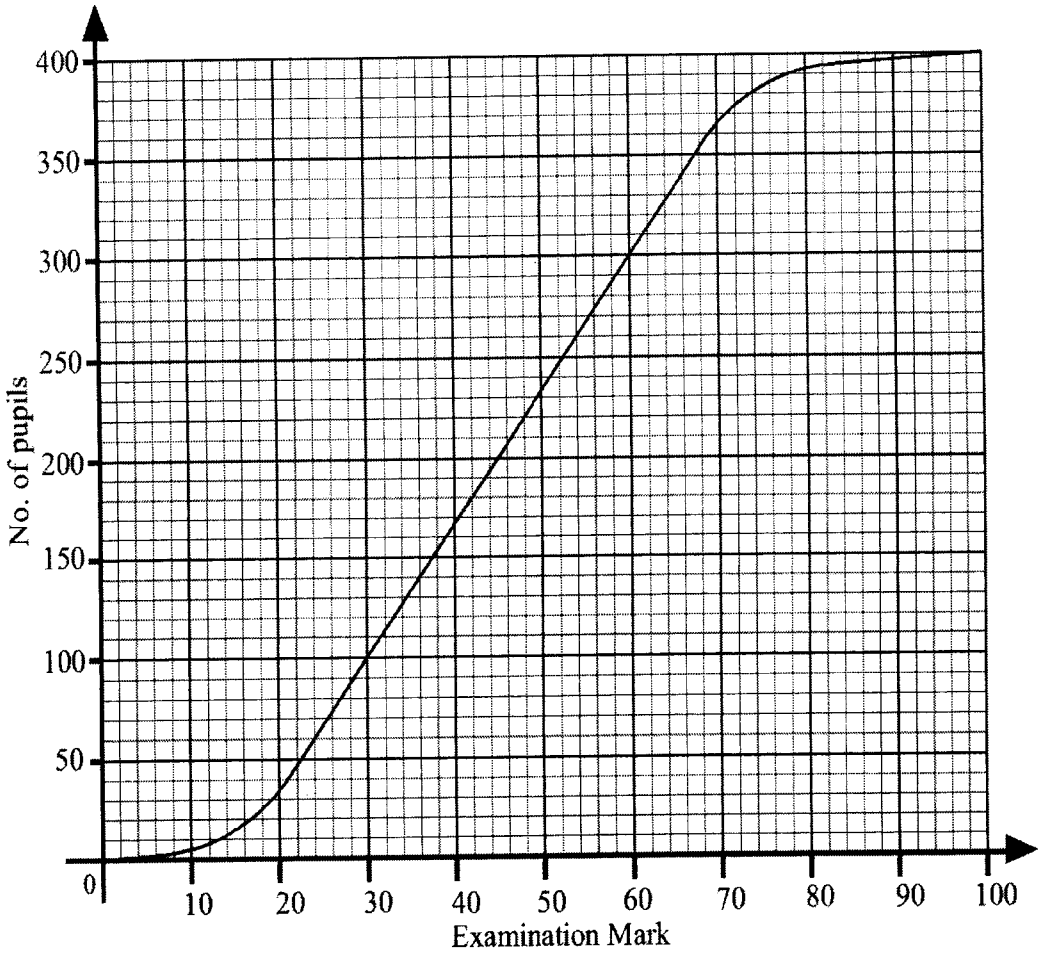
(a) Calculate angle ACD.

Answer angle ACD = ... ° [2]

(b) Find the bearing of A from C.

Answer ..... ° [1]

10 The cumulative frequency curve shows the marks of 400 pupils who sat for a Mathematics Paper 1 examination.



(a) Use the diagram to find

(i) the interquartile range of the marks,

Answer ..... [2]

(ii) the 35th percentile.

Answer ..... [1]

(b) One of the students is chosen at random.
Find the probability that this student's estimated mark is between 42 and 78.

Answer ..... [2]

11 $P = 2w - \dfrac{x^2 y}{w}$

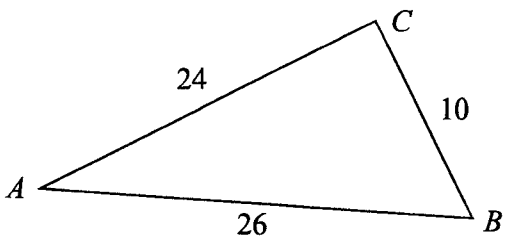
(a) Find P when $w = 86.3$, $x = 21.41$ and $y = 0.872$.
Give your answer correct to 4 significant figures.

Answer $P =$ ..... [1]

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

Answer $x =$ ..... [3]

12



The diagram shows a triangle ABC such that $AB = 26$ cm, $BC = 10$ cm and $AC = 24$ cm.
When a circle is drawn, it passes through A, B and C.
Explain, with reasons, why AB is the diameter of the circle.

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..... [3]

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13 Solve the simultaneous equations.

$$8x-3y=25$$
$$12x+5y=9$$

You must show your working.

Answer $x=$ ..... $y=$ ..... [3]

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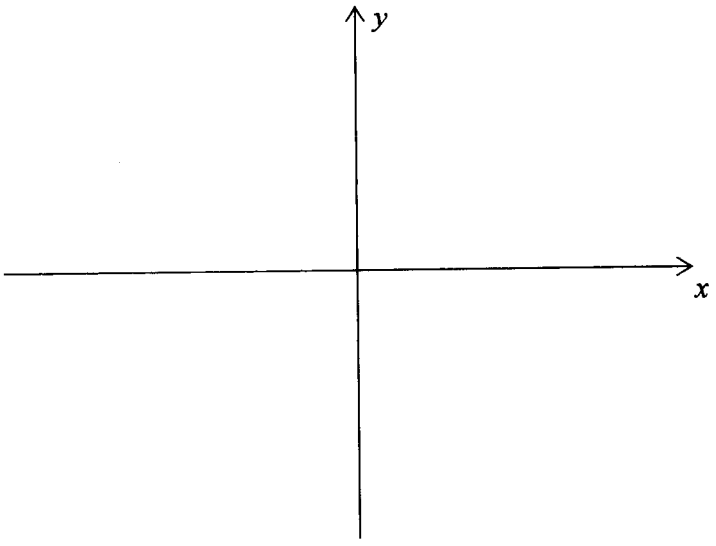
14 **Sketch** the graph of $y=-(x-2)^2+16$ on the axes below.

Indicate clearly the coordinates of the points where the graph crosses the axes and the maximum point on the curve.



[3]

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15 Aamon invested \$50000 into an account paying 3.6% per year compound interest, compounded monthly for 3 years.

Calculate the amount of interest Aamon earned at the end of 3 years.

Answer \$ ..... [3]

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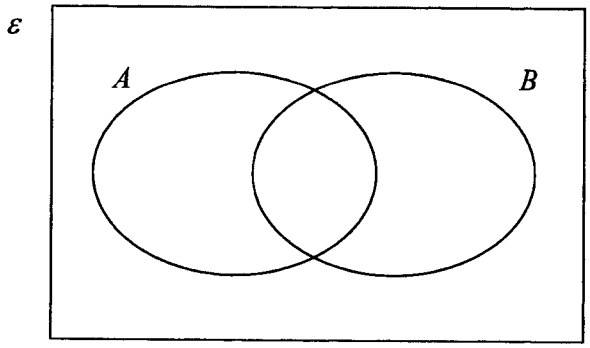
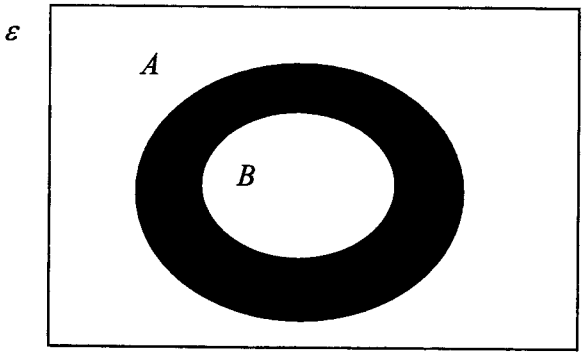
16 **(a)** On the Venn diagram, shade the region which represents $A' \cup B'$.



[1]

(b) Write down the set represented by the shaded region.



Answer ..... [1]

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17 **(a)** Write 0.00728 in standard form.

Answer ..... [1]

(b) **(i)** Write 8.17×10^{501} in the form $A\times10^{500}$.

Answer ..... [1]

(ii) Work out $\left(6.3\times10^{500}\right)+\left(8.17\times10^{501}\right)$.
Give your answer in standard form.

Answer ..... [2]

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18 Written as a product of its prime factors, $84=2^2\times3\times7$.

(i) Write 504 as a product of its prime factors.

Answer 504 = ... [1]

(ii) The highest common factor (HCF) of two numbers is 84.
The lowest common multiple (LCM) of the two numbers is 504.
Both numbers are greater than 100.
Find the two numbers.

Answer ..... and ..... [2]

---

19 $\sin x° = 0.427$

Find two possible values of x in the range $0° < x < 180°$.

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

---

20 The cash price of a laptop is \$1800.
The hire-purchase price of the laptop is \$1944.
The hire-purchase price is a deposit plus 24 equal monthly payments of \$66.

(a) Calculate the amount of deposit to be paid.

Answer \$ ..... [2]

(b) Calculate the interest rate per annum.

Answer ..... % [2]

---

21 $7 \quad 6t \quad 28 \quad 25 \quad 13 \quad 8t^2 \quad 12$

The list shows information about the total number of hours Kalea studied each week for 7 weeks.

The mean number of hours she studied per week is 16 hours.

(a) Show that $t = 1.5$.

Answer

[3]

(b) The standard deviation for Kalea's data is 7.41.

For the same 7 weeks, Kalea's brother also studied each week.
For his data, the mean is 13 hours and the standard deviation is 5.23.

By commenting on (1.) the means and (2.) the standard deviations, compare the distributions for the number of hours studied by Kalea and her brother.

1. .....

.....

2. .....

.....

[2]

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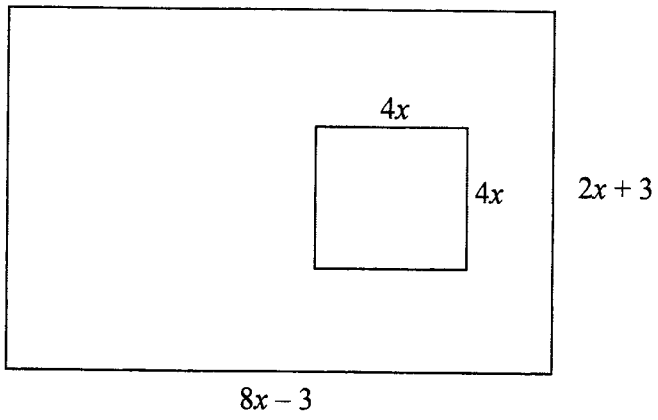
22 Expand $(2x^2 - 5x + 3)(5x - 4)$.

Answer ..... [2]

23



A rectangular cardboard has length and breadth $(8x - 3)$ cm and $(2x + 3)$ cm respectively.

A square of length $4x$ cm is removed from the cardboard.

The area of the remaining cardboard is y cm^2.

(a) Show that y is an odd number.

Answer

[3]

(b) Find a possible value of y and the corresponding value of x.

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

24 Simplify $\dfrac{5x^2-15x}{x^4-81}$.

Answer ..... [3]

---

25 Solve the equation $x^2+16x+18=0$ by **completing the square**.
Give your solutions correct to 2 decimal places.

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

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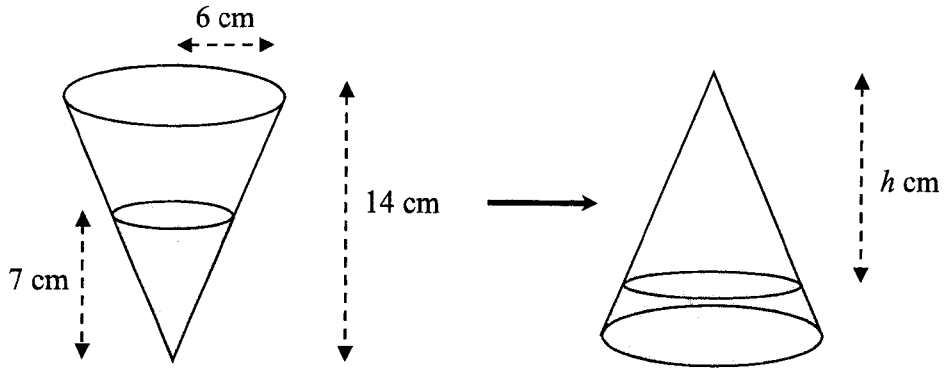
26 An inverted cone with base radius 6 cm and height 14 cm is filled with water to a depth of 7 cm.



Find, in terms of π,

(i) the capacity of the cone,

Answer ..... cm^3 [1]

(ii) the volume of the water inside the cone.

Answer ..... cm^3 [2]

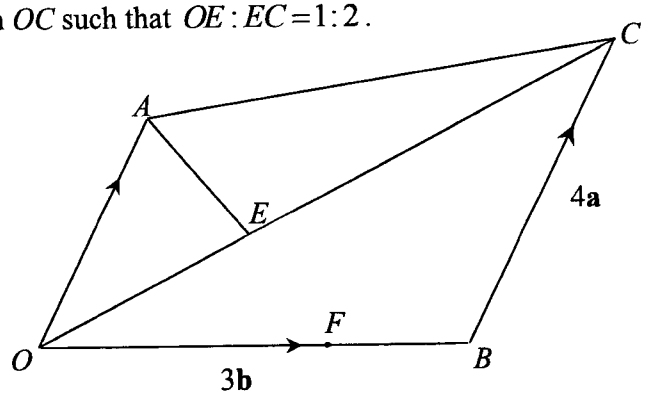
The cone is then turned upside down and the height of the empty space becomes h cm.

(iii) Find the value of h.

Answer $h =$ ..... [2]

27 In the diagram below, $\overrightarrow{BC} = 4\mathbf{a}$, $\overrightarrow{OB} = 3\mathbf{b}$, $\overrightarrow{OA} = \frac{3}{4}\overrightarrow{BC}$.

E is a point on OC such that $OE : EC = 1 : 2$.



(a) Show that $\overrightarrow{AE} = -\frac{5}{3}\mathbf{a} + \mathbf{b}$.

Answer

[2]

It is given that F is a point on OB such that $\overrightarrow{OF} = \frac{3}{5}\overrightarrow{OB}$.

(b) Express vector $\overrightarrow{AF}$ in terms of **a** and/or **b**, as simply as possible.

Answer $\overrightarrow{AF}$ = ... [2]

(c) Determine if points A, E and F lie on a straight line.
Justify your answer using vectors.
Answer

[2]

(d) The area of triangle AEC is 30 cm^2.
Find the area of triangle OAE.

Answer ..... cm^2 [1]

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

MATHEMATICS
Paper 2

4052/02
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.
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The total of the marks for this paper is 90.

For Examiner's Use
90

Mathematical Formulae

Compound interest

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

Mensuration

Curved surface area of a cone $= \pi rl$

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

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

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

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

Arc length $= r\theta$, where θ 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 $\mathbf{T} =$ [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 $\mathbf{C} =$ [1]

(ii) Evaluate the matrix $\mathbf{P} = \mathbf{FC}$.

Answer $\mathbf{P}$ = [2]

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

Explain which seller made a higher profit.

.....

.....

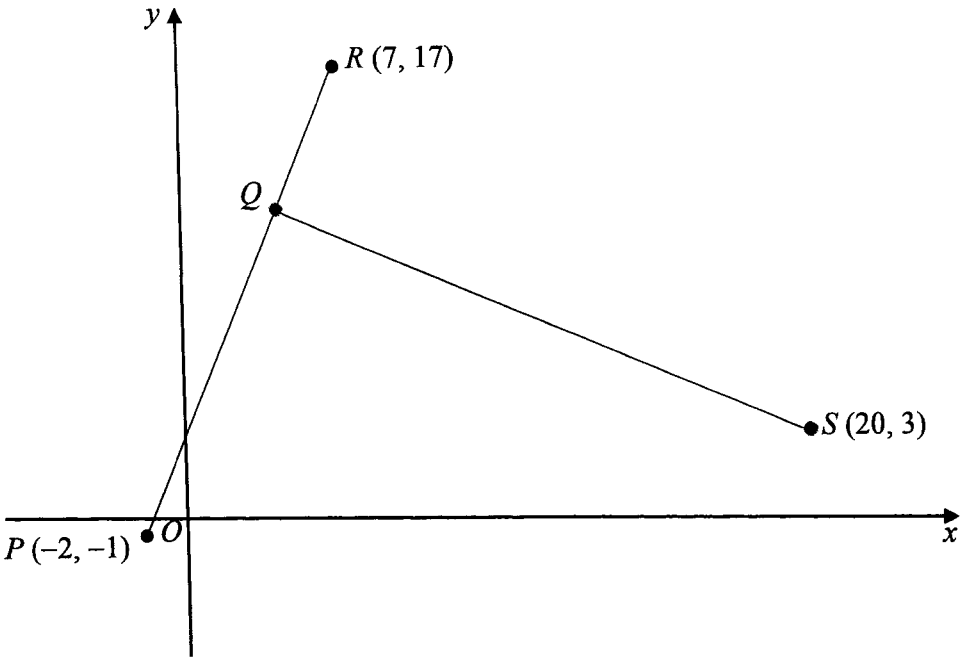
..... [1]

(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 $\mathbf{N}$ where each element represents the new selling price of a mango, an apple and an orange by seller *A* and *B* respectively.

Answer $\mathbf{N}$ = [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 (gradient of SQ) × (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 $-1\leq x\leq 5$. [3]

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

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 $-1\leq x\leq 5$. [2]

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

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

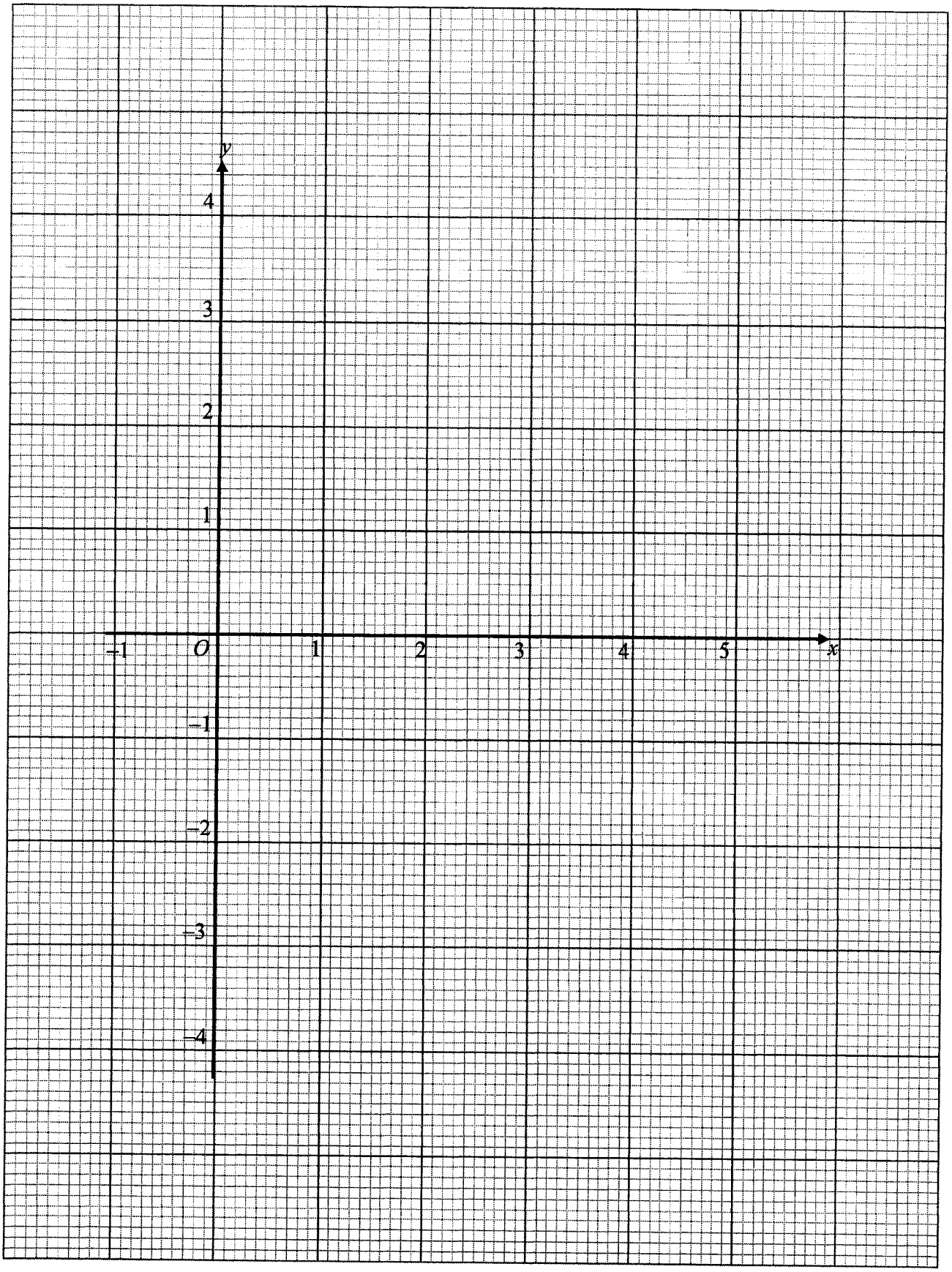
(iii) This value of x is the solution of the equation $x^3+Ax^2+Bx+C=0$.

Find the value of A, B and C.

Answer $A=$ .....

$B=$ .....

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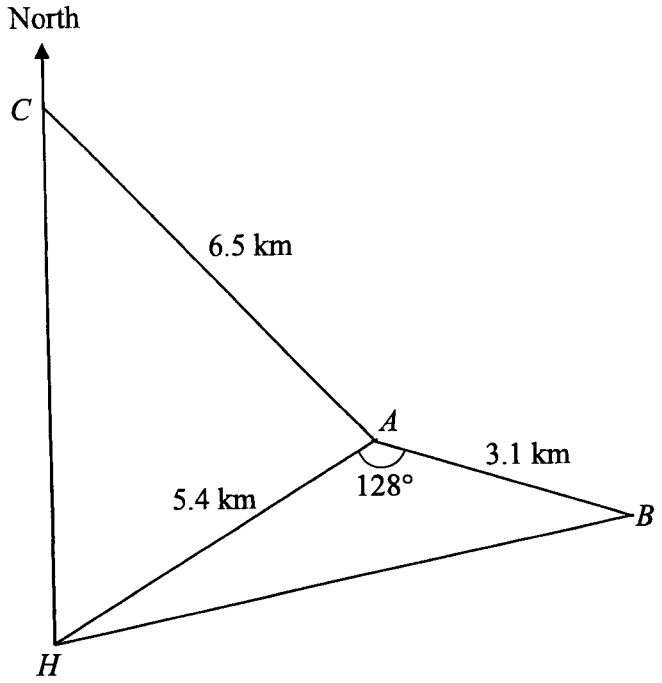


The diagram shows the position of a harbour, H, and three islands, A, B and C.
$HA = 5.4$ km, $AB = 3.1$ km and $AC = 6.5$ km.
The bearing of A from C is 133° and angle $HAB = 128°$.
C is due north of H.

(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°.

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.

.....

..... [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.

.....

.....

..... [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.

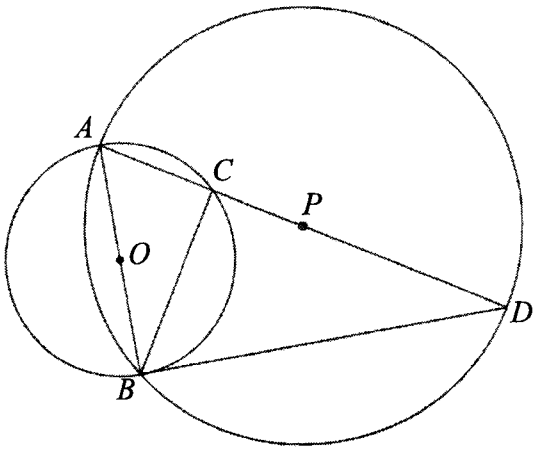
Answer ..... [1]

(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.

.....

.....

.....

.....

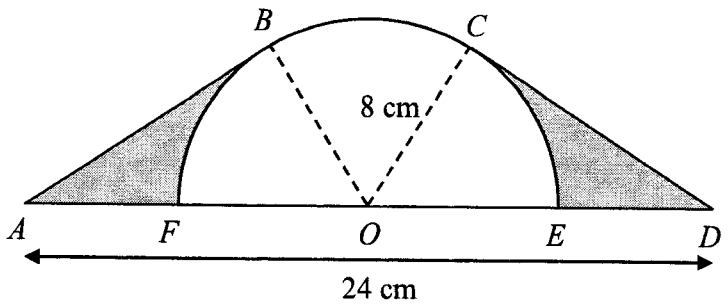
..... [2]

(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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