Name:	Class:	Class Register Number:

中正中学

CHUNG CHENG HIGH SCHOOL (MAIN)

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PRELIMINARY EXAMINATION 2025
SECONDARY 4

MATHEMATICS

4052/01

Paper 1

Friday 29 August 2025

2 hours 15 minutes

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number 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 Examiner's Use	
Total	**/ 90**

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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

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

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

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Answer **all** the questions.

1 Calculate $\dfrac{\sqrt[3]{0.5-(-1.5)^2\times 3.5}}{3\times 8}$.

Answer ..... [1]

---

2 Simplify $\dfrac{6xy-3y-4x+8x^2}{2x^2+3x-2}$.

Answer ..... [3]

---

3 James deposited some money in a bank.
The bank pays a compound interest of 1.52% per annum, compounded half yearly.
After 4 years, James withdrew a total of $26561.05.

Calculate the interest earned. Give your answer to the nearest dollar.

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Answer $..... [3]

4 **(a)** Solve $64x^2 = 8x$.

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

(b) Solve the equation $\frac{1}{2^{2x}} \div 4^{x+3} = 0.25$.

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

---

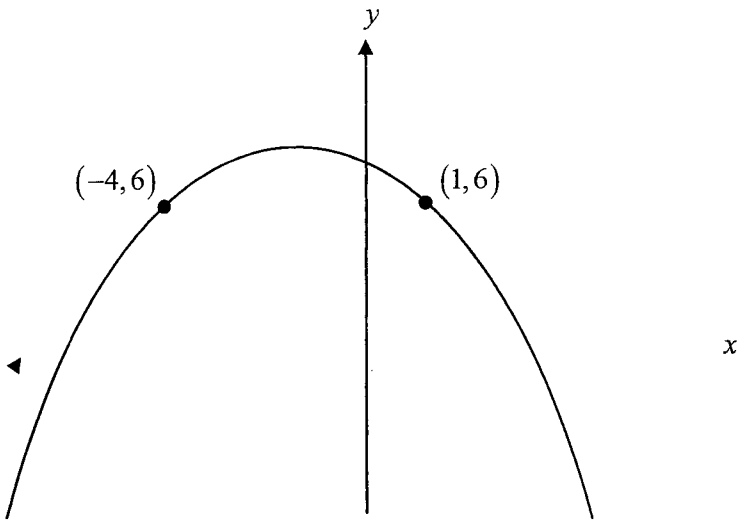
5 Janice bought some chicken burgers and fish burgers for an outing.
The ratio of the number of chicken burgers to the number of fish burgers bought was 3 : 2.
At the end of the outing, there were 3 burgers of each type left.
The ratio of the number of chicken burgers consumed to the number of fish burgers consumed was 11 : 7.

Calculate the total number of burgers that Janice bought.

Answer ..... [4]

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6



The figure shows the graph of a curve $y = -(x-p)^2 + q$, where p and q are constants.

Given that the curve passes through points $(-4, 6)$ and $(1, 6)$, find the values of p and q.

Answer $p =$ .....

$q =$ ..... [3]

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7 Solve the inequality $\frac{x}{3} < \frac{1}{4}(x+3) < 5$.

Answer ..... [3]

8 **(a)** Written as a product of its primes factors, $480 = 2^5 \times 3 \times 5$.

The number $480 \times 75 \times \frac{a}{b}$ is a perfect square where a and b are prime numbers.

Find the smallest value of $\frac{a}{b}$.

Answer $\frac{a}{b}$ = ... [2]

(b) Rectangle tiles, 60 cm by 35 cm each, are laid to form a square wall. Find the minimum area of the square wall.

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

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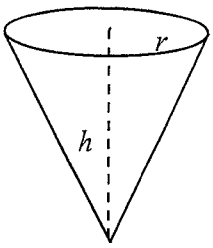
9 Kate bought a dress during her holiday trip in UK at a discounted price of 30% using a credit card. The exchange rate of the credit card company was SGD \$1 = £0.53.

Given that the total amount she paid to the credit card company in Singapore dollars (SGD) is \$349.81, find the price of the dress in pounds (£) before the discount, correct to the nearest pound.

Answer £..... [3]

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10



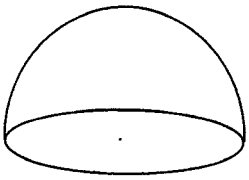


Figure 1

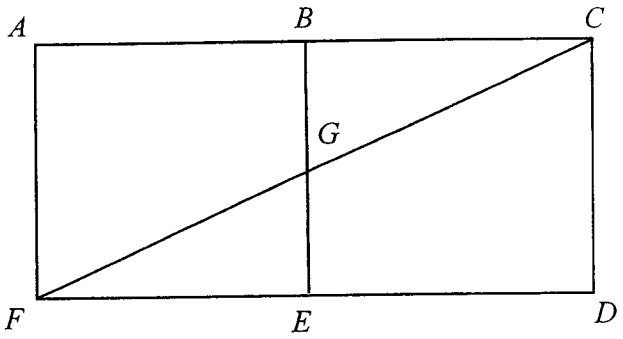
A conical candle in Figure 1 is melted to form a hemispherical candle in Figure 2.
The radius of the base of the cone and the hemisphere are both r cm. The height of the cone is h cm.

Find, in terms of r, the total surface area of the conical candle.

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

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11 The diagram shows 2 squares *ABEF* and *BCDE*. *CF* is the diagonal of the rectangle *ABCDEF*. The lines *BE* and *CF* intersect at point *G*.



Prove that triangle *BGC* is congruent to triangle *EGF*.

Answer

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..... [3]

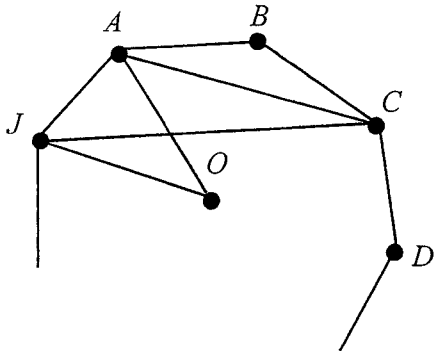
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12 It is given that y is inversely proportional to x^2, and that $y = 540$ for a particular value of x. Find the value of y when this value of x is tripled.

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

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13 The diagram shows part of a regular decagon $ABC....J$ centre O.
AC and JC are lines joining the vertices A, C and J.
OA and OJ are lines that join from O to A and J respectively.



(a) Find

(i) angle ABC,

Answer .....° [2]

(ii) angle AOJ.

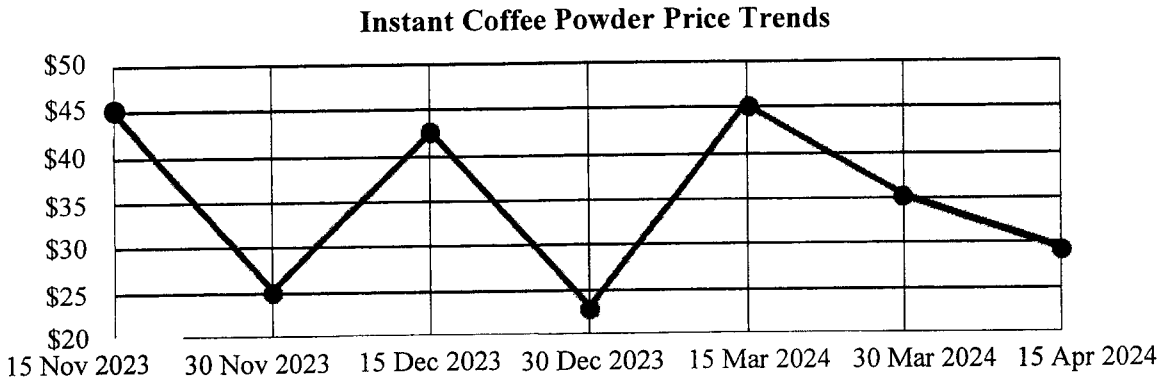
Answer .....° [1]

(b) Given that O is the centre of a circle that passes through the vertices of the decagon, find angle ACJ.

Answer .....° [1]

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14 A company presented their 2023 financial report in this graph.



State one aspect of the graph that may be misleading and explain how this may lead to a misinterpretation of the graph.

Answer

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.....

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..... [2]

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15 In 2005, the number of mobile phone users was 22.2×10^8.

(a) 22.2×10^8 can be written as k billion.
Find k.

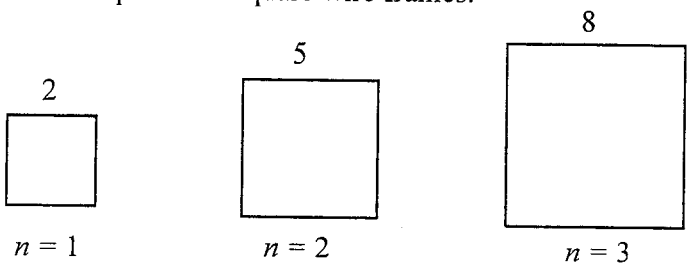
Answer $k =$ ..... [1]

(b) By 2025, the number of mobile phone users has increased by 250%. Calculate the number of mobile phone users in 2025, giving your answer in standard form.

Answer ..... [2]

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16 The diagram shows a sequence of square wire frames.



The lengths of a side of the first three frames are 2 cm, 5 cm, 8 cm respectively.

(a) Express the length of a side of the nth frame in terms of n.

Answer .....cm [2]

(b) A piece of wire is 160 cm long.
Hence, explain why the piece of wire cannot be bent to form a square wire frame in the sequence.

Answer

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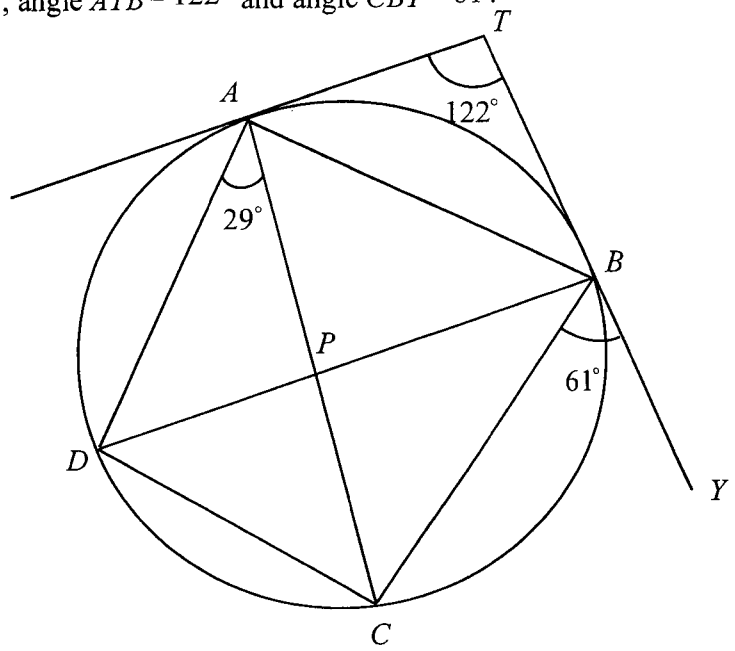
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..... [2]

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17 In the diagram below, A, B, C and D are points on a circle.
P is the intersection between the lines AC and BD.
AT and YBT are tangents to the circle.

Angle $DAC = 29^\circ$, angle $ATB = 122^\circ$ and angle $CBY = 61^\circ$.



(a) Find the angle TBA.
Give a reason for each step of the working.

Answer ..... ° [1]

(b) Find the angle DBC.
Give a reason for each step of the working.

Answer ..... ° [1]

(c) Show that point P is the centre of the circle.

Answer

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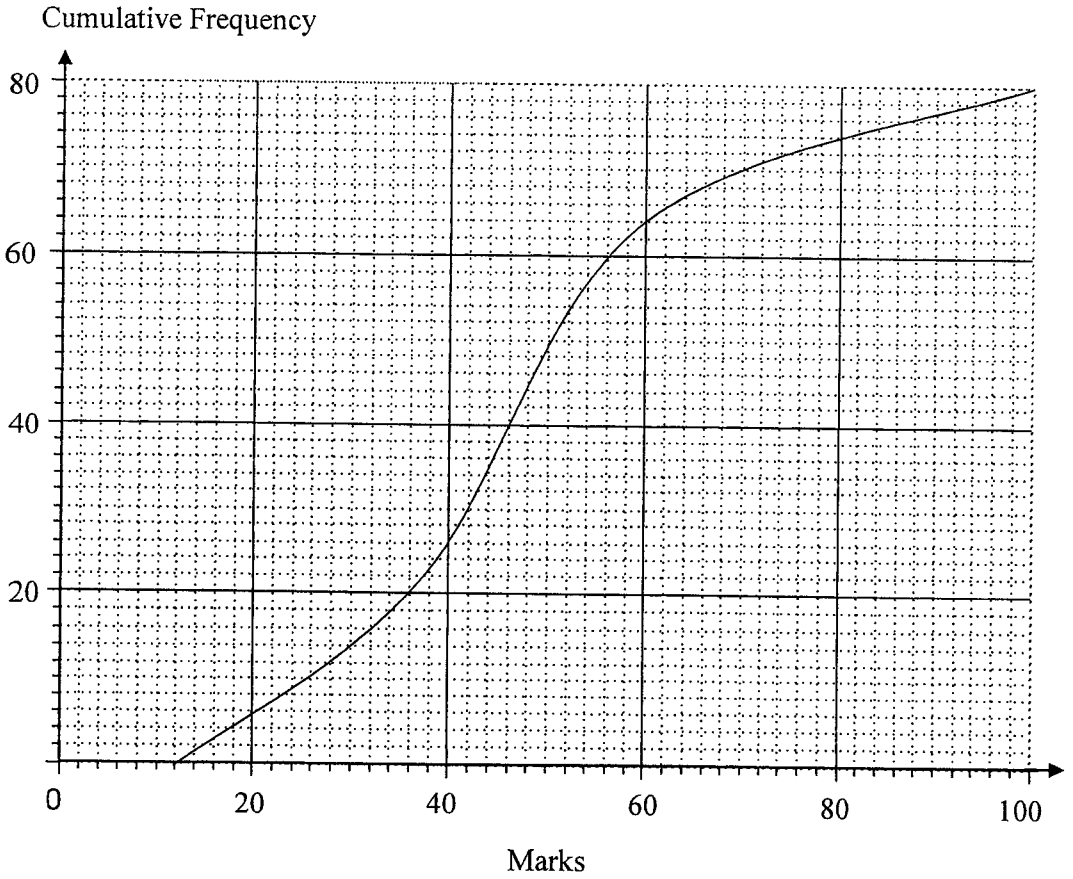
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..... [2]

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18 The marks obtained by a group of 80 students in a Mathematics Test are represented in the cumulative frequency curve below.



(a) Use the diagram to find the median mark.

Answer ..... [1]

(b) 20% of the pupils who scored more than y marks are given a grade A.
Find the value of y.

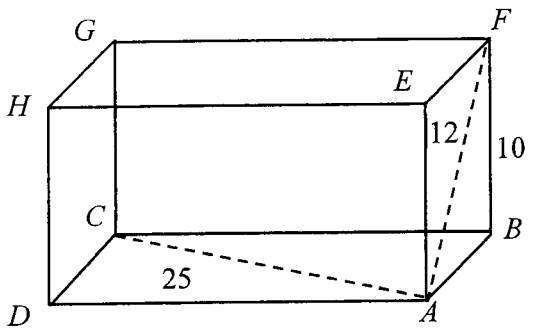
Answer $y =$ ..... [1]

(c) Two pupils are randomly selected from the class.
Find the probability that only one of the students obtained less than 40 marks.

Answer ..... [2]

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19 The diagram shows a cuboid $ABCDEFGH$.
$AC = 25$ cm, $FB = 10$ cm and $FA = 12$ cm.



Calculate the angle GAF.

Answer ..... ° [2]

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20 Given that $\varepsilon = \{x: x \text{ is an integer}, 1 \leq x \leq 12\}$, and

$A = \{x : x \text{ is a factor of } 6\}$

$B = \{x : \sqrt{x} < 3\}$

Find the value of $n(A' \cap B)'$.

Answer ..... [2]

---

21 The stem and leaf diagram shows the points scored by a basketball team for 12 matches. The interquartile range of the data is 23 points.

Stem	Leaf
3	0
4	2 3 4
5	0 1 5 7
6	x 8 8 9

Find the value of x.

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

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22 Mrs Lim has a garden in the shape of a trapezium $PQRS$ where PQ is parallel to SR.

The side $PQ = 42$ m, $PS = 36$ m $SR = 30$ m and angle $QPS = 70°$.
On a scale drawing where the scale used is 1: n, PS is represented by a line of 6 cm below.

(a) Find the value of n.

Answer $n =$ ..... [1]

(b) Construct a scale drawing of the garden using the value of n found in **(a)**. [2]

P S

(c) On your diagram,

(i) Construct perpendicular bisector of PQ. [1]

(ii) Construct the angle bisector of angle PQR. [1]

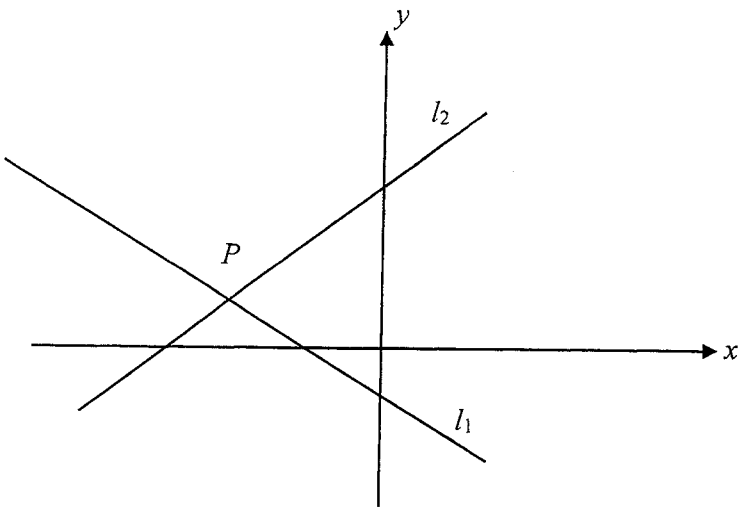
(d) Mrs Lim wants to build a fountain X, nearer to Q and equidistant from QR and QP, mark and label clearly a possible position of X. [1]

(e) Using the value of n, calculate the actual area of a small pond in the garden if the area of the pond on the scale drawing is 4 cm^2.

Answer .....m^2 [2]

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23



(a) The line l_1 has an equation $x+y+2=0$ and the line l_2 has an equation $x-3y+4=0$.
P is the of point intersection between the lines l_1 and l_2.
Find the coordinates of the point P.

Answer (....., ...) [3]

(b) The equation of the line l_3 is $y=\frac{1}{3}(x-2)$. Explain why the lines l_2 and l_3 do not meet.
Answer

.....

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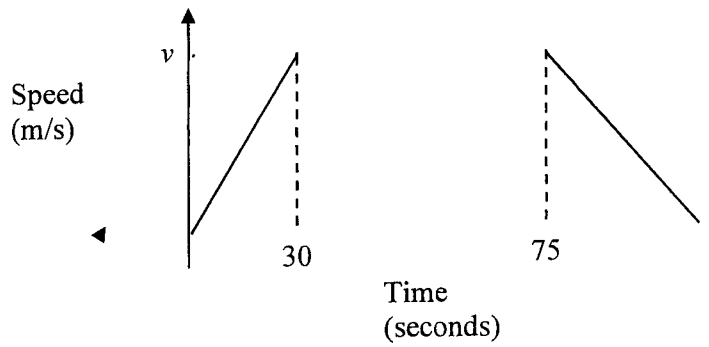
..... [2]

(c) Points A and B lies on the line l_1 such that the y-coordinate of A is 5.5 and B is below the x-axis. Given that AP: $PB=2$: 1, find the equation of the horizontal line that passes through the point B.

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Answer ..... [1]

24 The diagram shows the speed-time graph for a lorry's journey. The lorry starts from rest and accelerates uniformly to a speed of v m/s in 30 seconds. The lorry then travels at a constant speed for 45 seconds before it decelerates and comes to a rest.
The distance travelled for the first 75 seconds is 1.2 km.



(a) The area beneath the speed-time graph represents the distance travelled by the lorry.
Calculate the greatest speed, v m/s of the lorry.

Answer $v =$ ..... [2]

(b) Given that the lorry decelerates at 5 m/s^2, calculate the total time taken for the journey.

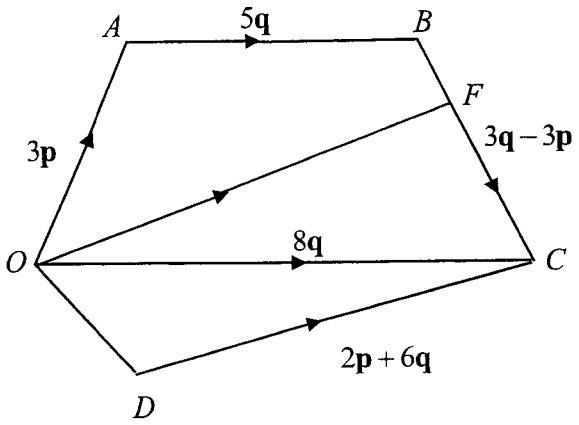
Answer .....s [2]

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Turn over for Question 25

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25



In the diagram, $\overrightarrow{OA} = 3\mathbf{p}$, $\overrightarrow{OC} = 8\mathbf{q}$, $\overrightarrow{AB} = 5\mathbf{q}$, $\overrightarrow{BC} = 3\mathbf{q} - 3\mathbf{p}$ and $\overrightarrow{DC} = 2\mathbf{p} + 6\mathbf{q}$.

F is point on BC such that $BF : FC = 1 : 2$.

(a) Express, as simply as possible, in terms of **p** and **q**,

(i) $\overrightarrow{OF}$,

Answer ..... [1]

(ii) $\overrightarrow{AD}$.

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Answer ..... [2]

(b) Write down two facts about $\overrightarrow{OD}$ and $\overrightarrow{BC}$.

Answer

.....

.....

.....

..... [2]

(c) Find the value of $\frac{\text{area of triangle } OBC}{\text{area of quadrilateral } OABC}$.

Answer ..... [1]

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PRELIMINARY EXAMINATION 2025
SECONDARY 4

MATHEMATICS

4052/02

Paper 2

Monday 25 August 2025

2 hours 15 minutes

Candidates answer on the Question Paper

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For π, use either your calculator value or 3.142.

For Examiner's Use	
Question Number	Marks Obtained
1	
2	
3	
4	
5	
6	
7	
8	
9	
Total Marks	

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

Statistics

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

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

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1 40 students from Class A took the standing broad jump test.
The students' jump distances are shown in the table.

Jump Distance (x cm)	$120 < x \leq 140$	$140 < x \leq 160$	$160 < x \leq 180$	$180 < x \leq 200$
Number of students	6	13	14	7

(a) Use the table to estimate the mean jump distance of Class A.

Answer ..... cm [1]

(b) The mean jump distance of 40 students from Class B is 155 cm. Use this information to make a comparison between the jump distances of the 2 classes.

.....

..... [1]

(c) The standard deviation of the jump distances of Class B is 16 cm.
A new student joined Class B and his jump distance is 196 cm.

Calculate the

(i) new mean jump distance of Class B,

Answer ..... cm [1]

(ii) new standard deviation of the jump distances of Class B.

Answer ..... cm [3]

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2 **(a)** Simplify $\frac{3x-4}{5x^2-x} \times \frac{15x^3}{9x-12}$.

Answer ..... [2]

(b) Simplify $\left(\frac{4}{9x^2}\right)^{-\frac{3}{2}} \div 3x$.

Answer ..... [3]

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(c) The period, T seconds, of a pendulum swing is given by $T = 2\pi\sqrt{\frac{L}{g}}$, where L m is the length of the pendulum and g m/s^2 is the acceleration acting on the pendulum due to gravity.

(i) Find the value of T when $g = 10$ and $L = 1.2$.

Answer ..... [1]

(ii) Make L the subject of the formula.

Answer ..... [2]

(d) Express as a single fraction in its simplest form $\frac{3}{2x^2-8} - \frac{2}{x+2}$.

Answer ..... [3]

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3 Apollo 11 was the first manned mission to land on the Moon. It was launched on July 16, 1969, at 9:32 am from Kennedy Space Center in Florida.

Apollo 11 travelled an estimated total distance of 384000 km at an average speed of x km/s to reach the Moon.

(a) Show that Apollo 11 took $\frac{320}{3x}$ hours to reach the Moon.

Answer

[1]

(b) The average speed for the return trip back to Earth was 0.5 km/s faster than the average speed of Apollo 11 from Earth to the Moon.

Assuming that the estimated distance for the return trip is also 384000 km, write and simplify an expression, in terms of x, for the number of hours taken for return journey.

Answer ..... h [2]

(c) The return trip for Apollo 11 to travel from the Moon back to Earth was shorter by 32 hours. Write down an equation to represent this information and show that it reduces to $6x^2 + 3x - 10 = 0$.

Answer

[3]

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(d) Solve the equation $6x^2 + 3x - 10 = 0$, giving your answers correct to 5 decimal places.

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

(e) Hence, find the estimated date and time that Apollo 11 reached the Moon.

Answer **Date:** ....., **Time:** ..... [4]

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4 (a) $\mathbf{P} = \begin{pmatrix} 2 & 1 \\ 3 & -2 \end{pmatrix}$ and $\mathbf{Q} = \begin{pmatrix} 3 & -2 \\ -6 & 11 \end{pmatrix}$.

Given that $\mathbf{P}^2 - \mathbf{Q} = k\,\mathbf{P}$, find the value of k.

Answer $k =$ ..... [3]

(b) A donut shop sells 3 flavours of donuts: cinnamon, chocolate and strawberry.

The table below shows the number of donuts sold by the shop at different times of a day (before 7pm and from 7pm to 9pm).

	Cinnamon	**Chocolate**	**Strawberry**
Before 7pm	150	240	165
7pm to 9pm	25	38	21

(i) Represent the data in the above table using a 2×3 matrix **A**.

Answer **A** = ... [1]

(ii) Given $\mathbf{B} = \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix}$, find **AB**.

Answer **AB** = ... [1]

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(iii) Explain clearly what the elements in **AB** represent.

.....

..... [1]

Before 7pm of the day, the price for each flavour of donuts is $2.80.
From 7pm to 9pm, all donuts are sold at a 25% discount.

(iv) Write down a matrix **C** such that **CAB** gives the total amount of money collected from the sales of donuts for the day.

Answer **C** = ... [1]

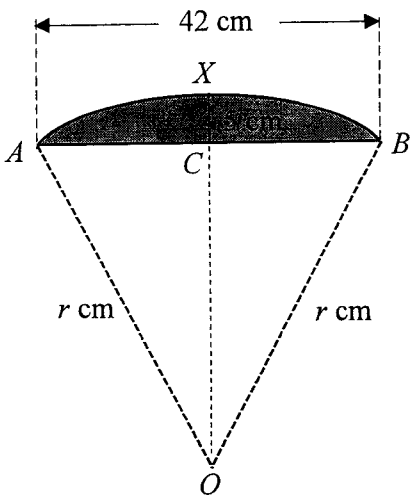
(v) Hence, find the total amount of money collected from the sales of donuts for the day.

Answer $ ..... [2]

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5 The cross section of a speed bump, AXB, is formed by removing triangle AOB from sector $OAXB$. The sector, centre O, has a radius of r cm.

The width of the speed bump, AB, is 42 cm and the height CX is 5 cm.



(a) Show that $r = 46.6$.

Answer

[3]

(b) Calculate

(i) angle AOB in radians,

Answer ..... [3]

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(ii) the cross-sectional area of the speed bump.

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

According to safety regulations, the height of a speed bump cannot exceed 10 cm.
A new geometrically similar speed bump is designed such that the cross-sectional area is 225% of the cross-sectional area of the speed bump shown in the diagram.

(c) Does the new speed bump meet the safety regulations?
Show clear mathematical calculations to support your answer.

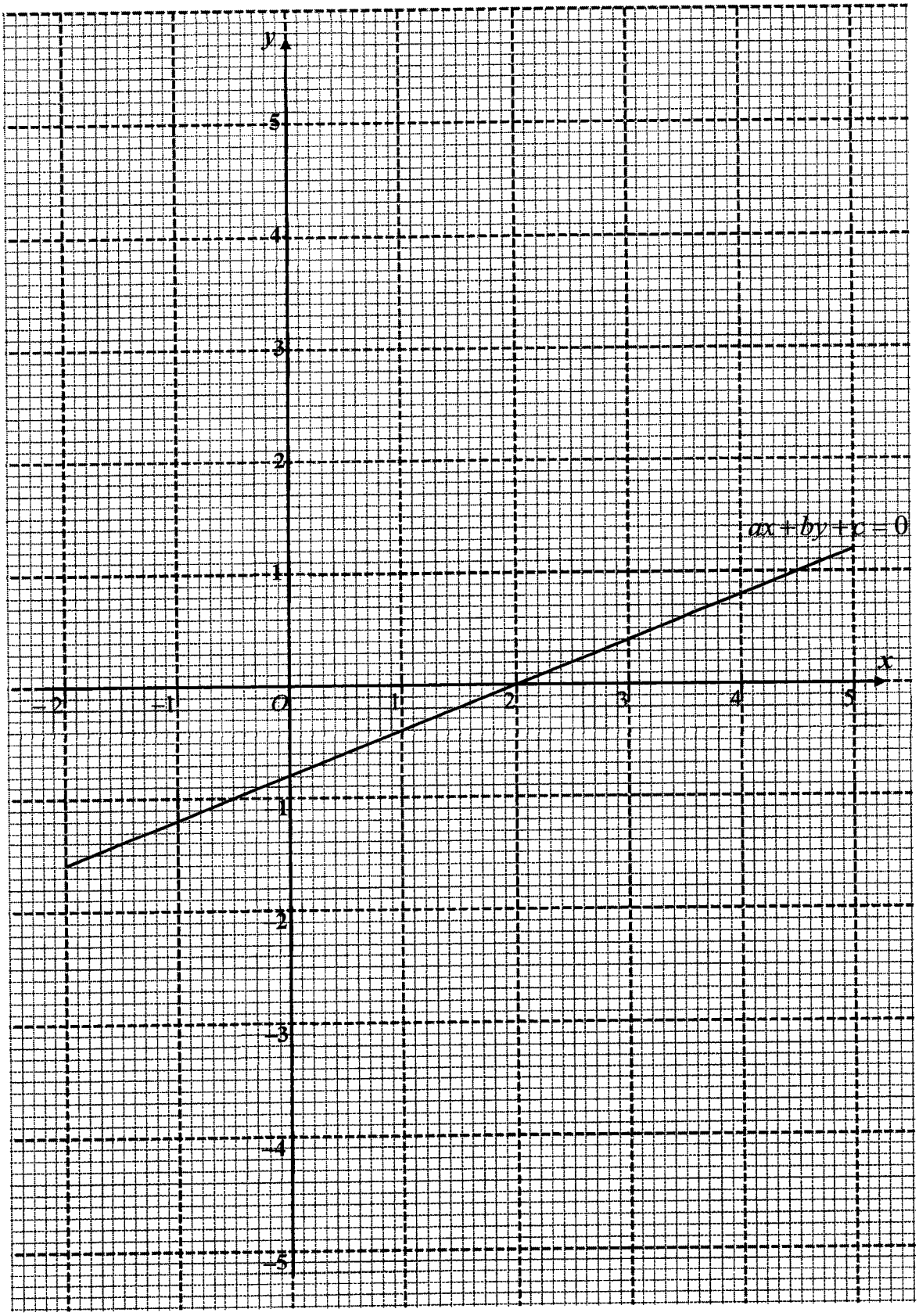
Answer

.....

..... [2]

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6 The graph of $ax+by+c=0$, where a, b and c are integers, is drawn for $-2 \le x \le 5$ on the grid below. The line $ax+by+c=0$ intersects the x-axis at (2, 0) and the y-axis at $(0,-0.8)$.



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(a) Given that a is a prime number, find the values of a, b and c.

Answer $a =$ ....., $b =$....., $c =$ ..... [3]

(b) The table below shows the corresponding x and y values for the graph of $y = \frac{x^2}{5}(x-4)$.

x	−2	−1	0	1	2	3	4	5
y	−4.8	−1	0	−0.6	−1.6	−1.8	0	5

(i) On the same grid, plot the points given in the table and join them with a smooth curve. [3]

(ii) By drawing a tangent, find the gradient of the curve at $(-1,-1)$.

Answer ..... [2]

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

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

(iv) These values of x are solutions of the equation $Px^3 + Qx^2 + ax + c = 0$.

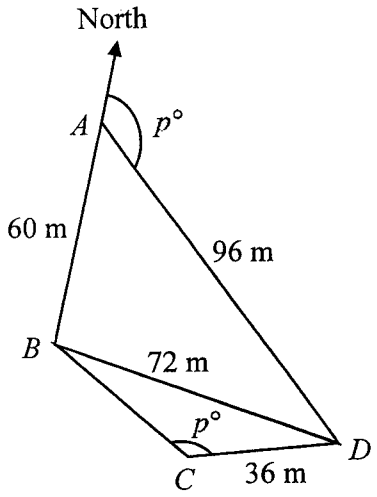
Find the value of P and of Q.

Answer $P =$ .....

$Q =$ ..... [3]

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7 The diagram shows a field $ABCD$ on horizontal ground. BD is a path across the field.
$AB = 60$ m, $BD = 72$ m, $AD = 96$ m and $CD = 36$ m.
B is due south of A. Angle $BCD = p°$. The bearing of D from A is also $p°$.



(a) Without solving for any angles, show that the exact value of $\cos p°$ is -0.6625.

Answer

[2]

(b) Hence, find angle CBD.

Answer ..... ° [2]

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(c) Find the area of the field, *ABCD*.

Answer ..... m^2 [3]

(d) A bird is at *F*, which is 20 m vertically above *A*.

Find the angle of depression of *D* from *F*.

Answer .....° [2]

The town council would like to build a circular track passing through *A*, *B*, *C* and *D*.

(e) Determine whether this plan is feasible by explaining if it is possible to draw a circle passing through the 4 points.

Answer

.....

..... [2]

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8 The position vectors of S and T are $\begin{pmatrix} 5 \\ -4 \end{pmatrix}$ and $\begin{pmatrix} 2 \\ k \end{pmatrix}$ respectively.

(a) Find the possible values of k if $\left|\overrightarrow{ST}\right| = \sqrt{45}$ units.

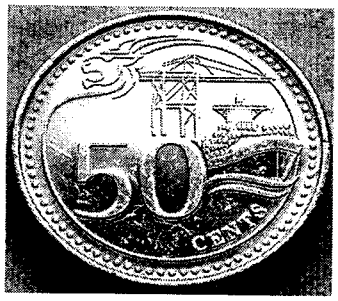
Answer $k =$ ..... or ..... [3]

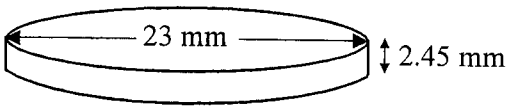
(b) $\overrightarrow{RS} = \begin{pmatrix} -2 \\ 6 \end{pmatrix}$. Find the equation of the line RS.

Answer ..... [2]

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9 The Singapore 50-cent coin can be modelled by a cylinder with diameter of 23 mm and thickness of 2.45 mm.





(a) Show that the volume of the 50-cent coin is 1.018 cm^3 when correct to 4 significant figures.

Answer

[2]

(b) The Singapore 10-cent coin can also be modelled by a cylinder with diameter of 18.5 mm and thickness of 1.38 mm. Explain whether the 10-cent and 50-cent coins are geometrically similar.

Answer

.....

..... [2]

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You are asked to design a set of 3 coins. You can assume that all three coins are cylindrical in shape.

The first coin has a diameter of 16.5 mm, thickness of 1.4 mm and will be made using copper.

The second and third coins must meet the following requirements:

	Second Coin	**Third Coin**
Diameter (mm)	At least 25% larger than the diameter of First Coin	At least 15% larger than the diameter of Second Coin
Thickness (mm)	1.8 mm	2.4 mm
Mass (M g)	$M \geq 4.6$	$M < 7.8$
Type of metal to make coin	Steel	Zinc

The density of the metals are as follows:

Type of Metal	**Density (g/cm^3)**
Copper	8.96
Steel	7.86
Zinc	7.14

The minting machinery can only produce coins with diameters up to one decimal point of millimetres. For example, 17.1 mm is allowed but 17.13 mm is not.

(c) Find the mass of the first coin.

Answer ..... g [2]

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(d) Showing your calculations clearly, suggest a possible diameter for the second coin and for the third coin.

.....

..... [5]

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