AHMAD IBRAHIM SECONDARY SCHOOL
END-OF-YEAR EXAMINATION 2024

SECONDARY 3 EXPRESS

Name:	Class:	Register No.:

MATHEMATICS **4052**
Paper 1 **1 October 2024**
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** questions.
If working is needed for any questions 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 your calculator value or 3.142, unless the question requires the answer in terms of π.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of 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 a sphere $= 4\pi r^2$

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

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

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

Arc length $= r\theta$, where θ 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

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

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

Answer **all** the questions.

1 Calculate $\dfrac{\sqrt{3.5}+2}{6.1^{0.9}-4}$.

Answer ..... [1]

---

2 Write the following in order of size, smallest first.

$$0.805, \quad \sqrt{0.64}, \quad 0.71^{\frac{2}{3}}, \quad \frac{21}{25}, \quad 79\%$$

Answer ....., ..., ..., ..., ... [2]

---

3 The populations of four states in India are shown below.

State	Population (millions)
Maharashtra	112.3
Tripura	3.674
Rajasthan	68.56
Ladakh	0.274

Calculate the total population of the four states.

Give your answer in standard form.

Answer ..... [2]

---

4 In a regular polygon, the ratio interior angle : exterior angle = 8 : 1.

Calculate the number of sides of the polygon.

Answer ..... [3]

---

5 A person jogs 975 m in 8.134 minutes.

(a) By rounding each number correct to 1 significant figure, estimate the speed of the person.

Answer ..... m/min [2]

(b) Without doing any further calculations, explain why the actual speed of the person is less than the answer to **part (a)**.

Answer .....

..... [1]

---

6 **(a)** If $4x = 9y$, find the ratio $x^2 : y^2$.

Answer ..... [2]

(b) **(i)** Nouryn makes a salad.

She uses tomatoes, lettuce and corn in the ratio 7 : 2 : 5 respectively.

She uses 882 g of tomatoes.

How much corn does she use?

Answer ..... g [1]

(ii) Amily makes a salad using spinach, olives and carrots.

The ratio of spinach : olives is 2 : 3.

The ratio of olives : carrots is 8 : 7.

Find the ratio of spinach : olives : carrots.

Answer ..... : ..... : ..... [1]

7 A water tank is 60% full.

24% of the water in the tank is used.

There are now 171 litres of water in the tank.

Calculate the capacity of the tank when full.

Answer ..... *l* [2]

8 Given that $2^{-a} \times \frac{1}{8^a} = 32$, find a.

Answer $a =$ .....
[2]

9 Simplify

(a) $2x^3 \times 15x^4 \div 3x^0$,

Answer ..... [1]

(b) $\left(\frac{27y^6}{z^9}\right)^{-\frac{2}{3}}$, giving your answer in positive index form.

Answer ..... [2]

10 Simplify

(a) $\frac{4x}{3} - \frac{3(2-5x)}{4}$,

Answer ..... [2]

(b) $\frac{4y^2-1}{6y^2-11y+4}$.

Answer ..... [3]

11 Factorise $p^2 - 2pq + q^2 - 4$ completely.

Answer ..... [2]

12 **(a)** Show that $\frac{3}{x-5}+\frac{x}{(5-x)^2}$ can be simplified to $\frac{4x-15}{(x-5)^2}$.

Answer

[2]

(b) Hence solve $\frac{3}{x-5}+\frac{x}{(5-x)^2}=1$ by factorisation.

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

13 $g = \dfrac{h^2 + k}{5 - h^2}$

(a) Calculate the value of g when $h = -1.2$ and $k = 3.45$.

Answer $g =$ ..... [1]

(b) Rearrange the equation to make h the subject.

Answer ..... [3]

14 **(a)** Given $360 = 2^3 \times 3^2 \times 5$, explain why 360 is not a perfect square.

Answer .....

..... [1]

(b) Find the smallest integer k such that $360k$ is a perfect cube.

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

(c) Wei Ler has 360 sweets and 336 chocolate bars to be packed into bags.

Given that each bag contains the same number of sweets and the same number of chocolate bars, calculate the maximum number of bags that can be packed.

Answer ..... [2]

15 **(a)** y is directly proportional to the square of x.

When $x = 6$, $y = 9$.

Find the value of y when $x = 8$.

Answer $y =$ ..... [2]

(b) p is inversely proportional to the cube root of q.

Explain what happens to the value of p when q is multiplied by 343.

Answer .....

.....

.....

..... [1]

16 The graphs of $y = x - 4$ and $3x - 4y = 7$ meet at point P.
Find the coordinates of point P.

Answer (……, ……) [3]

---

17 Five positive integers have a mean of 8, a median of 10 and a mode of 13.
Find the five numbers.

Answer ……, ……, ……, ……, …… [2]

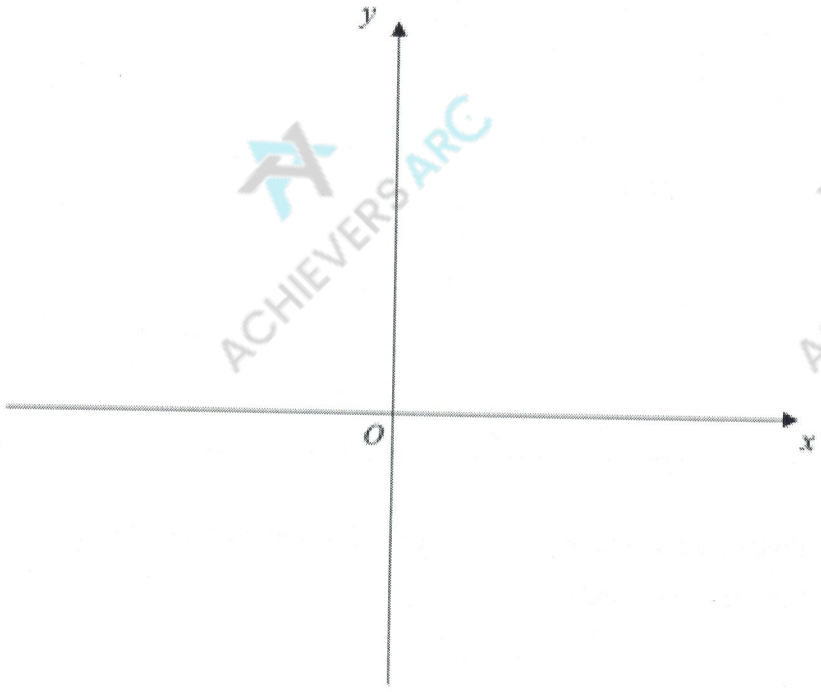
---

18 **(a)** Express $x^2 + 6x + 11$ in the form $(x + p)^2 + q$.

Answer ..... [2]

(b) Sketch the graph of $y = x^2 + 6x + 11$ on the axes below.

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



[2]

(c) Explain how your graph shows that the equation $x^2 + 6x + 11 = 0$ has no solutions.

Answer .....

..... [1]

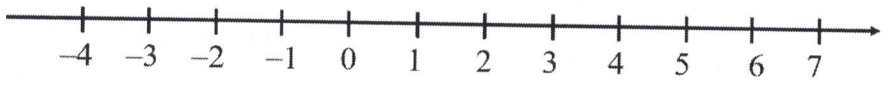
19 Wan Zhen invested \$7000 in an account paying compound interest at r % per year.
After 3 years, she earned an interest of \$800.
Calculate the value of r.

Answer $r =$ ..... [3]

20 **(a)** Solve the inequalities $\frac{x-13}{2} < 3x+1 \leq 16$.

Answer ..... [3]

(b) Represent your answer on the number line below.

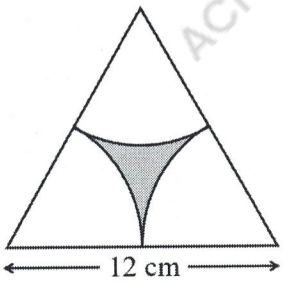


[1]

(c) Write down the smallest prime number that satisfy $\frac{x-13}{2} < 3x+1 \leq 16$.

Answer ..... [1]

21 The diagram shows an equilateral triangle of side 12 cm and three identical sectors.
Calculate the shaded area.



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

22 The first five terms of a sequence are 2, 5, 8, 11, 14.

(a) Find an expression, in terms of n, for the nth term of the sequence.

Answer ..... [1]

(b) Find the 21st term of the sequence.

Answer ..... [1]

(c) Alvin says that 323 is a term in this sequence.
Is he correct? Explain your answer.
Answer

[1]

(d) The first five terms of another sequence are 3, 9, 17, 27, 39.
Using **part (a)**, deduce the expression, in terms of n, for the nth term of the sequence.

Answer ..... [1]

23 The scale of a map is given as 1 : 50 000.

(a) A road on the map is 17 cm long.

Find the actual length of the road in kilometres.

Answer ..... km [1]

(b) A farm has an area of 30 km^2.

Find the area of the farm on the map in square centimetres.

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

24 In triangle ABC, $AB = 8$ cm, $BC = 10$ cm and angle $BAC = 45°$.
AB is drawn below.

(a) Construct triangle ABC. [2]

(b) Construct the perpendicular bisector of AB. [1]

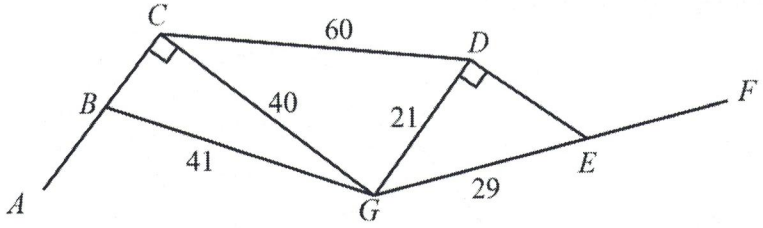
(c) Construct the angle bisector of angle ABC. [1]

(d) The two bisectors meet at X.
Measure and write down the length of XC.

Answer ..... cm [1]

25 In the diagram below, $BG = 41$ cm, $CG = 40$ cm, $CD = 60$ cm, $DG = 21$ cm, $GE = 29$ cm, angle $BCG = 90°$ and angle $GDE = 90°$.

ABC and GEF are straight lines.



(a) Find the exact value of $\sin \angle DEF$.

Answer ..... [1]

(b) Is triangle CGD a right-angled triangle?

Show your working to justify your answer.

Answer

[2]

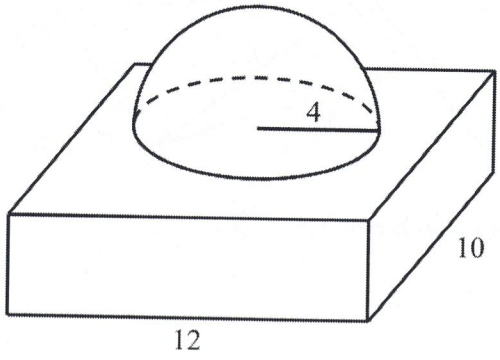
(c) Given that $\cos \angle ABG = -\frac{9}{41}$, find the length of BC.

Answer ..... cm [1]

26 The toy can be modelled with a cuboid and a hemisphere.

The cuboid has length 12 cm and breadth 10 cm.

The hemisphere has radius 4 cm.



Given that the cuboid has a volume of 420 cm^3, find the total surface area of the toy.

Answer ..... cm^2 [4]

27 The stem-and-leaf diagram shows the marks of 20 students for a test.
The total is 40 marks.

1	0	3	3	4					
2	2	2	3	5	8	9			
3	0	1	1	2	5	6	6	7	9
4	0								

Key: 1 | 0 represents 10 marks

(a) Find the range.

Answer ..... marks [1]

(b) Find the median mark.

Answer ..... marks [1]

(c) One must score 80% or more to qualify for distinction.
What is the percentage of the class that scored distinction?

Answer ..... % [2]

End of Paper

Setter: Miss Melody Ho

AHMAD IBRAHIM SECONDARY SCHOOL
END OF YEAR EXAMINATION 2024

SECONDARY 3 EXPRESS

Name:	Class:	Register No.:

MATHEMATICS **4052/02**
Paper 2 **2 October 2024**

Candidates answer on the Question Paper. **2 hours 15 minutes**

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For Examiner's Use
/90

This document consists of **23** printed pages.

Mathematical Formulae

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Curved surface area of a cone = πrl

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

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

Arc length = $r\theta$, where θ is in radians

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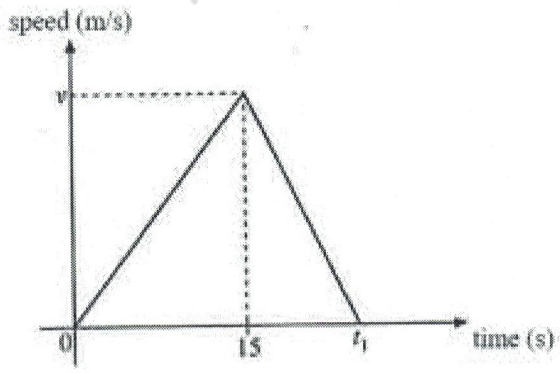
Answer **all** the questions.

1



The diagram shows the speed-time graph of an object from 0 to t_1 seconds.
The object starts from rest and accelerates to a maximum speed of v m/s in 15 seconds.
It then decelerates till it finally comes to rest at t_1 seconds.

(a) Calculate the maximum speed of the object if the distance covered in the first 15 seconds is 60 m.

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

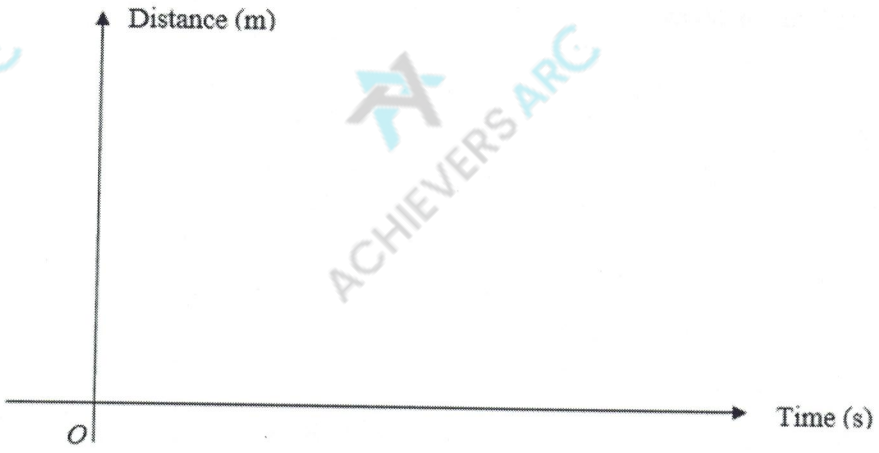
(b) Hence find the acceleration of the object in the first 15 seconds.

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

(c) Calculate the value of t_1 if the deceleration of the object is 0.8 m/s^2.

Answer ..... [2]

(d) Sketch a distance-time graph for the object. [2]



2 John took up a job offer in Japan.
His annual salary in 2022 was 5 500 000 Yen.
The exchange rate between Singapore dollars and Japanese Yen in 2022 was S$1 = 111.52 Yen.

(a) Calculate his average monthly salary in Singapore dollars in 2022.
Give your answer correct to the nearest dollar.

Answer S$..... [2]

In 2023, John's company offered him a pay rise of 3.5% and a bonus of 200 000 Yen.

(b) Calculate John's revised annual salary in Yen.

Answer ..... Yen [2]

Based on the exchange rate between Singapore dollars and Japanese Yen in 2023, John realised that his new average monthly salary in Singapore dollars was S$5191.

(c) Find the exchange rate between Singapore dollars and Japanese Yen in 2023. Give your answer to two decimal places.

Answer S$ 1 : ……..…. Yen [2]

(d) Calculate the percentage decrease in the value of Yen against the Singapore dollar.

Answer ……..…… % [2]

3 An **open** box is in the shape of a cuboid.
The height of the box is 4 cm less than its length.
The width of the box is twice its height.

(a) Given that the length of the box is x cm, write down the expressions, in terms of x, for the height and the width of the box.

Answer Height = ... cm

Width = ... cm [1]

(b) The external surface area of the open box is 46 cm^2.
Write down an equation to represent this information and show that it simplifies to $4x^2 - 24x + 9 = 0$.

Answer

[3]

(c) Solve the equation $4x^2 - 24x + 9 = 0$.
Give your solutions correct to two decimal places

Answer $x =$ …….. or $x =$ …… [3]

(d) Explain why one of the solutions in part **(c)** must be rejected as the length of the box.

Answer

……

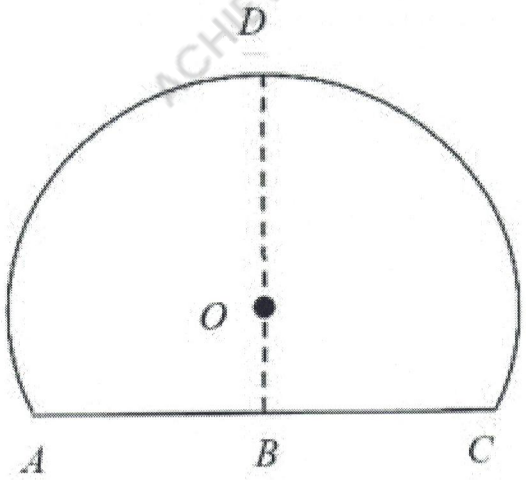
……

…… [1]

(e) Find the volume of the box.

Answer ……..... cm^3 [2]

4 (a)



$ABCD$ is a major segment of a circle, centre O.
BD is 32 cm, AC is 48 cm and angle DBA is $\frac{\pi}{2}$ radian.

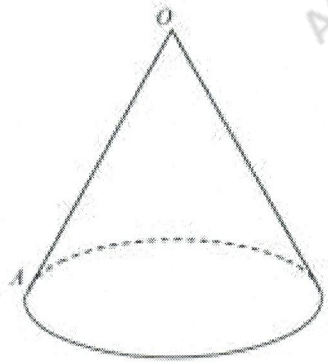
(i) Show that the radius of the circle is 25 cm.

[3]

(ii) Find the area of the major segment $ABCD$.

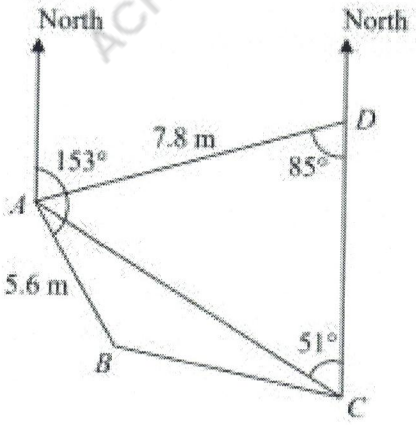
Answer ..... cm^2 [4]

(b) The sector $OADC$ was made into a cone where arc ADC becomes the circumference of the base.
Find the vertical height of the cone.



Answer ..... cm [5]

5



In a soccer match, four players are standing at points A, B, C and D on level ground.
$AB = 5.6$ m and $AD = 7.8$ m.
B is on a bearing of 153° from A and C is due south of D.
Angle $ACD = 51°$ and angle $ADC = 85°$

(a) Find

(i) the bearing of C from A,

Answer ..... [1]

(ii) AC.

Answer ..... m [2]

(b) A player is standing at a point P along AC such that he is nearest to B.

(i) Find the distance PB.

Answer ..... m [2]

(ii) A bird is flying at a point 5 m above B.
Explain why the largest angle of elevation of the bird from P is 65.5°, correct to 1 decimal place.
Show your working.

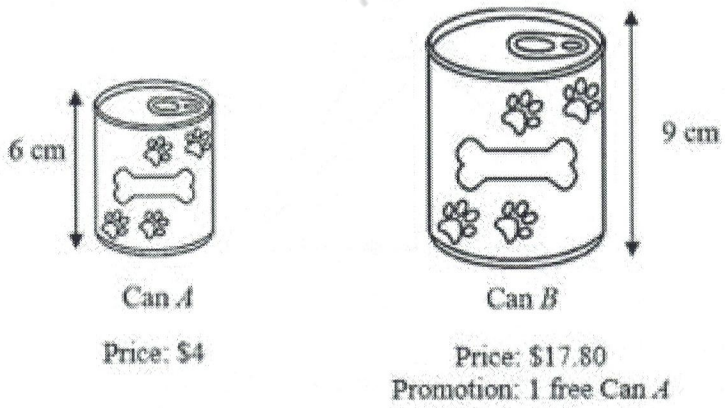
Answer

[2]

(c) Another player is running in a straight line from B to D at a speed of 130 metres per minute.
Find the time taken, in seconds, that he will take to reach D.

Answer ..... s [4]

6 **(a)** A type of dog food is sold in two similar can sizes at a supermarket.
The height of Can *A* is 6 cm while the height of Can *B* is 9 cm.



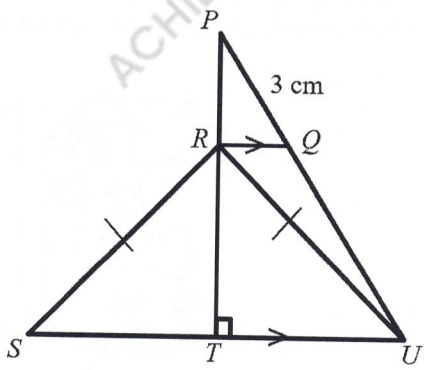
(i) The mass of Can *A* is 150g.
Find the mass of Can *B*.

Answer ..... g [2]

(ii) The supermarket is running a promotion on the dog food.
The selling prices of the cans are shown in the diagram above.
Which can gives better value for money?
Justify your answer clearly.

[2]

(b)



In the diagram, STU is a straight line.
RQ is parallel to SU, $RS = RU$, $PQ = 3$ cm and $\angle PTU = 90°$.

(i) Show that triangles RST and RUT are congruent.

Answer

[3]

(ii) Show that triangles PQR and PUT are similar.

Answer

[2]

(iii) Given that $TU = 3RQ$, find the length of QU.

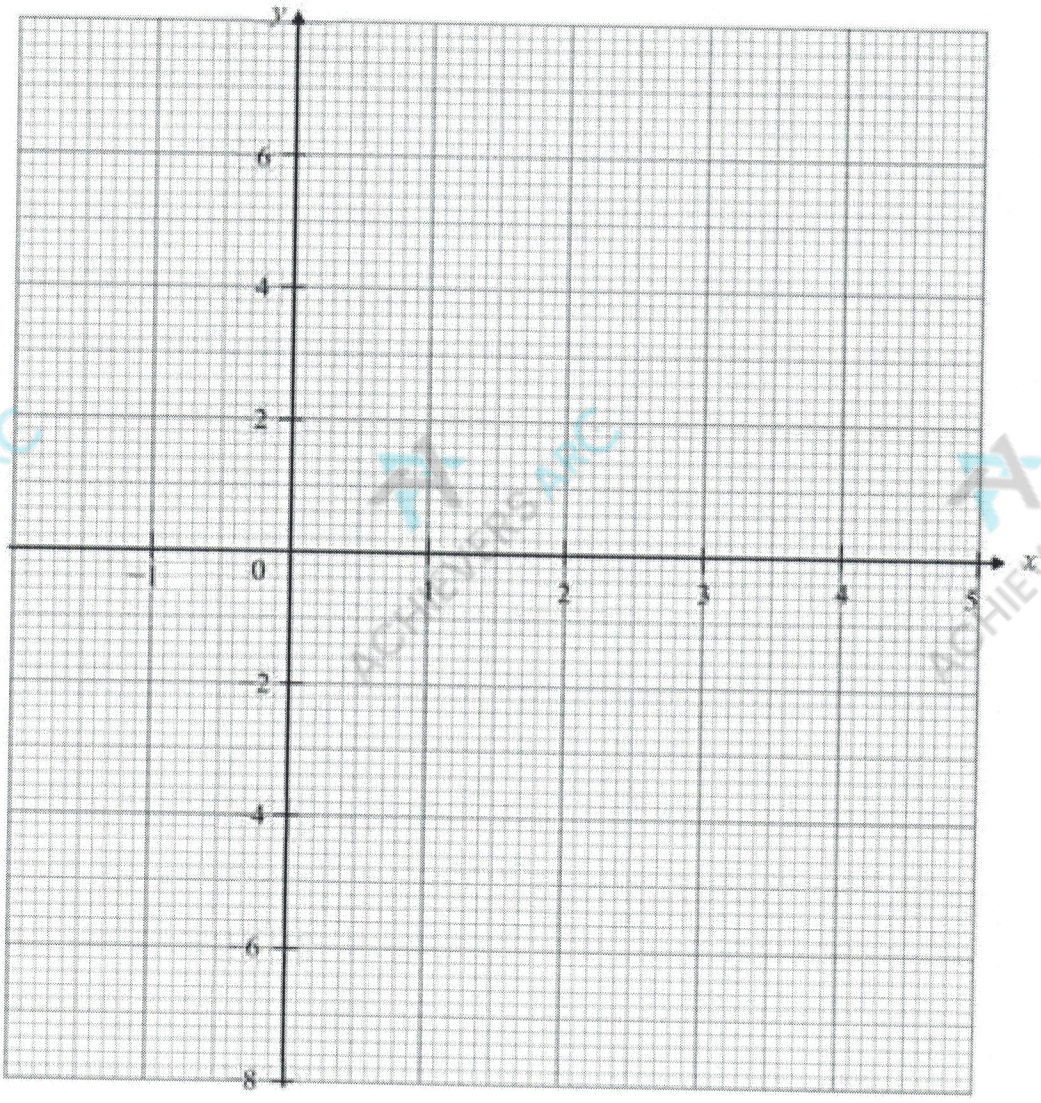
Answer $QU =$ ..... cm [2]

7 **(a)** Complete the table of values for $y = \frac{1}{5}(18x - x^3)$.

x	−1	0	1	2	3	4
y	−3.4	0	3.4	5.6	5.4	

[1]

(b) On the grid, draw the graph of $y = \frac{1}{5}(18x - x^3)$ for $-1 \le x \le 4$.



[3]

(c) Use your graph to find the values of x for which $15 = 18x - x^3$.

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

(d) The line $y = kx + 5$, where k is a constant, is a tangent to the curve.
By drawing a suitable straight line on the graph, find the value of k.

Answer $k =$ ..... [2]

(e) The solutions of the equation $x^3 + Ax + B = 0$ are obtained from the $x-$coordinates of the points at which the line $y = 2 - x$ intersects with the graph $y = \frac{1}{5}\left(18x - x^3\right)$.
Find the value of A and the value of B.

Answer $A =$ .....

$B =$ ..... [3]

8 The points A and B are $(-4, 2)$ and $(2, 5)$ respectively.

(a) Find the length of the line segment AB.

Answer ..... units [2]

(b) Find the equation of the line AB.

Answer ..... [2]

(c) P is a point on AB produced such that P is equidistant from the two axes. Find the coordinates of P.

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

(d) Given that C is (2, 4) and length of AB and CD are equal, find the two possible coordinates for D if it lies on the vertical line passing through A.

Answer D ....., ...)

D ....., ...) [2]

(e) A trapezium $ABCE$, with AE parallel to BC, has an area of 81 units^2.
Find the coordinates of E.

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

9 Maple syrup is made by boiling down the sap of the maple trees.
The sap is a liquid found in the tree which is collected by drilling a hole into the tree and putting a tap into it.
Each tree can have at most 3 taps, depending on its size.

Below is some information about tapping maple trees.

Diameter of Tree	Number of Taps
Less than 10 inches	0
10-17 inches	1
18-25 inches	2
More than 25 inches	3

An average of 12 gallons of sap can be collected per tap.
10.5 gallons of sap boils down to 0.25 gallons of syrup.
1 gallon = 3.875 litres

(a) What percentage of the sap eventually becomes maple syrup?

Answer ..... % [1]

(b) Calculate the total volume, in litres, of maple syrup that can be produced from three maple trees of diameters 10, 15 and 27 inches respectively.

Answer ..... [2]

The maple syrup found in stores come from maple trees which are grown in farms.
Information about a typical maple farm is shown below.

Number of acres = 40
Number of taps per acre = 200
Cost of maintaining the farm: $1200 per acre
Cost to convert sap to syrup: $18 per gallon of syrup

(c) The owner of a maple farm would like to make a profit of at least $20 for every gallon of maple syrup he sells.

What price should he charge for one gallon of maple syrup to achieve his aim? Justify any decisions you make and show your calculations clearly.

[7]

END OF PAPER