CEDAR GIRLS' SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2025
SECONDARY FOUR

CANDIDATE NAME

CLASS

INDEX NUMBER

MATHEMATICS

Paper 1

4052/01

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

For Examiner's Use
90

This document consists of **20** printed pages.

[Turn over]

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Mathematical Formulae

Compound interest

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

Mensuration

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

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

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

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

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

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

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

Trigonometry

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

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

Statistics

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

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

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Answer **all** the questions.

1 **(a)** Given $a = \dfrac{v^2 - t^2}{2s}$, express v in terms of a, t and s.

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

(b) Simplify $\dfrac{xy}{x^2 - 4xy + 4y^2} - \dfrac{2y}{4y - 2x}$.

Answer..... [3]

2 The diameter of a solid sphere is 7.12 cm, measured correct to 3 significant figures.
Its density is 2.2 g/cm^3.
Find the smallest possible mass of the sphere.

Answer..... g [2]

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3 An area of 512 km^2 is represented by 50 cm^2 on a map.
Find the scale of the map in the form 1 : n.

Answer ..... : ..... [2]

4 **(a)** Factorise completely $m^3 + 30 + 5m + 6m^2$.

Answer ..... [2]

(b) Given that m is a positive integer, explain why $m^3 + 30 + 5m + 6m^2$ is not a prime number.

Answer

.....

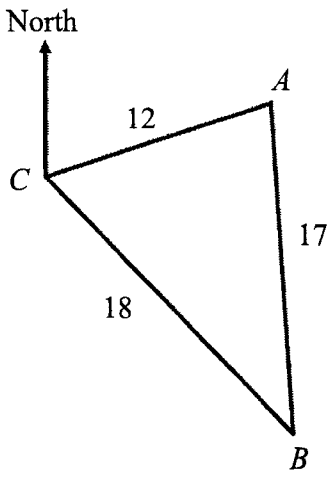
..... [1]

5 Mary cycles 2.8 km at an average speed of 12 km/h and takes a break.
She then continues to cycle a further 1.4 km in 5 minutes.
Given that her average speed for the whole journey is $9\frac{1}{3}$ km/h, find the duration of her break.

Answer ..... h [2]

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6 (i)



The diagram below shows 3 lighthouses A, B and C at sea.
$AC = 12$ km. $BC = 18$ km. $AB = 17$ km.
The bearing of B from C is 136°.
Find the bearing of A from C.

Answer ..... ° [2]

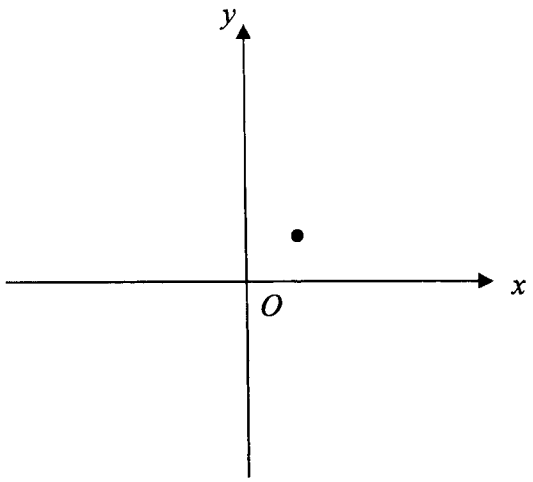
(ii) Find the area of the region enclosed by triangle ABC.

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

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7 On the axes given, sketch the graphs $y = 3^x$ and $y = \frac{3}{x}$, indicating the x- and y-intercepts where relevant.
The point (1, 1) is marked in the diagram.

Answer



[2]

8 **(a)** ε = {all real numbers}

A = {all perfect cubes}

B = {all rational numbers}

C = {all recurring decimals}

D = {1, 2, 3, 4, 5, 6, 7, 8, 9}

(i) List all the elements contained in the set $A \cap D$.

Answer ..... [1]

(ii) Explain why $C \cap B' = \phi$.

Answer

.....

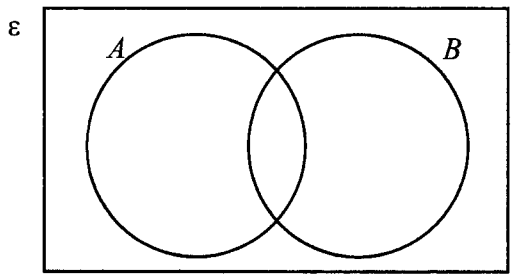
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..... [1]

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(b) On the Venn diagram, shade the region(s) which represent $(A' \cap B') \cup (A \cap B)$.

Answer



[1]

9 A quadratic curve $y = -x^2 + mx + 3.5$ has a turning point at $(-1.5, p)$, where both m and p are constants. Find the value of m and of p.

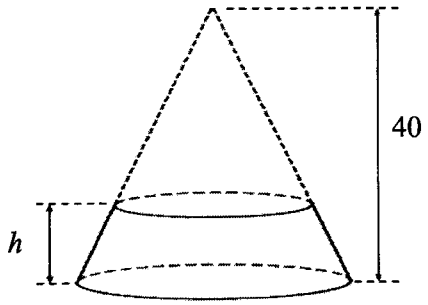
Answer m = ...

p = ... [4]

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10 A pet dish bowl is in the shape of a frustum, as shown in the diagram.
It is formed by removing a smaller cone from the top of a larger cone.
The smaller cone is similar to the original cone, and its volume is $\frac{3}{8}$ of the volume of the original cone. The original cone has a height of 40 cm.

(a) Find h, the height of the frustum.



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

(b) Given that the curved surface area of the frustum is 966 cm^2, find the curved surface area of the smaller cone.

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

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11 The table shows the income tax rates for different tax brackets.

Chargeable income	Income tax rate (%)
First \$20 000	0
Next \$10 000	2
Next \$10 000	3.5
Next \$40 000	7
Next \$40 000	11.5

In 2022, given that David's chargeable income is \$60,500, find his income tax payable for YA 2022.

Answer \$ ..... [2]

12 **(a)** Express 630 as a product of its prime factors.

Answer ..... [1]

(b) Find the smallest integer value of m such that $630m$ is a perfect square.

Answer m =..... [1]

(c) Given that $588 = 2^2 \times 3 \times 7^2$, find the smallest integer value of k such that $630k$ is a multiple of 588.

Answer k =..... [1]

(d) A rectangular piece of paper measuring 588 mm and 630 mm is being cut into identical squares with no waste.
Find the minimum number of squares that can be obtained.

Answer ..... [2]

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13 Consider the pattern

$$L_1 : 4^2 - 1^2 = 15$$
$$L_2 : 5^2 - 2^2 = 21$$
$$L_3 : 6^2 - 3^2 = 27$$
$$L_4 : 7^2 - 4^2 = 33$$
$$\vdots$$
$$L_n : \ldots\ldots\ldots\ldots\ldots\ldots$$

(a) Write down L_n of the pattern.

Answer $L_n =$ ..... [1]

(b) Explain, with working, whether 3336 is a term of the sequence 15, 21, 27, 33.....

Answer

.....

..... [2]

(c) Find the exact value of $L_1 + L_4 + L_7 + L_{10} + L_{13} + \ldots\ldots L_{97} + L_{100}$.

Answer ..... [2]

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14 **(a)** A polygon has three of its interior angles, measuring 150°, 160° and 170°.
The other interior angles are 130° each.
Find n, the number of sides of the polygon.

Answer $n =$ ..... [2]

(b) Explain why it is not possible for a regular polygon to have an interior angle of 145°.

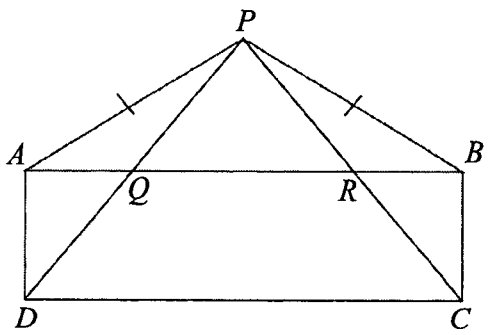
Answer

.....

.....

..... [2]

15 The diagram shows a rectangle $ABCD$ and an isosceles triangle PAB in which $PA = PB$.
PD and PC meet AB at Q and R respectively.
Prove that triangle PDC is an isosceles triangle.



Answer

[3]

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16 The table below shows the number of books students read in a certain week.

Number of books	0	1	2	3	4	5
Number of students	9	13	16	21	x	17

(a) If the mode is 3, state the largest possible value of x.

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

(b) If the mean is 3, find the value of x.

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

(c) Melanie claims that it is not possible for the median to be 2.
Explain whether you agree with Melanie's claim.

Answer

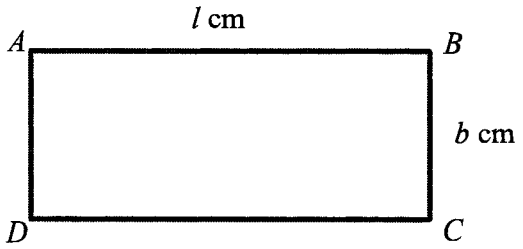
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..... [2]

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17 The diagram shows a sheet of rectangular paper $ABCD$.
The length is l cm. The breadth is b cm.
This sheet can be rolled to form an open cylinder in two different ways:

Method 1: By joining the breadths together.
Method 2: By joining the lengths together.



Justify with mathematical workings, why the volume of the open cylinder, formed using **Method 1** is larger than that formed using **Method 2**, for all real values of l and b.

Answer

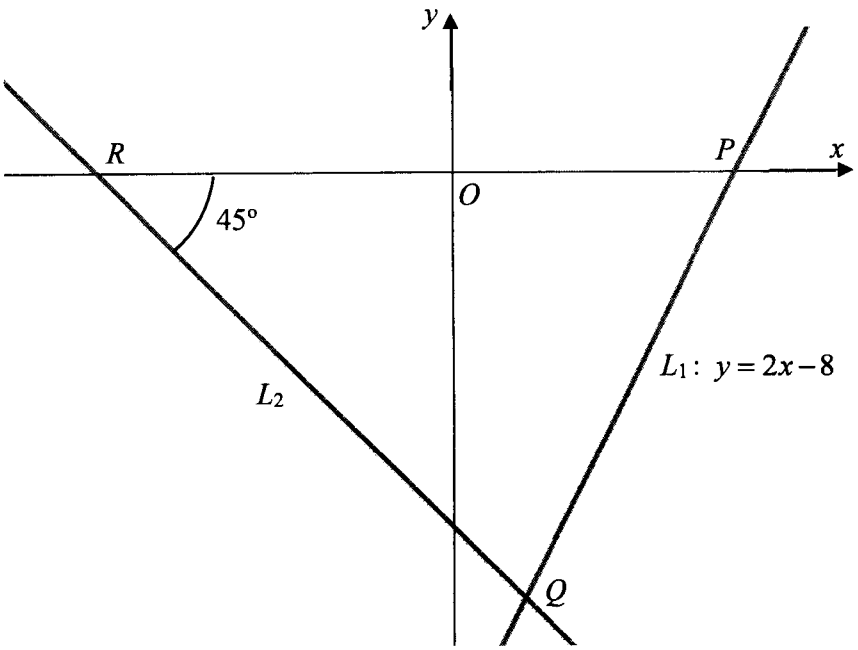
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..... [4]

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18 In the figure below, line L_1 and line L_2 cut the x-axis at P and R respectively.
The equation of L_1 is $y = 2x - 8$.
Angle PRQ is 45°. PR is 9 units.
Line L_2 meets line L_1 at Q.



(a) By finding the coordinates of R, show that the equation of Line L_2 is $y = -x - 5$.

Answer

[4]

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(b) Find the coordinates of Q.

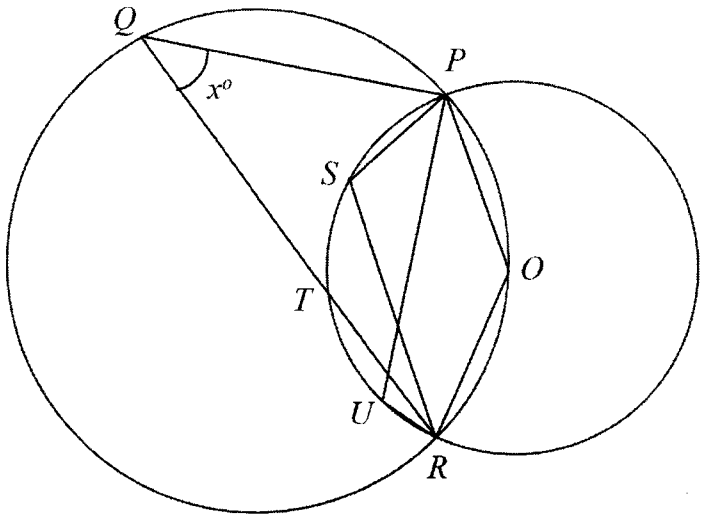
Answer (..... , ...) [2]

(c) Find the shortest distance from R to line PQ.

Answer ..... units [3]

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19



In the diagram, O is the centre of the smaller circle passing through the points P, S, T, U and R.
QTR is a straight line.
The points P, Q, R and O lie on the larger circle. It is given that angle $PQR = x^o$.

(a) Find angle PSR, in terms of x.
Give a reason for each step of your working

Answer

.....

.....

.....

.....

..... [3]

(b) It is now given that angle PUR is 105°, find the value of x.

Answer x = ... [2]

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20 There are 3 statues located at points A, B and C respectively.
The diagram in the space below shows the positions of points A and B.

(a) It is given that AC is 8 km and BC is 10 km.
Using appropriate constructions, find and label the position of point C.

[1]

Answer

Scale: 1 cm to 1 km



(b) There is a treasure chest buried in a location that is equidistant from A, B and C. Find and label this point X in the diagram above.

[2]

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21 P is inversely proportional to the square of Q.
Given that Q increases by 10%, find the percentage decrease in P.

Answer ..... % [3]

22 In Australia, a 16-oz bottle of shampoo costs A$60.
The shampoo company wants to price a 500ml bottle of the same shampoo at the same rate in France.

€ 1 = A$1.65.
1 oz = 29.5735 ml.

What should the price be in euros (€) ?
Leave your answer to the nearest 10 cents.

Answer € ..... [3]

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23 A bag contains 12 counters, n of which are green and the remainder are blue. One counter is drawn at random and not replaced.

(a) Write down, in terms of n, the probability that the counter is blue.

Answer ..... [1]

A second counter is then drawn at random.

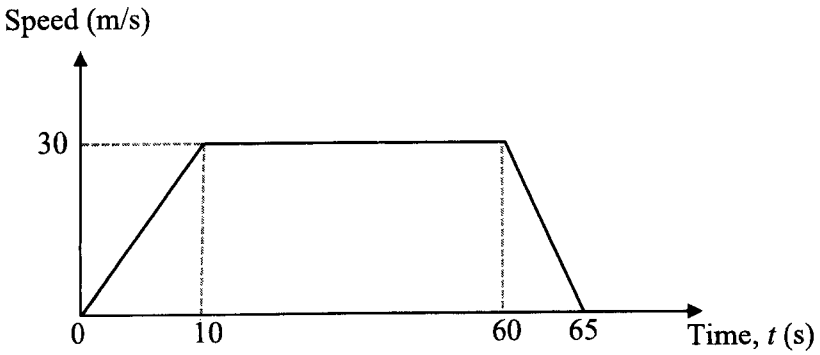
(b) Given that the probability that both counters drawn are blue is $\frac{5}{22}$, form an equation in the form $n^2 + bn + c = 0$, where b and c are integers.

Answer

[3]

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24 The diagram shows the speed-time graph of a car as it travelled from point A to B.



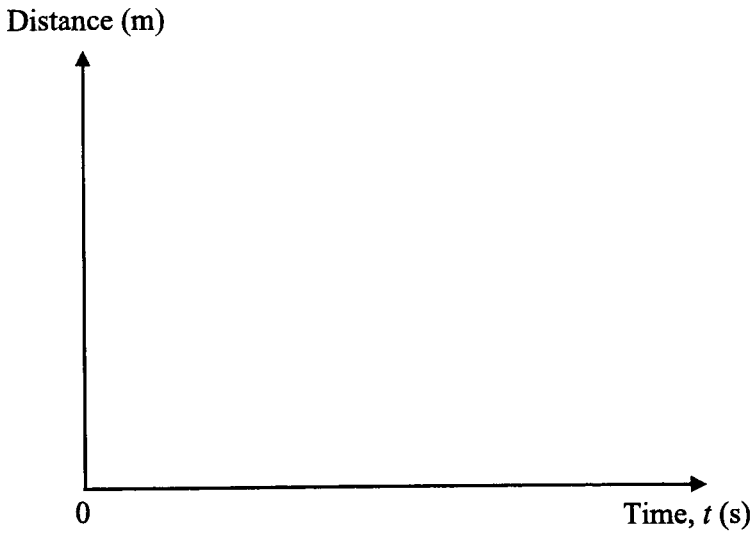
(a) Find the deceleration of the car from 60s to 65s.

Answer.....m/s^2 [1]

The area beneath the speed-time graph represents the distance travelled by the object.

(b) Draw the distance-time graph to represent the journey.

Answer



[3]

End of Paper

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CEDAR GIRLS' SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2025
SECONDARY FOUR

CANDIDATE NAME

CLASS

INDEX NUMBER

MATHEMATICS

Paper 2

4052/02

22 August 2025

2 hours 15 minutes

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

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

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Answer **all** the questions.

1 **(a)** Solve the inequality $1+4y \leq \frac{2y-1}{2} < 0$.

Answer ..... [2]

(b) Solve $-(1-x)\left(\frac{4}{5}x-1\right)=3$.

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

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(c) **(i)** Given that $243^p \times 2^{5p} = 6^{6-p}$, find the value of p.

Answer $p =$ ..... [2]

(ii) Simplify $\left(\frac{16p^4}{q^8}\right)^{-\frac{3}{2}} \div pq^5$ and leave your answer in positive index notation.

Answer ..... [3]

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2 **(a)** The diameter of a red blood cell is 8.2×10^{-6} m.
Express this value as a decimal, in millimetres.

Answer ..... mm [1]

(b) In 2024, Changi Airport handled 67.7 million passengers.
Calculate the mean number of passengers handled by the airport each month.
Leave your answer in standard form, correct to 2 significant figures.

Answer ..... [2]

(c) LBB Bank currently charges 3% per year compound interest on all loans, compounded once every three months.
The bank manager proposes to adjust the frequency of interest compounded to once every month instead, so as to increase the earnings of the bank.

Do you agree with the bank manager's proposal?
Explain your answer with clear workings.

Answer

.....

.....

.....

[3]

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3 A bakery selling assorted tarts operates for 7 days a week.
The matrix, **T**, shows the number of tarts of different types that are made each day.

$$\mathbf{T} = \begin{array}{c} \begin{matrix} \text{Apple} & \text{Banana} & \text{Cheese} \end{matrix} \\ \begin{pmatrix} 55 & 35 & 70 \\ 40 & 30 & 30 \end{pmatrix} \end{array} \begin{matrix} \\ \text{Small} \\ \text{Large} \end{matrix}$$

The cost of making a small tart is \$0.80.
The cost of making a large tart is \$1.75.

(a) Represent these costs in a 1×2 row matrix **N**.

Answer **N** = [1]

(b) Evaluate the matrix **C** = 7**NT**.

Answer **C** = [2]

(c) State what each of the elements of **C** represent.

.....

..... [1]

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(d) The tarts are sold at 55% more than the cost to make them.
On a particular day, the number of banana tarts to cheese tarts sold is in the ratio $5:7$ while the number of apple tarts to banana tarts sold is in the ratio $5:4$. A total of 41 unsold tarts were given away.

If the number of small cheese tarts sold is twice the number of large cheese tarts sold, calculate the total amount earned by the bakery from selling cheese tarts on that day.

Answer $ ..... [3]

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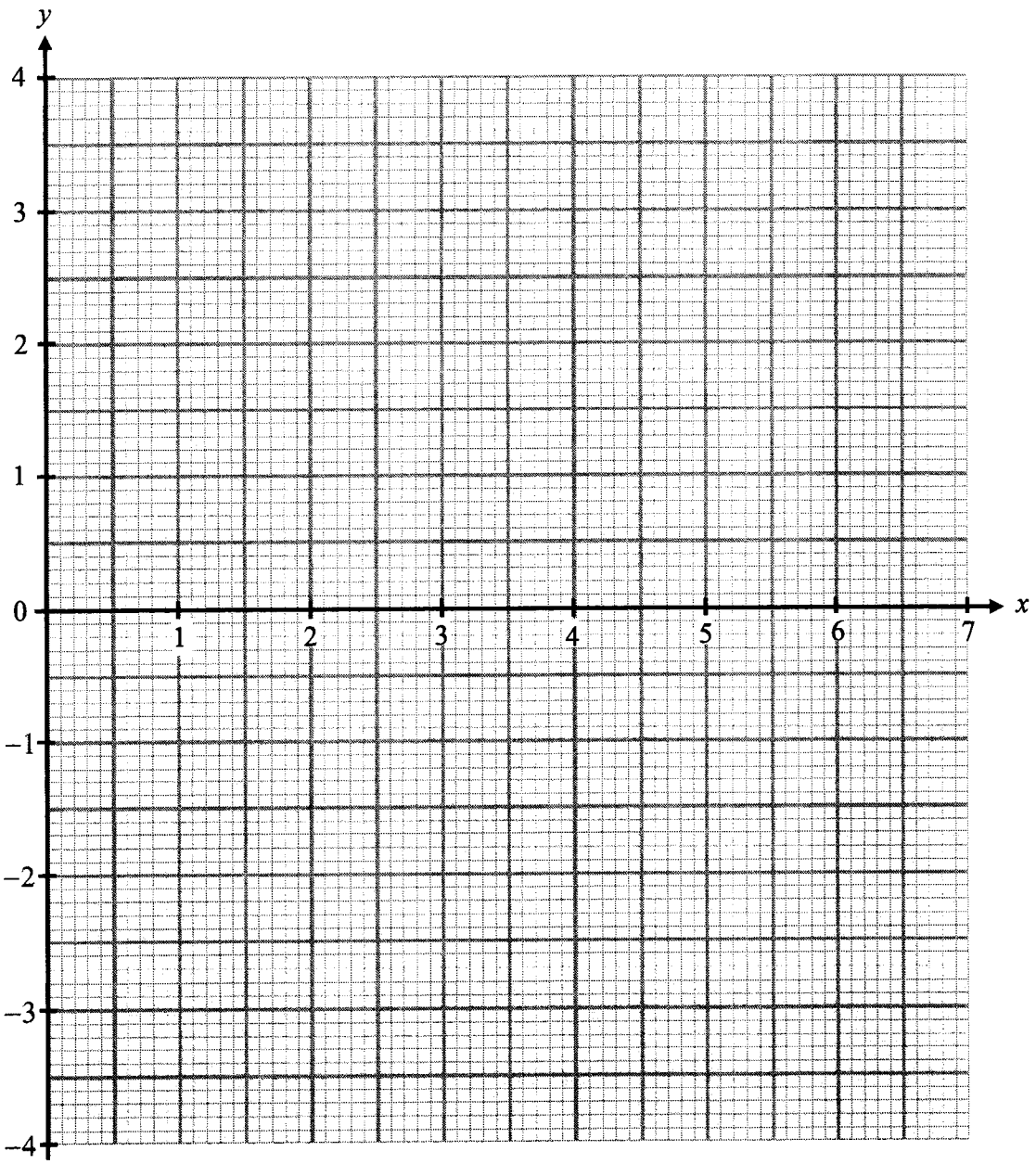
4 **(a)** The variables x and y are connected by the equation $y = \frac{7}{x} + 2x - 11$.

Some corresponding values are given in the table below.
Values are given to 1 decimal place where appropriate.

x	0.5	1	1.5	2	3	4	5	6	6.5
y		−2	−3.3	−3.5	−2.7	−1.25	0.4	2.2	3.1

Fill in the missing value in the table. [1]

(b) On the grid below, draw the graph of $y = \frac{7}{x} + 2x - 11$ for $0.5 \leq x \leq 6.5$. [2]



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(c) By drawing a tangent, find the gradient of the curve at $x = 2$.

Answer Gradient = ... [2]

(d) Using your graph,

(i) explain why the equation $2x + \frac{7}{x} - 7 = 0$ has no solution.

Answer

.....

..... [2]

(ii) find the x-coordinate of the points where the line $2y = 4 - x$ intersects the curve.

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

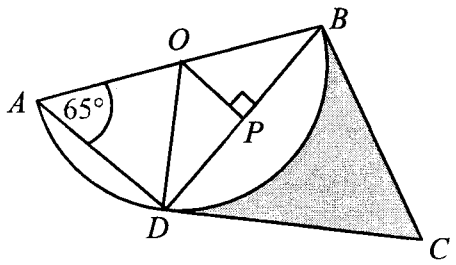
(iii) These values of x are the solutions of the equation $Ax^2 + Bx + 14 = 0$.

Find the value of A and of B.

Answer $A =$ ....., $B =$ ..... [3]

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5 The figure shows a semi-circle $AOBD$ with centre O and OP is perpendicular to BD. BC and CD are tangents to the semi-circle at B and D.



(a) Show that triangles ABD and OBP are similar.
Give a reason for each statement you make.

Answer

.....

.....

.....

..... [2]

(b) Find the ratio $\dfrac{\text{area of triangle } OBP}{\text{area of triangle } AOD}$.

Answer ..... [2]

(c) Show that angle $BOD = 2.2689$ radians, correct to 5 significant figures.

Answer

[2]

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(d) It is given that the radius of the semi-circle is 4 cm and $BC = 8.58$ cm.

Calculate

(i) the perimeter of the shaded part,

Answer ..... cm [2]

(ii) the area of the shaded part.

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

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6 (a) (i) The position vector of point A and point B are $\begin{pmatrix} k \\ 6 \end{pmatrix}$ and $\begin{pmatrix} 2 \\ -2 \end{pmatrix}$ respectively.

Given that $\left|\overrightarrow{AB}\right| = 10$, find the negative value of k.

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

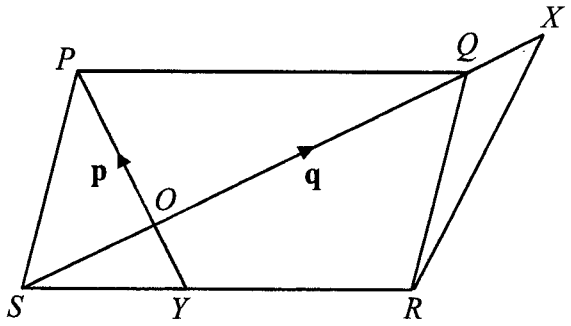
(ii) C is the point $(5, -6)$.
Using the value of k found in part **(a)(i)**, show that A, B and C are collinear.

Answer

[3]

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(b) The diagram shows a parallelogram $PQRS$ and a triangle QXR.
QS is a diagonal of the parallelogram and Y is a point on RS such that $OS : QS = 3 : 10$.



It is given that $\overrightarrow{OP} = \mathbf{p}$ and $\overrightarrow{OQ} = \mathbf{q}$.

(i) Express $\overrightarrow{QR}$, as simply as possible, in terms of **p** and **q**,

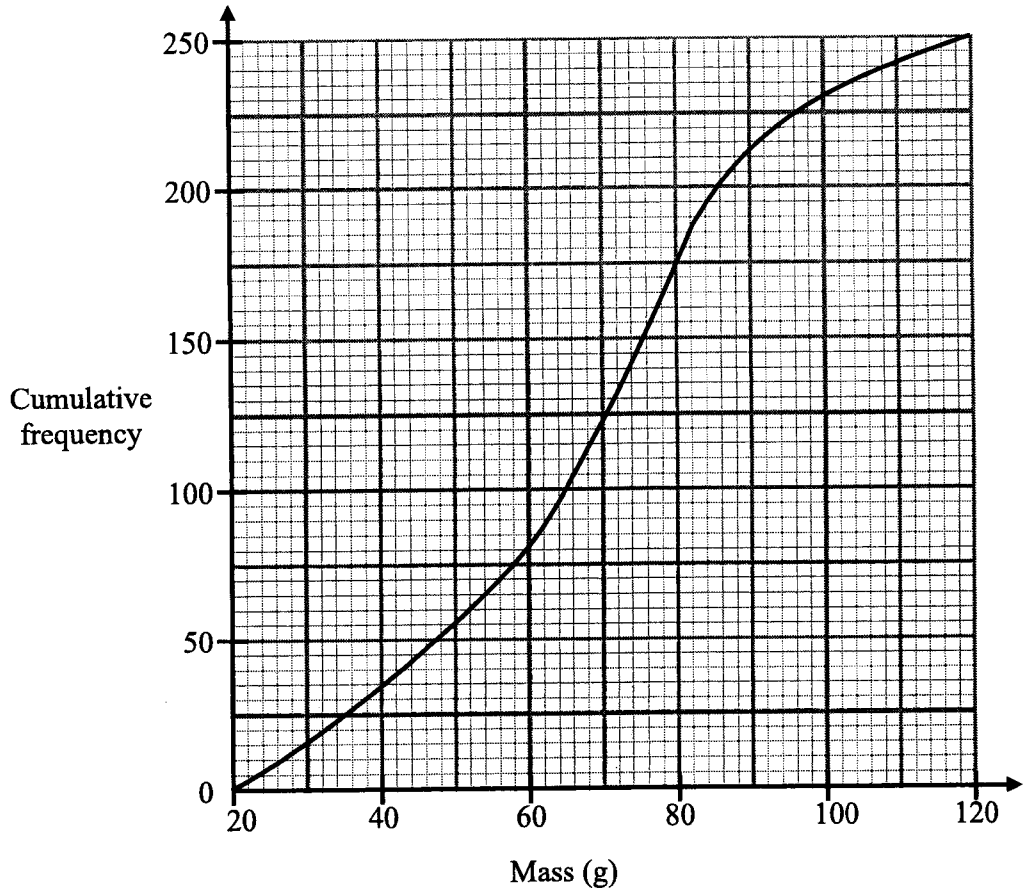
Answer $\overrightarrow{QR}$ = ... [3]

(ii) If $\overrightarrow{QX} = m\overrightarrow{SQ}$ and $\overrightarrow{RX} = n\left(\frac{1}{5}\mathbf{p} + \frac{1}{7}\mathbf{q}\right)$, where m and n are rational numbers, find the value of m and of n.

Answer m = ..., n = ... [4]

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7 A farmer harvested 250 potatoes which were grown using Fertiliser X.
The cumulative frequency curve below shows the mass distribution of the potatoes.



(a) The farmer only sells potatoes that weigh 56 g and above.

Using the curve, find the percentage of potatoes that can be sold.

Answer ..... % [1]

(b) (i) Complete the grouped frequency table for the mass of the potatoes.

Mass (m g)	$20 \le m < 40$	$40 \le m < 60$	$60 \le m < 80$	$80 \le m < 100$	$100 \le m < 120$
Frequency	35	45		55	20

[1]

(ii) Find the interval that contains the median mass.

Answer ..... $\le m <$ ..... [1]

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(iii) Calculate an estimate of the mean mass.

Answer ..... g [1]

(iv) Calculate an estimate of the standard deviation of the masses.

Answer ..... g [1]

(c) Two of the potatoes are selected at random, without replacement.

Find the probability that

(i) none has a mass between 60 g and 100 g,

Answer ..... [2]

(ii) one has a mass less than 60 g and the other has a mass greater than 100 g.

Answer ..... [2]

(d) The farmer harvested another 250 potatoes that were grown using Fertiliser Y.
The estimated mean mass of this batch of potatoes is 62 g.
The estimated standard deviation of the masses is 23 g.

Make two comments comparing the mass of the potatoes grown using Fertiliser X and those grown using Fertiliser Y.

Answer

.....

.....

.....

..... [2]

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8 A factory produces bowls in two sizes, small size and large size.

(a) It is found that x large bowls can be produced in a minute.
Write down an expression in terms of x, the time taken to produce 1 large bowl, **in seconds**.

Answer ..... s [1]

(b) 4 more small bowls can be produced in a minute, compared to the large bowls.
Write down an expression in terms of x, the time taken to produce 1 small bowl, **in seconds**.

Answer ..... s [1]

(c) Given that it takes 2.5 seconds longer to produce a large bowl than a small bowl, form an equation in x and show that it reduces to $x^2 + 4x - 96 = 0$.

Answer

[2]

(d) Solve the equation $x^2 + 4x - 96 = 0$.

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

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(e) Hence find the time taken to produce 3500 small bowls.
Give your answer in hours and minutes, correct to the nearest minute.

Answer ..... h ..... min [2]

(f) The factory sells each small bowl at \$0.35 and each large bowl at \$0.50.

Explain, with clear workings, why it is more profitable for the factory to produce only small bowls than only large bowls.

Answer

.....

..... [3]

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9 Ryan has set up a home theatre system in one of his rooms, which is in the shape of a cuboid with dimensions 4 m by 3.6 m by 3 m.

Figure 1 shows the three-dimensional layout of the room, where a television is mounted on the front wall $QRVU$ and two speakers are mounted on the back wall $PSWT$, at P and T respectively.

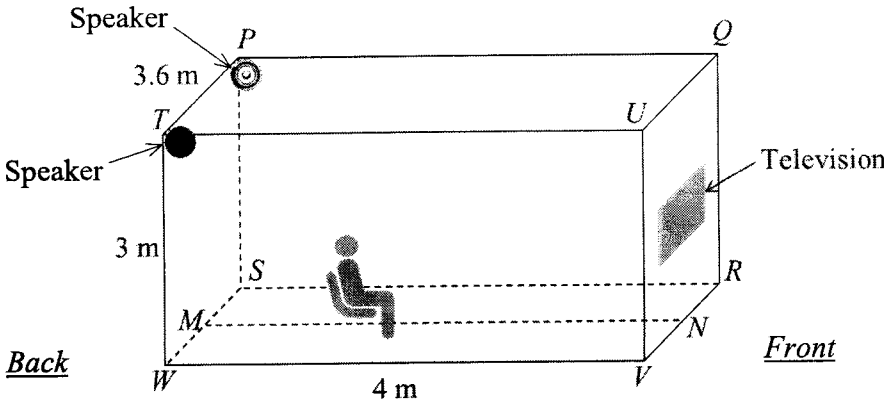


Figure 1

Ryan is planning to put an armchair along MN, which is a straight path that cuts across the centre of the room from the back to the front.

Figure 2 shows the cross-sectional view of him sitting in the armchair, where his eye level at X, is 1.24 m directly above the ground and $\boldsymbol{d}$ m away from the front wall. The centre of the television at Y, is 1.6 m directly above N.

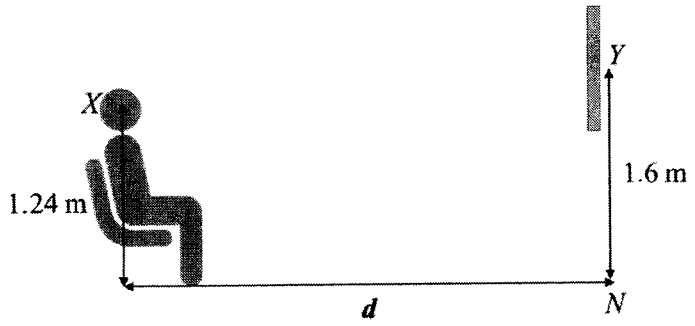


Figure 2

(a) Find the angle of elevation from X to Y when $\boldsymbol{d}$ = 1.2 m.

Answer ..... ° [2]

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(b) Ryan found out that:

- To have an optimal view of the television, the angle of elevation from X to Y should be less than $15°$.
- To have an optimal audio experience, the position of the two speakers and X should form an equilateral triangle.

Suggest a suitable value for ***d*** such that the position of the armchair will provide Ryan with best possible user experience.
Justify the decisions you make and show your calculations clearly.

Answer

.....

..... [7]

~ End of paper ~

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