Mock Preliminary Examination 2024

NAME: _____

CLASS: _____ REGISTER NUMBER: ( )

MATHEMATICS **4048/01**

PAPER 1 **14 August 2024**

Secondary 4 Express **2 hours**

Additional Materials: Nil

READ THESE INSTRUCTIONS FIRST

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

Answer **all** the questions.
If working is needed for any question it must be shown with the answer.
Omission of essential working will result in loss of marks.
The use of an approved scientific calculator is expected, where appropriate.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.
For π, use either 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 of the marks for this paper is 80.

Mathematical Formulae

Compound interest

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

Mensuration

Curve surface area of a cone = πrl

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

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

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

Answer **all** the questions

1 Sally and Ken both have a total of \$550 in the ratio of 3 : 8.

How much does Ken have?

Answer \$...……..……. [2]

---

2 Solve $\frac{x}{4} + 5 = 8$.

Answer.……..……. [1]

---

3 John walks to school. He leaves home at 6.00 am and reaches his school at 7.15 am. The distance of the school from his house is 1200 m.

Calculate his walking speed in km/h.

Answer…….……... km/h [2]

---

4 The prime factorisation of two integers, *M* and *N* are shown below.

$$M = p^8 \times q^4 \times r^6$$

$$N = p^{x+1} \times q^4 \times r^{2y-1}$$

(a) Explain why *M* is a perfect square?

Answer ……

……..... [1]

(b) The HCF of *M* and *N* is $p^5 \times q^4 \times r^3$.

Find the values of *x* and *y*.

Answer x =……, *y* =……. [2]

[Turn over

5 **(a)** Simplify and expand $(2x + 4)(3x - 7)$.

Answer……..……. [2]

(b) Simplify $\frac{2a^3b^7c}{8a^{-2}b^{-3}}$.

Answer……..……. [2]

---

6 Show that $(2n + 3)^2 - 5$ is a multiple of 2 for all integer values of n.

Answer

[2]

---

7 **(a)** Express $x^2 - 6x + 5$ in the form of $(x - a)^2 + b$.

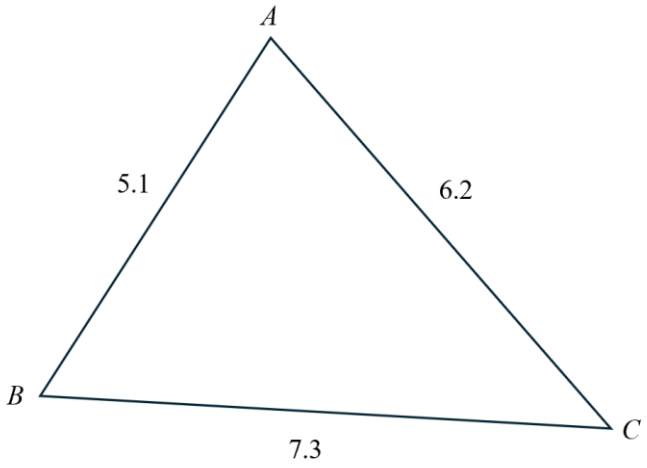
Answer……..……. [1]

(b) Hence, solve $x^2 - 6x + 5 = 0$.

Answer…… or ……..…... [1]

---

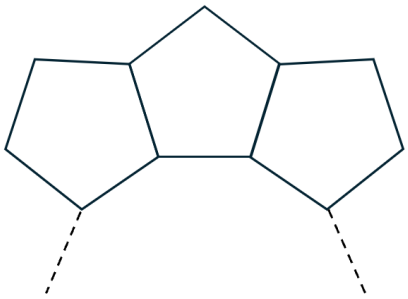
8 In the diagram, $AB = 5.1$ cm, $BC = 7.3$ cm and $AC = 6.2$ cm.



Find the area of triangle ABC.

Answer……..……. [4]

9 Three identical pentagons are shown below to form a regular n-sided polygon.



How many more such pentagons to completely form the regular polygon?

Answer.....[3]

---

10 The average length of a string of hair is 2.64×10^{-5} m. The average length of a bacteria is 0.00000192 m.

(a) Express the average length of a bacteria in standard form.

Answer..... m [1]

(b) Find the difference in their lengths of a hair and a bacteria. Express your answer in standard form.

Answer..... m [2]

---

11 **(a)** Express $\frac{2}{x+2} - \frac{x-3}{x^2-4}$ as a single fraction.

Answer.....[3]

(b) **(i)** Factorise $x^2 + 6x + 9$ completely.

Answer.....[2]

(ii) Hence, solve $\frac{2x}{x+3} - \frac{x-3}{x^2+6x+9} = 0$.

Answer.....[5]

12 Janet collects stamps.
$\frac{3}{8}$ of her stamps are from Australia.
35% of the **remaining** stamps are from Malaysia.
The rest are from Singapore.
She has 195 Singapore stamps.
How many Australia stamps does she collect?

Answer……...……. [3]

---

13 **(a)** Convert 73 degree into radian.

Answer…...…… rad [2]

(b) Given that $\sin\theta = \frac{4}{5}$, find the two possible angles of θ.

Answer θ=……. or ……... [2]

---

14 A tablet is sold at \$1450 after a discount of 20%.

(a) Find the marked price of the tablet.

Answer \$……..……..……. [1]

(b) A customer bought the tablet at the discounted price, and he paid for it using a hire purchase scheme according to the following terms: a down-payment of 60% and the remaining to be paid in monthly instalments over 16 months at a simple interest rate of x% per annum. Given that the total interest he paid is \$34.80, find x.

Answer \$……..……..……. [2]

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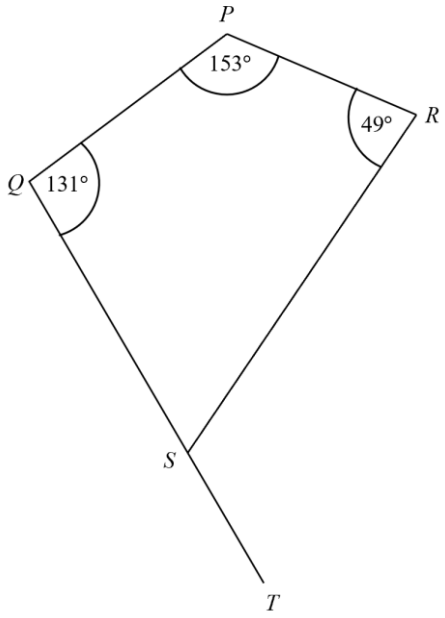
15 In the diagram, $PQRS$ is a quadrilateral and QST is a straight line.



(a) Explain why a circle can be drawn with points P, Q, R and S?

Answer ……

……..... [1]

(b) Find angle RST.

Answer……..……° [1]

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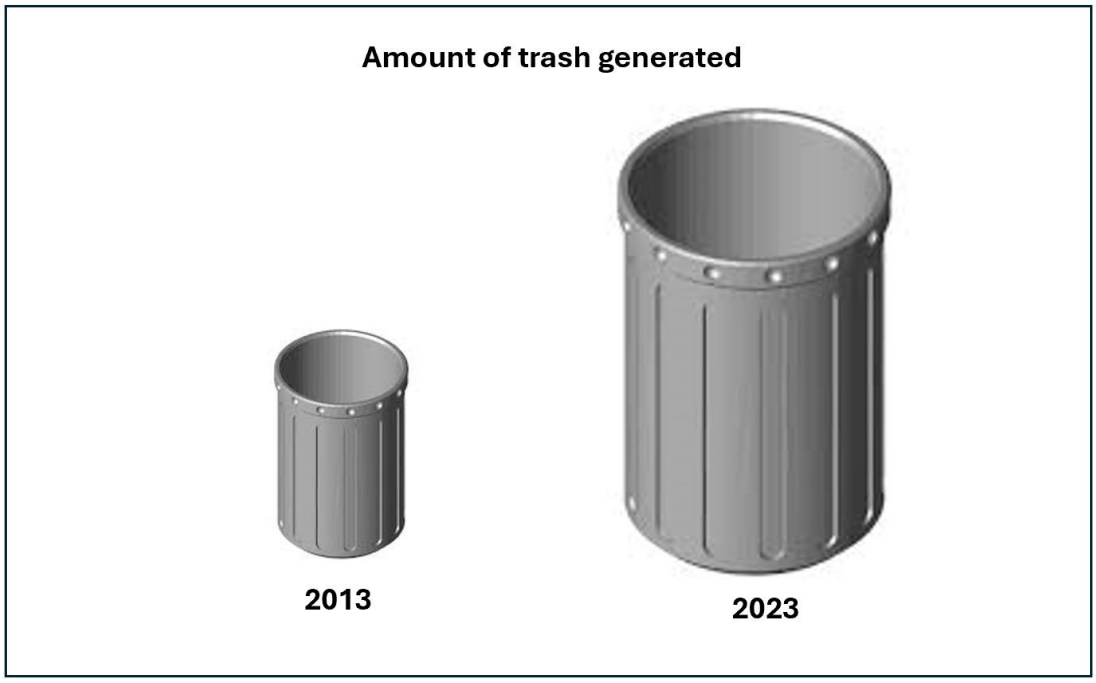
16 Jacob draws the infographic below to show the trend of the number of trash generated in 2013 and 2023 in his country.



Jacob claims that the amount of trash generated in 2023 is **thrice** of that in 2013.

State one aspect of the infographic that may be misleading and explain why Jacob's claim is wrong.

Answer ……

……

……

……..... [2]

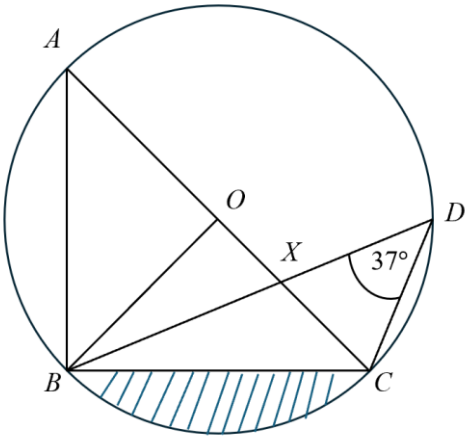
---

17 Solve $2^{5x-1} = 3^{5x-1}$.

Answer x =……..……. [2]

---

18 **(a)** In the diagram, A, B, C and D lie on the circle with centre O. Angle $BDC = 37°$. AOC and BD meets at point X.



(i) Find angle BOC.
State a reason for your answer.

Answer.....……° [1]

(ii) Given that the radius of the circle is 8 cm, find BC.
State a reason for each working.

Answer ……...……...…… cm [3]

(iii) Hence, find the perimeter of shaded part.

Answer……...…..…… cm [3]

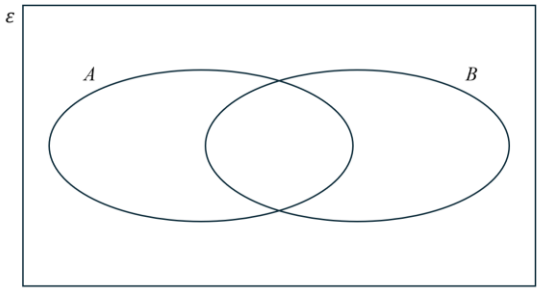
(b) A sector with radius 12 cm and an angle of 1.2 rad.

Find the perimeter of the sector.

Answer..... cm [2]

19 **(a)** On the Venn diagram in the answer space, shade the region which represents $(A \cap B)' \cap (A \cup B)$.

Answer



[1]

(b) ε = {x:x is an integer between 0 and 21}
P = {x:x is a multiple of 5}
Q = {x:x is not a prime number}

(i) List the elements contained in the set $(P \cup Q)'$.

Answer……..……. [1]

(ii) Find n$(A \cap B)$.

Answer……..……. [1]

---

20 In the figure, five numbers are shown below to form a pattern.

5, 12, 19, 26, 33

(a) **(i)** Find the sixth term in the pattern.

Answer……..……. [1]

(ii) Find the general term of the pattern.

Answer……..……. [1]

(b) Aaron says that 112 is a term in the pattern.

Is he correct? Explain your answer.

Answer ……

……..... [1]

---

21 Famous Factory produces pastries and delivers them to two outlets every day that each outlet is open. There are 3 deliveries for each day. The number of pastries supplied in a single delivery is represented by the table below.

Pastries	Outlet 1	Outlet 2
Chicken Pie	60	80
Tuna Puff	30	50
Cream Puff	80	100

(a) Represent the above information in a matrix **P**.

Answer **P** = $\begin{pmatrix} & \end{pmatrix}$ [1]

(b) Evaluate the matrix **D** = 3**P**.

Answer **D** = $\begin{pmatrix} & \end{pmatrix}$ [1]

(c) A chicken pie is sold at \$2. A tuna puff is sold at \$1.80. A cream puff is sold at \$1.40. Represent these prices in a 1 × 3 matrix **C**.

Answer **C** = ( ) [1]

(d) Evaluate the matrix **Q** = **CD**.

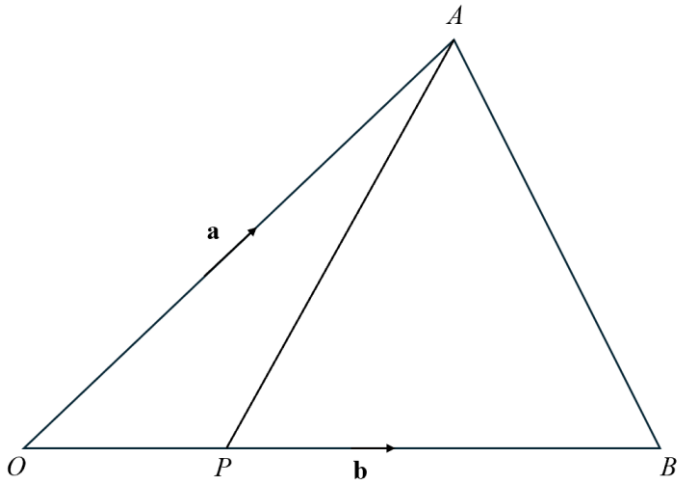
Answer **Q** = ( ) [2]

(e) State what the elements of **Q** represents.

Answer ……

……..... [1]

22 In the diagram, OAB is a triangle.
P is a point on OB such that $OP : PB = 1 : 2$.
$\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$.



(a) Express and simply the following vectors in terms of **a** and **b**.

(i) $\overrightarrow{OP}$

Answer.....[1]

(ii) $\overrightarrow{AP}$

Answer.....[1]

(iii) $\overrightarrow{AB}$

Answer.....[2]

(b) X is a point on AB.
Given that $\overrightarrow{XA} = \frac{1}{4}\mathbf{a} - \frac{1}{3}\mathbf{b}$, explain why OA // PX.

Answer

……..

……..

……..

……..... [3]

Mock Preliminary Examination 2024

NAME: _____

CLASS: _____ REGISTER NUMBER: ( )

MATHEMATICS **4048/02**

PAPER 2 **14 August 2024**

Secondary 4 Express **2 hours 30 minutes**

Additional Materials: Nil

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Write in dark blue or black pen.
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The total of the marks for this paper is 100.

Mathematical Formulae

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

Mensuration

Curve surface area of a cone = πrl

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

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

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

Statistics

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

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

Answer **all** the questions

1 **(a)** It is given that $a = \frac{2b-3c}{b}$.

(i) Find a when b = 0.5 and c = -3.

Answer……..……. [1]

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

Answer……..……. [3]

2 **(a)** Simplify $\frac{2x^2-3x-9}{2x+xy-6-3y}$.

Answer……..……. [3]

(b) Solve $\frac{3}{x-1} + \frac{4}{2x+1} = 7$.
Give your answers to 2 significant figures.

Answer……..……. [3]

(c) Solve the pair of simultaneous equations.

$$5y + 2x = 1$$
$$4x - 7y = 19$$

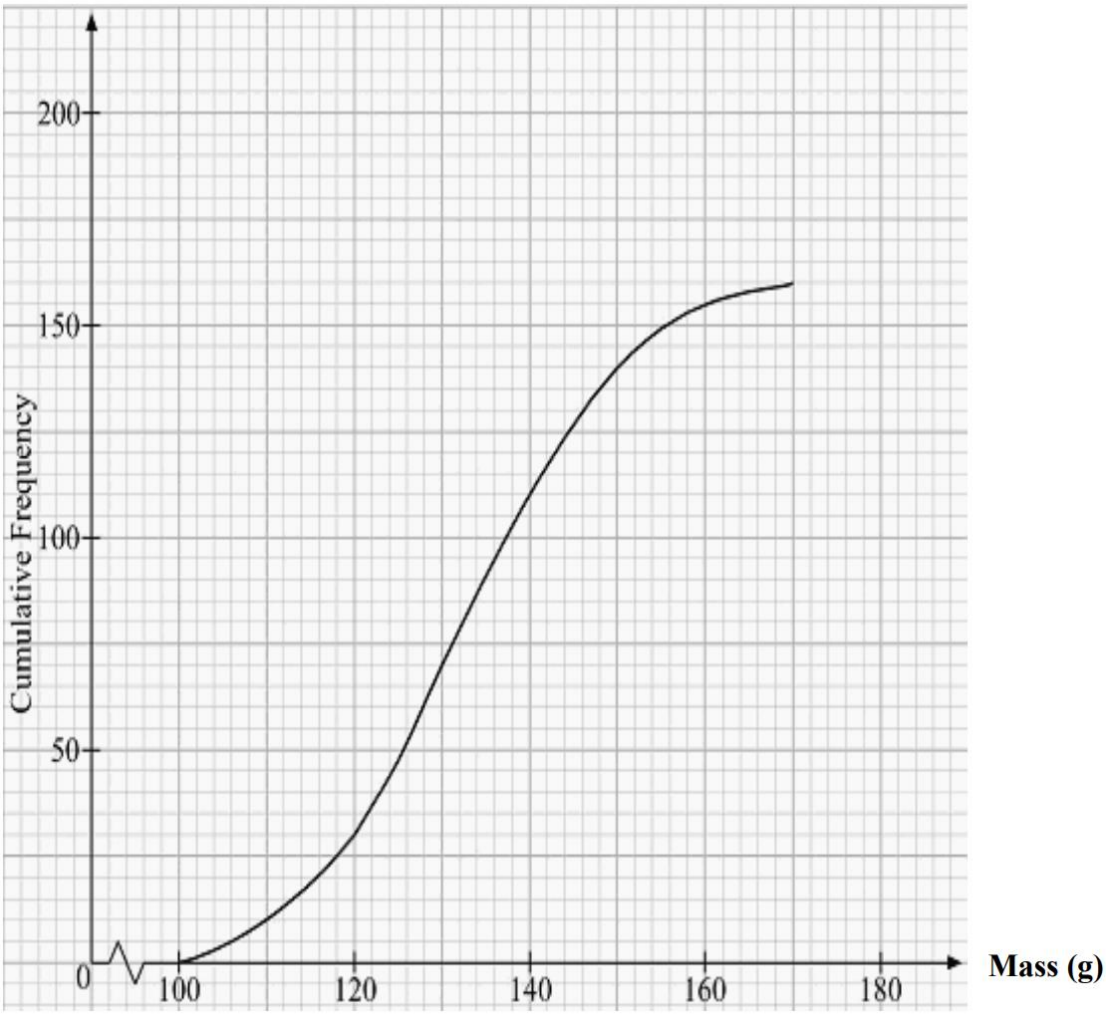
Answer x =……

y =…… [3]

(d) Simplify $(2b^2cd^3)^3$.

Answer……..……. [2]

3 The cumulative frequency curve shows the distribution of the masses of 160 chicks from Dairy Farm.



(a) From the curve, find

(i) the median mass,

Answer……..……. [1]

(ii) the interquartile range,

Answer……..……. [1]

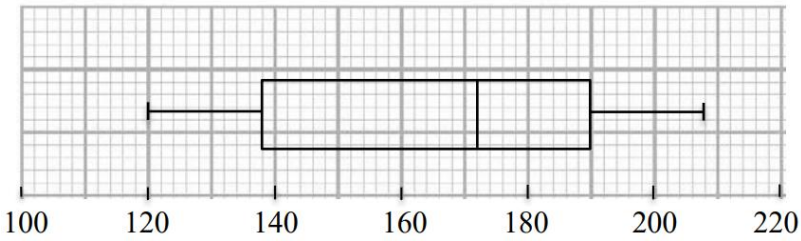
(b) Given that 62.5% of the chicks have mass of more than x g, find the value of x.

Answer……...……. [2]

(c) Chicks that have mass less than 120g are classified as malnourished. Two chicks are selected at random. Find the probability that at least 1 chick selected is malnourished.

Answer……...……. [2]

(d) The box-and-whisker plot below shows the distribution of the weight of the chicks one month later.



Make two comparisons between the distributions of the weights of the chicks in the one month.

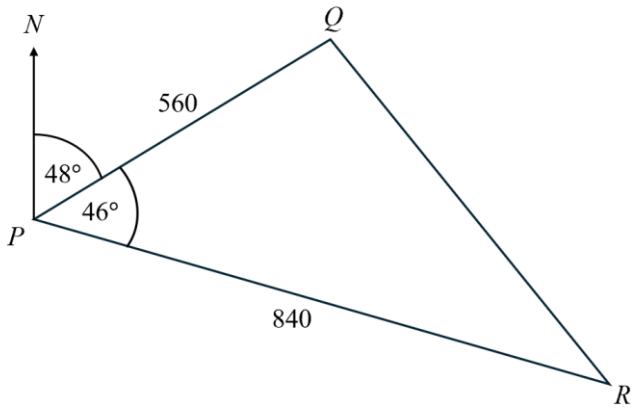
Answer …….

……..

……..

……..... [3]

4



P, *Q* and *R* lie on the ground.
P is west of *Q*.
The bearing of *Q* from *P* is 048°.
Angle *QPR* = 46°.
PQ = 560 m, *PR* = 840 m.

(a) Find the bearing of *P* from *Q*.

Answer.....……° [2]

(b) Find the area of triangle *PQR*.

Answer.....…… m^2 [2]

(c) Find distance QR.

Answer ……..……..……..… m [3]

(d) Find angle PRQ.

Answer...……...……° [3]

(e) A bird is flying vertically above point Q. The angle of elevation of the bird when viewed from a boy standing on point R is 37°. Find the vertical distance of the bird from the ground.

Answer ……..……..……..… m [2]

5 **Figure I** show a cylinder with radii $2x$ cm and height of y cm.
Figure II show a cone with height h cm and a hemisphere with radii $3x$ cm. The height of the same figure is also y cm.

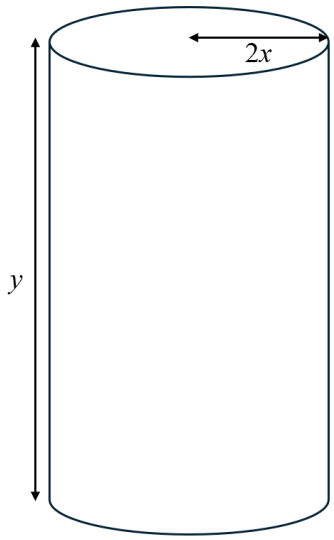


Figure I

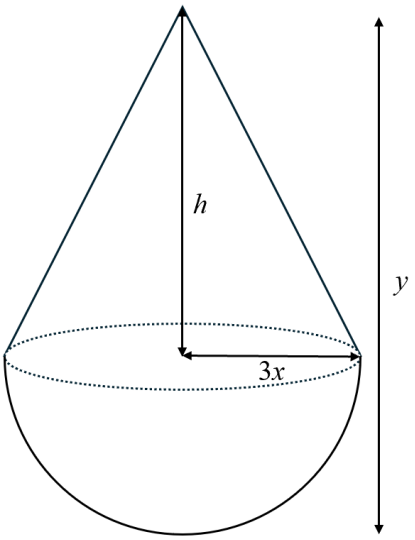


Figure II

(a) Show that $h = y - 3x$.

Answer

[1]

(b) The volume of the cylinder in **Figure I** and the composite figure in **Figure II** are the same. Express y in terms of x.

Answer y =……..……. [6]

(c) Hence, given that the radius of the cylinder is 4 cm, find the total surface area of the cylinder in **Figure I**.

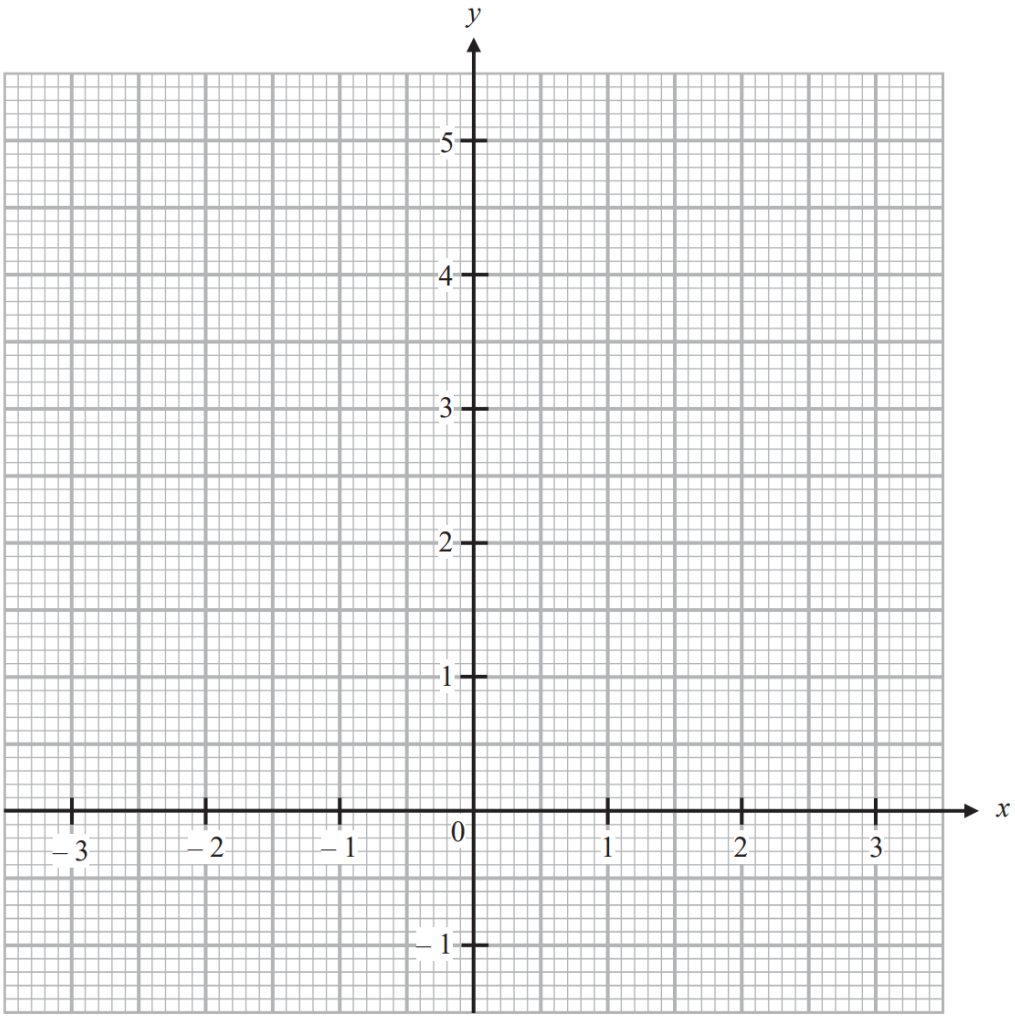
Answer..…….....….. cm^2 [4]

6 **(a)** Complete the tables values for $y = 2 + x - 0.2x^3$.

x	-3	-2	-1	0	1	2	3
y	4.4	1.6	1.2	2	2.8	2.4	

[1]

(b) On the grid, draw the graph of $y = 2 + x - 0.2x^3$ for $-3 \leq x \leq 3$. [3]



(c) The equation $2 + x - 0.2x^3 = k$ has exactly two solutions.

Use your graph to write down a possible value of k.

Answer……..…… [1]

(d) By drawing a tangent, find the gradient of the curve at (2, 2.4).

Answer……..……. [2]

(e) The points of intersection of the line $x + 4y = 5$ and the curve give the solutions of the equation $Ax^3 - Bx - 15 = 0$.

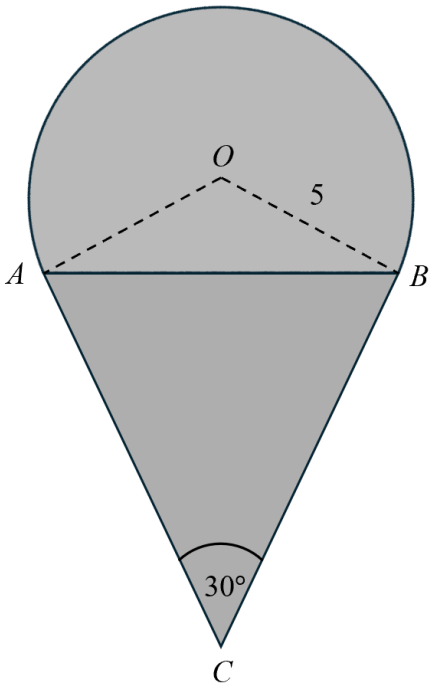
(i) Find the values of A and of B.

Answer A =……, B =……. [2]

(ii) By drawing the line $x + 4y = 5$ on the grid for $-3 \leq x \leq 3$, solve the equation $Ax^3 - Bx - 15 = 0$.

Answer x =……..……. [2]

7



The figure shows an ice cream logo.
AC and BC are tangents to the circle with centre O and meet at C.
$OB = 5$ m.
Angle $ACB = 30°$

(a) Show that triangle AOC and triangle BOC are congruent.

Answer ……

……..

……..

……..

……..... [3]

(b) **(i)** Find angle *AOB*.

Answer……° [1]

(ii) Find length *AB*.

Answer…… cm [3]

(iii) Find length *AC*.

Answer…… cm [3]

(iv) Find the perimeter of the shaded part.

Answer…… cm [4]

(v) Find the area of the shaded part.

Answer..…...…. cm^2 [4]

8 A tank with a capacity of 1000 m^3 is to be filled up with water by either pump *A* or pump *B*.

(a) **(i)** Pump *A* takes x minutes to fill up the tank with water.

How much water is filled using pump *A* in 1 minute in terms of x?

Answer.....…….. m^3 [1]

(ii) Pump *B* takes 5 minutes less than pump *A* to fill up the tank with water.

How much water is filled using pump *B* in 1 minute in terms of x?

Answer.....…….. m^3 [1]

(b) The volume of water filled by pump *B* is 150 m^3 more than when it is filled by pump *A* in 1 minute.

Form an equation, in terms of x, to represent this information and show that it simplifies to

$$3x^2 - 15x - 100 = 0.$$

[3]

(c) Solve the equation $3x^2 - 15x - 100 = 0$.
Give your solutions correct to two decimal places.

Answer x =…… or x =…… [4]

(d) Explain why one of your solutions is not acceptable.

Answer …….

…….....[1]

(e) Hence, calculate the volume of water filled by pump *B* only in 1 minute.

Answer:..……..…. m^3 [2]

9 The Singapore Cable Car system is a notable attraction in Singapore, providing both transportation and scenic views.

Singapore Cable Car

Diagram I show a simplified model of a cable car.
Diagram II show rectangle $ABCD$ and a sector with centre O.
Angle AOB = angle DOC = 44°.
All dimensions are in metres.

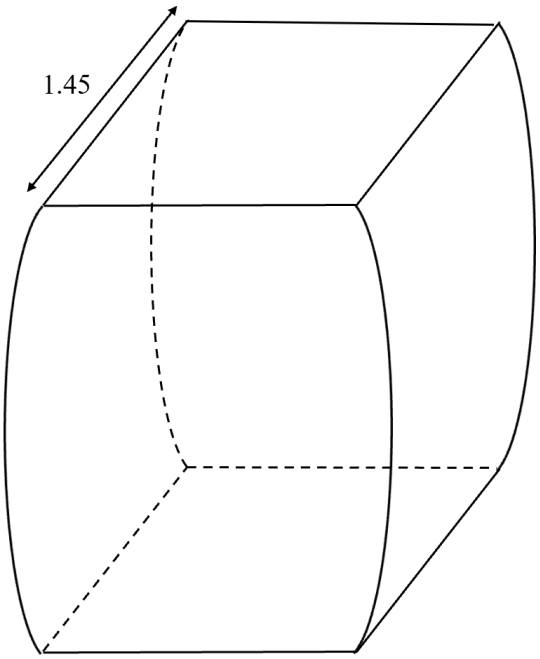


Diagram I

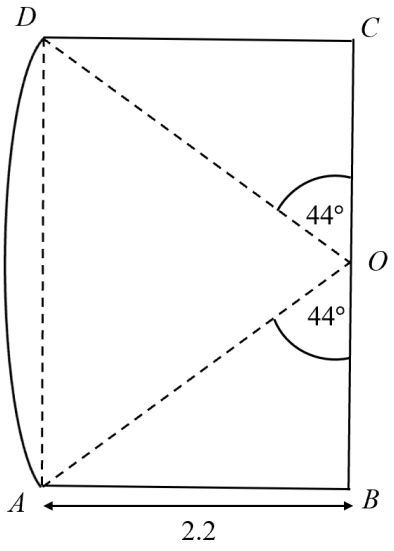


Diagram II

There are three types of cable cars that can choose from: Standard cabins, Sky Dining cabins, Crystal cabins.

Information about the three cabins:

Features	Standard Cabin	Sky Dining Cabin	Crystal Cabin
Floor type	Regular floor	Regular floor with dining setup	Glass floor
Max number of passengers	10 passengers	6 passengers	6 passengers
Max mass per person	250 kg	500 kg	417 kg
Material	Steel	Steel	Steel
Mass of cabin	2.0 tons	2.5 tons	2.15 tons

Information about the cables:

Features	Mount Faber Line	Sentosa Line
Length	1.5 km	1.5 km
Diameter	50 mm	50 mm
Mass per unit length	1.0 kg/m	1.0 kg/m
Tensile strength	1800×10^6 Pa	1800×10^6 Pa
Safety factor	6	6

Calculations:

Cross-sectional area = $\frac{1}{4} \times \pi \times$ Cable diameter
Breaking strength = Tensile strength × Cross-sectional area
Number of cabins: 10 – 15 cabins
Total weight of cabins = Weight per cabin × Number of cabins
Total weight of passengers = Weight per passenger × Number of cabins
Total weight load = (Total weight of cabins + Total weight of passengers) × 9.81
Dynamic factor: 10 % of the Total weight load
Dynamic load = Total weight load × Dynamic factor
Design load = Total weight load + Dynamic load
Design strength required = Design load × Safety factor

Conversion:

1 tonne = 1000 kg
1 cm = 10 mm

(a) **(i)** Calculate angle *AOD* in **Diagram II**.

Answer...……...……° [2]

(ii) Calculate the area of the sector *AOD* in **Diagram II**.

Answer...……..…. m^2 [2]

(iii) Hence, calculate the volume of the cable car in **Diagram I**.

Answer...……..…. m^3 [4]

(b) Mr Tan, an engineer, needed to build 10 **Sky Dining Cabins** that run both **Mount Faber Line** and **Sentosa Line**. The safety protocol states that the breaking strength must be greater than or equal to the design strength required.

Justify whether Mr Tan follows the safety protocol. Show **all** your workings. State any assumptions if necessary.

Answer …….

……..... [8]