



BENDEMEER SECONDARY SCHOOL
2024 END-OF-YEAR EXAMINATION
SECONDARY THREE EXPRESS

CANDIDATE
NAME

CLASS

INDEX
NUMBER

MATHEMATICS

Paper 1

4052/01

25 September 2024

1 hour 45 minutes

Candidates answer on the Question Paper.
No additional materials are required.

READ THESE INSTRUCTIONS FIRST

Write your name, class and register 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, highlighters, 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 number of marks for this paper is 70.

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

70

MATHEMATICAL FORMULAE

Compound Interest

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

Mensuration

$$\text{Curved surface area of cone} = \pi r l$$

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

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

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

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

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

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

Trigonometry

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

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

Statistics

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

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

Answer all the questions.

1 (a) Calculate $\frac{-2^{13}}{0.03^4 - \sqrt[5]{45}}$.

Write your answer correct to 5 significant figures.

Answer [1]

(b) Write your answer to **part (a)** in standard form.

Answer [1]

2 Simplify $\frac{4x^2 - 23x + 15}{x^3 - 25x}$.

Answer [3]

3 Find the equation of the line joining $(-3, 5)$ and $(6, -4)$.

Answer [3]

- 4 (a) Simplify the following, giving your answer in positive index notation.

(i) $\sqrt{9x^{-4}}$

Answer [2]

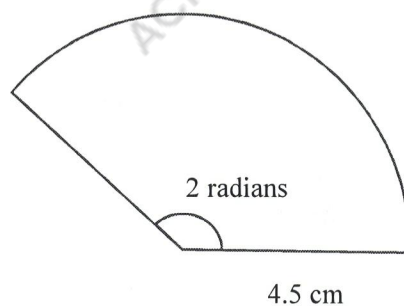
(ii) $(2y^3)^{-2} \times 5y^4$

Answer [2]

- (b) Given $\frac{4^a}{64^b} = 16^c$, find an expression for b in terms of a and c .

Answer $b =$ [3]

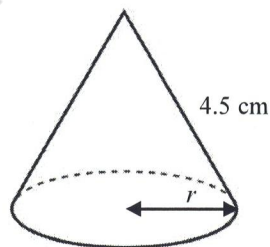
- 5 The diagram shows a sector of a circle with angle 2 radians and radius 4.5 cm.



- (a) Calculate the perimeter of the sector.

Answer cm [2]

- (b) The above sector is used to make a cone as shown in the diagram below.



Calculate the base radius of the cone, r .

Answer cm [2]

- 6 (a) Given $\sin x^\circ = 0.8491$, find two possible values of x in the range $0 \leq x \leq 180$.

Answer or [2]

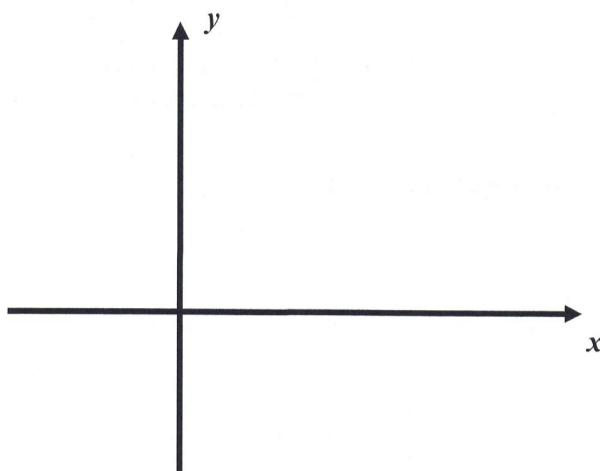
- (b) Convert 5.29 radians into degrees.

Answer [1]

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

Answer [2]

- (b) Hence, sketch the graph of $y = x^2 - 5x - 6$, clearly indicating the x -intercepts, y -intercept and turning point.



- 8 In the sequence below, each term is found by subtracting the same number from the previous term.

$a, \quad 26, \quad b, \quad c, \quad 5, \dots$

- (a) Find the values of a , b and c .

Answer $a = \dots\dots\dots$
 $b = \dots\dots\dots$
 $c = \dots\dots\dots$ [2]

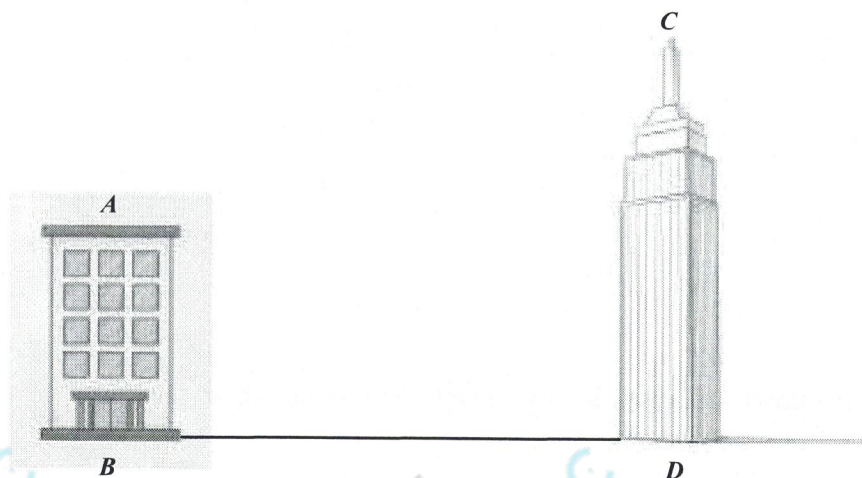
- (b) Write down an expression for the n th term of the sequence.

Answer $\dots\dots\dots$ [1]

- (c) Explain why -202 is not a term of this sequence.

$\dots\dots\dots$
 $\dots\dots\dots$
 $\dots\dots\dots$
 $\dots\dots\dots$
 $\dots\dots\dots$
 $\dots\dots\dots$ [1]

- 9 The diagram below shows a building AB and a tower CD .
 A and C are at the top while B and D are at the foot of the building and tower respectively.
The angle of depression of B from C is 72° .
The angle of elevation of C from A is 30° .
The height of tower CD is 52 m.
Calculate the height of building AB .

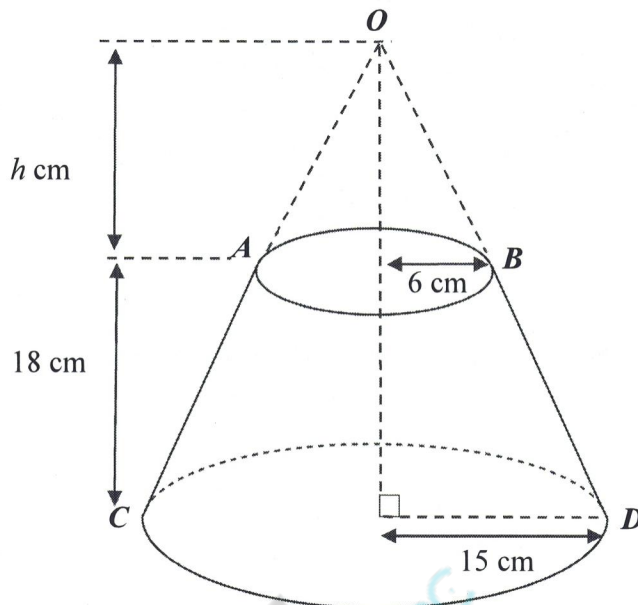


Answer m [3]

10 A glass ornament is in the shape of a frustum of a cone.

The frustum is made by removing a smaller cone OAB with a base radius 6 cm from a similar larger cone OCD that has a base radius 15 cm as shown in the diagram.

The height of the smaller cone OAB is h cm and the height of the frustum is 18 cm.



(a) Use similar triangles to find the value of h .

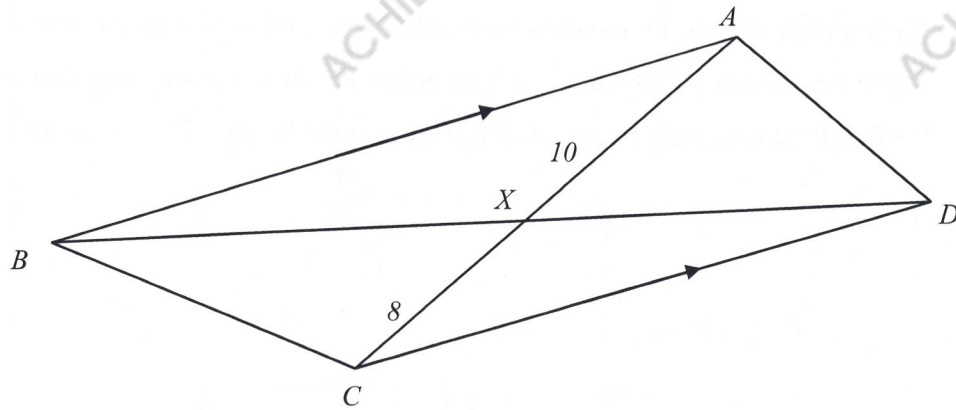
Answer [2]

(b) Given that 1 cm^3 of glass has a mass of 2.2 grams, calculate the mass of the glass ornament.

Answer g [2]

11

10



In the diagram above, $ABCD$ is a quadrilateral where BA is parallel to CD , AXC and BXD are straight lines.

- (a) Explain why triangles AXB and CXD are similar.

Answer

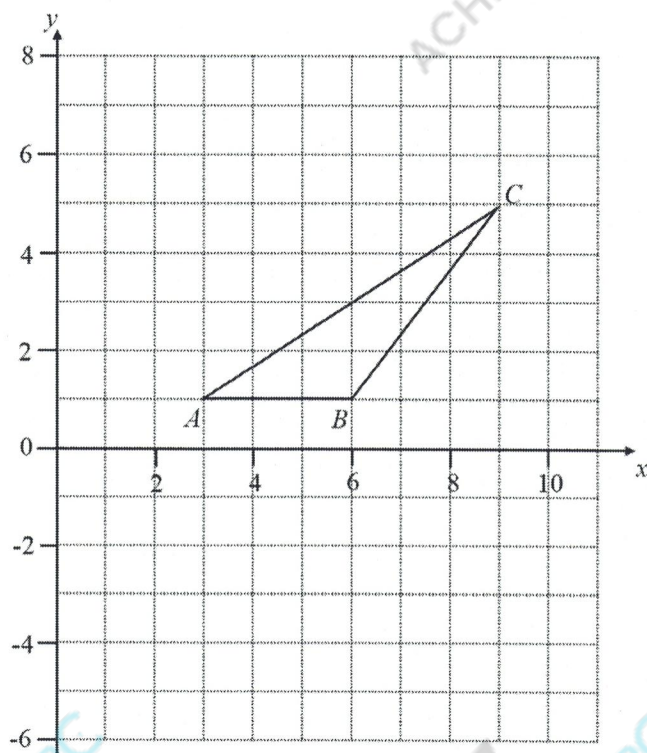
- (b) Given that $AX = 10$ cm, $CX = 8$ cm and $BD = 27$ cm, find the length of XD .

Answer cm [2]

- (c) Find the ratio of area of triangle AXB to area of triangle AXD .

Answer [1]

- 12 The figure below shows a triangle ABC with coordinates of $A(3, 1)$, $B(6, 1)$ and $C(9, 5)$.



- (a) Calculate the length of BC .

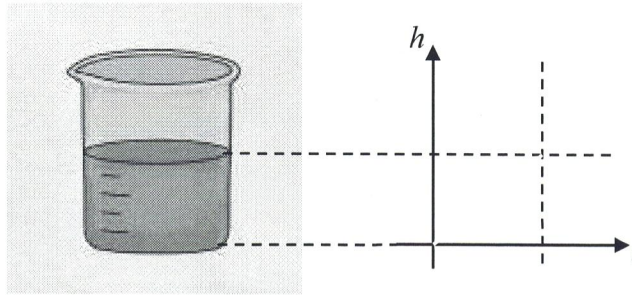
Answer units [2]

- (b) Write down the value of $\cos \angle ABC$.

Answer [1]

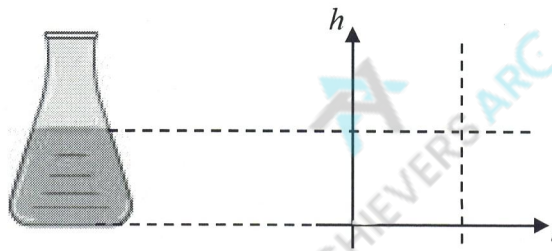
- 13 Water is being poured at a constant rate into each of these empty containers.
For each container, sketch a graph of the height of the water level (h) against time (t).

(a)



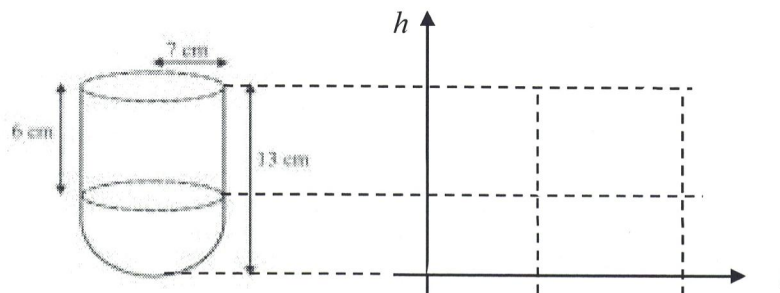
[1]

(b)



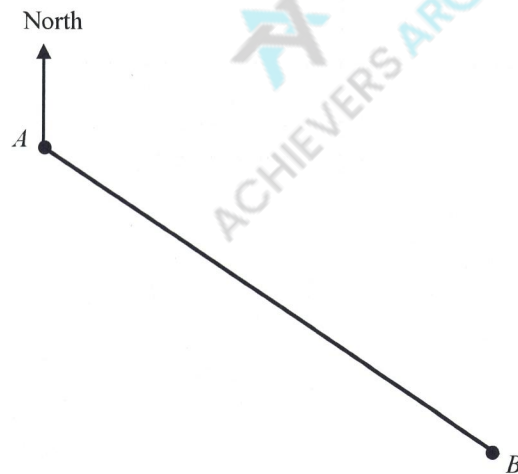
[1]

(c)



[1]

- 14 The diagram below shows a scale drawing and positions of two points A and B .



Scale: 1 cm represents 5 km

- (a) Find the bearing of A from B .

Answer [1]

- (b) The point C is 32.5 km from A and 50 km from B .

Construct the location of point C and join points A , B and C to form a triangle ABC .

[1]

- (c) Construct the perpendicular bisector of BC .

[1]

- (d) Construct the bisector of angle ABC .

[1]

- (e) A point M is located inside the triangle ABC , where M is equidistant from points B and C , and equidistant from the lines AB and BC .

Mark and label clearly the position of M . Find the distance MC in kilometres.

Answer km [1]

- 15 (a) Claudia has a memory card with a storage capacity of 145 gigabytes.
Express, in bytes, the storage capacity of the memory card.
Express your answer in standard form.
[1 gigabyte = 10^9 bytes]

Answer bytes [1]

- (b) Claudia has 2 types of documents, A and B, as tabulated below.

Document	Quantity	Size of each document
A	32	500 kilobytes
B	6	0.04 terabytes

Does the memory card have sufficient storage capacity for all of Claudia's documents? Support your answer with clear working.

[1 terabyte = 10^{12} bytes]

Answer [2]

- 16 A sum of money was invested in an account which paid 1.2 % compound interest per annum compounded monthly. After 6 months, an interest of \$ 200 was earned.
Calculate the original sum of money invested, corrected to the nearest dollar.

Answer \$ [2]

- 17 (a) Two cuboid open containers P and Q are similar in shape and the ratio of their base areas is 1: 4.
- (i) Find the ratio of the base length of P : base length of Q .

Answer [1]

- (ii) If the larger container can be fully filled with \$20.80 of ice-cream, find the cost of filling the smaller container with the same type of ice-cream.

Answer \$ [2]

- (b) Mushroom soup are sold in cylindrical cans of different sizes.

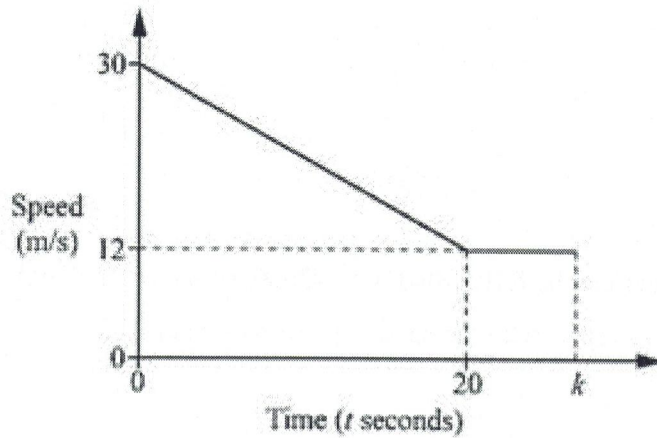
Can A has a radius $2r$ and height h while Can B has a radius $\frac{1}{2}r$ and height $6h$.

Both are sold at the same price.

Which one is a better buy? Show all your working clearly.

Answer Can A / B (circle one) is a better buy. [2]

- 18 The diagram shows the speed-time graph of a car which slows down from 30 m/s to 12 m/s in 20 seconds, and then continues at a speed of 12 m/s.



- (a) Find the retardation when $t = 10$.

Answer m/s² [1]

- (b) Find the speed of the car when $t = 15$ seconds.

Answer m/s [2]

- (c) The distance travelled by the car between $t = 20$ and $t = k$ is 60 m.
Find the value of k .

Answer $k = \dots\dots\dots$ [1]

- (d) Hence, calculate the average speed of the whole journey.

Answer $\dots\dots\dots$ m/s [2]

END OF PAPER

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**BENDEMEER SECONDARY SCHOOL
2024 END-OF-YEAR EXAMINATION
SECONDARY THREE EXPRESS**

CANDIDATE
NAME

CLASS

INDEX
NUMBER

MATHEMATICS

Paper 2

4052/02

30 September 2024

1 hour 45 minutes

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1 Given $y = \frac{9x+2}{3+x} + 1$,

(a) find the value of y when $x = -2$, and

Answer [1]

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

Answer $x =$ [3]

- 2 (a) Write as a single fraction in its simplest form $\frac{x}{x^2 - 4} - \frac{1}{x + 2}$.

Answer [2]

- (b) Solve the equation $\frac{1}{x + 2} - \frac{2}{x - 1} = 2$.

Answer $x = \dots\dots\dots$ or $x = \dots\dots\dots$ [4]

- 3 (a) The price of a particular brand of mobile phone is \$ 1200 in Singapore.

The price of the same phone in the United States is USD 880.

The exchange rate between Singapore dollars (S\$) and the US dollars (USD) is

S\$1 : USD 0.74.

Determine if it is cheaper to buy the mobile phone in Singapore or from the United States.

Answer Singapore / United States (*circle one*) [1]

- (b) The sales price of an electronic device is \$ 1426.

This sales price is 8 % less than the original selling price.

Calculate the original selling price of the electronic device.

Answer \$ [2]

- (c) The showroom price of a car was \$ 94 890.

Ms Asyiqah paid 40 % of the showroom price of a car as a deposit and the balance in

equal monthly instalments of \$ 1116 over a period of 5 years.

Calculate the total amount Ms Asyiqah paid for the car.

Answer \$ [2]

- 4 The variables x and y are connected by the equation $y = \frac{x^3}{2} - x + 6$.

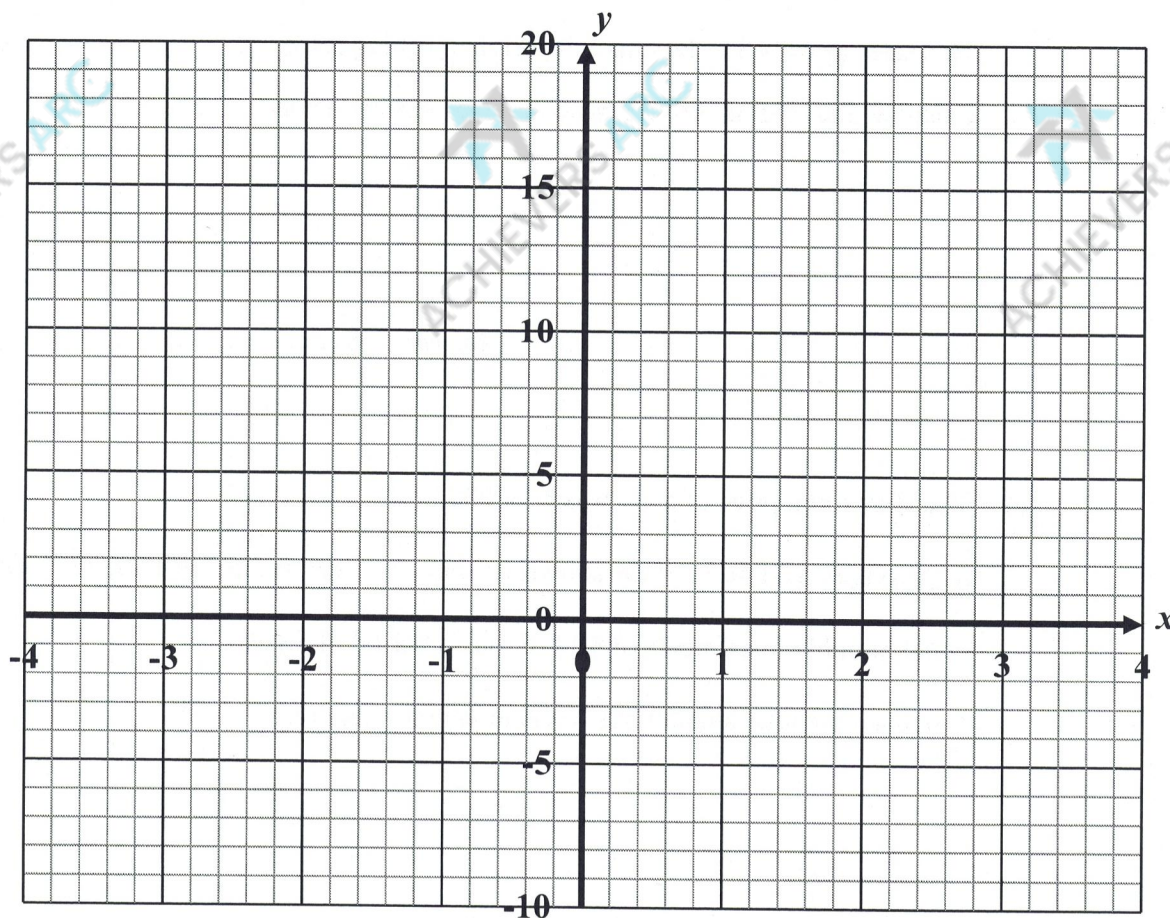
Some corresponding values of x and y are given in the following table.

x	-3	-2	-1	0	1	2	3
y	p	4	6.5	6	5.5	8	16.5

- (a) Find the value of p .

Answer $p = \dots\dots\dots$ [1]

- (b) On the grid, draw the graph of $y = \frac{x^3}{2} - x + 6$ for $-3 \leq x \leq 3$.



[2]

- (c) The equation $\frac{x^3}{2} + x - 1 = 0$ can be solved by finding the points of intersection of the straight line $y = ax + b$ and the curve $y = \frac{x^3}{2} - x + 6$.

(i) Find the values of a and b .

Answer $a = \dots\dots\dots$

$b = \dots\dots\dots$ [2]

- (ii) By drawing the line $y = ax + b$, solve the equation $\frac{x^3}{2} + x - 1 = 0$.

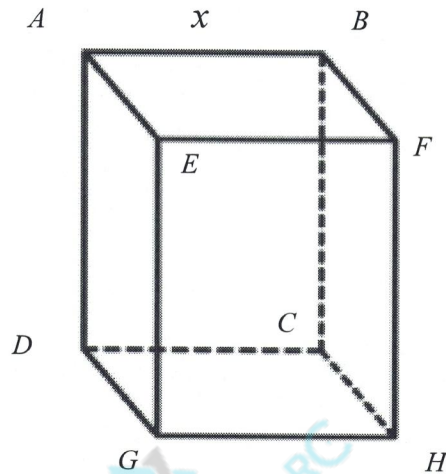
Answer $x = \dots\dots\dots$ [2]

- 5 The diagram shows a cuboid with length x cm.

The length of the cuboid is 4 cm more than the width.

Its height is 1 cm more than its length.

The length of the diagonal, GB , of the cuboid is 10 cm.



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

$$3x^2 - 6x - 83 = 0$$

Answer

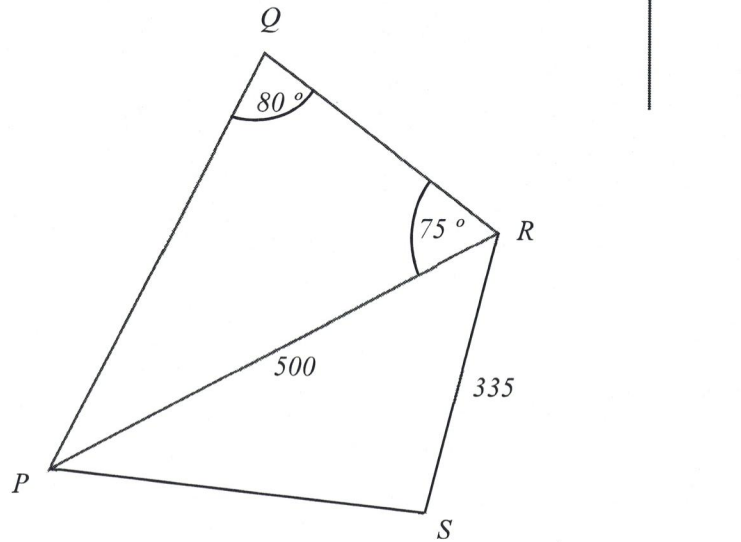
- (b) Solve the equation $3x^2 - 6x - 83 = 0$, giving your answers correct to 2 decimal places.

Answer $x = \dots\dots\dots$ or $x = \dots\dots\dots$ [3]

- (c) Calculate angle BGC .

Answer° [2]

- 6 The diagram shows the positions P , Q , R and S of four bus-stops.



The bearing of R from P is 065° and the bearing of S from R is 210° .
 $RS = 335$ m, $RP = 500$ m, angle $PQR = 80^\circ$ and angle $PRQ = 75^\circ$.

- (a) Calculate the bearing of P from Q .

Answer $^\circ$ [2]

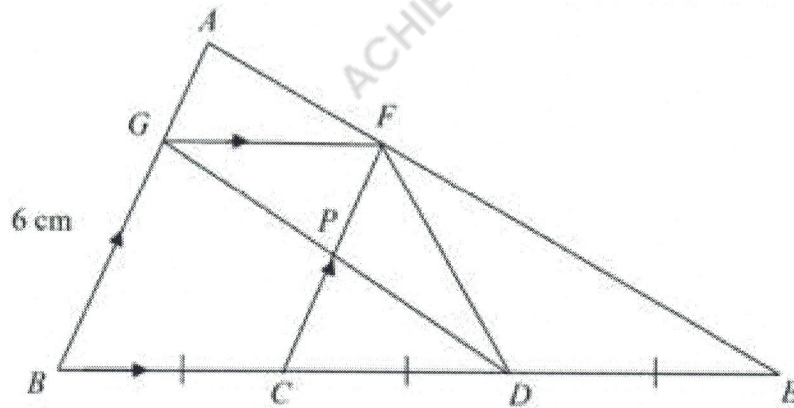
- (b) Calculate the distance of PQ .

Answer m [2]

- (c) Rachel ran round triangle PRS in 8 minutes.

Calculate her average speed in m/min.

Answer m/min [3]



In the diagram above, GF is parallel to BE and AB is parallel to FC .

Given that $BC = CD = DE$ and $GB = 6$ cm,

- (a) show that triangle PCD is congruent to triangle CFG .

Answer

- (b) (i) Name another triangle that is similar to triangle PCD .

Answer [1]

- (ii) Find the length of PC .

Answer cm [1]

- (c) Write down the value of

(i)
$$\frac{\text{area of triangle } FCD}{\text{area of triangle } FDE}$$

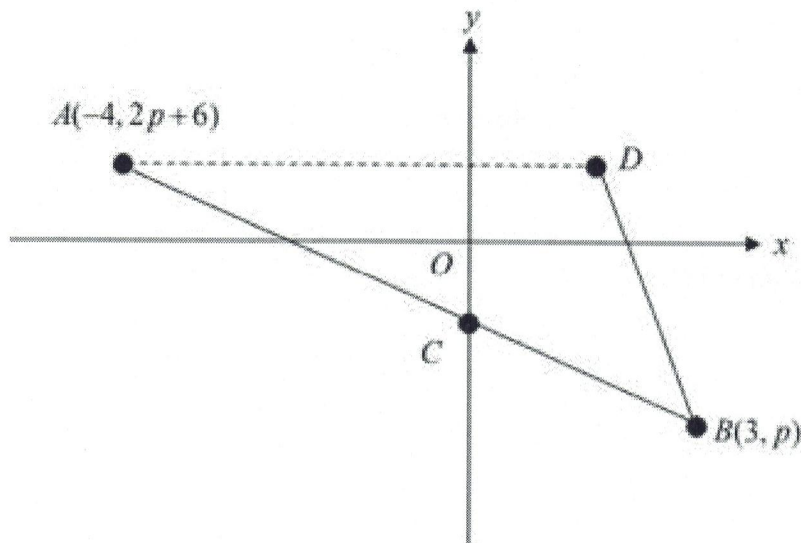
Answer [1]

(ii)
$$\frac{\text{area of triangle } FCE}{\text{area of triangle } ABE}$$

Answer [1]

- 8 In the diagram, $A(-4, 2p+6)$, $B(3, p)$ and C are points on a straight line.

C is on the y -axis and AD is horizontal.



- (a) Given that the gradient of the line AB is -0.5 , show that $p = -2.5$.

[2]

- (b) Find the length of AB .

Answer units [2]

- (c) State the equation of line AD .

Answer [1]

- (d) Given that the gradient of CD is equal to that of line $3y = 4x + 9$, show that the coordinates of $D = (1.5, 1)$.

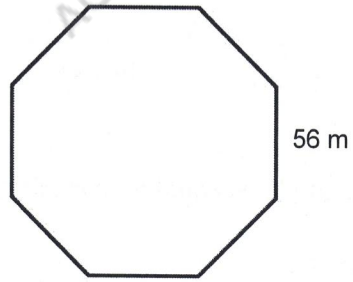
- (e) Find the area of triangle ADB .

Answer units² [2]

- (f) Hence, or otherwise, find the perpendicular distance from D to AB .

Answer units [2]

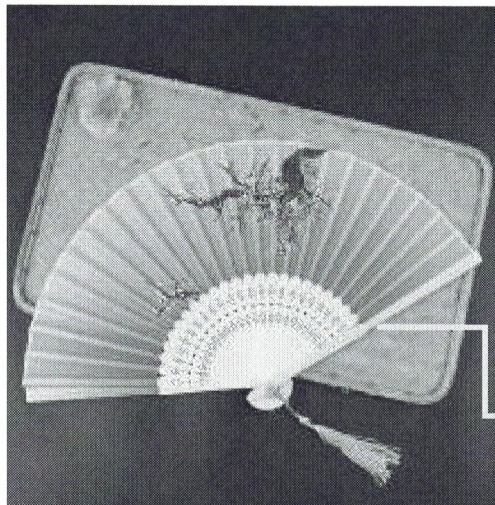
- 9 The floor of a function room is in the shape of a regular octagon with sides 56 m.



Calculate the floor area.

Answer m² [3]

- 10 The handheld fan below is made of paper with bamboo sticks.

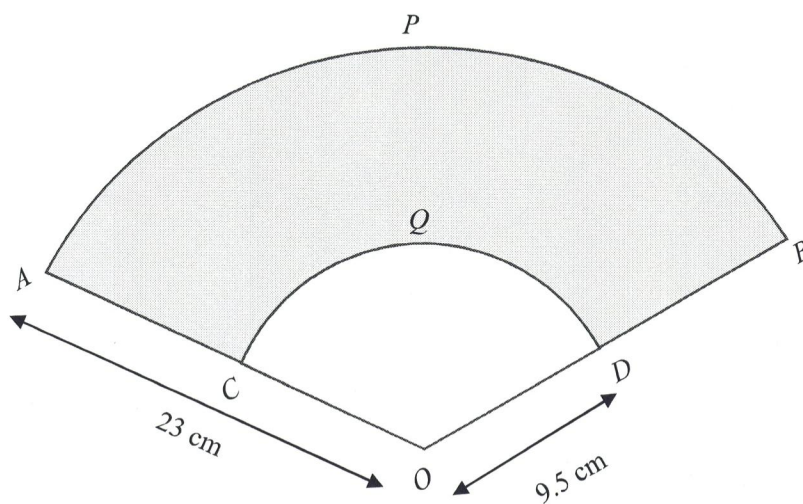


flat bamboo sticks

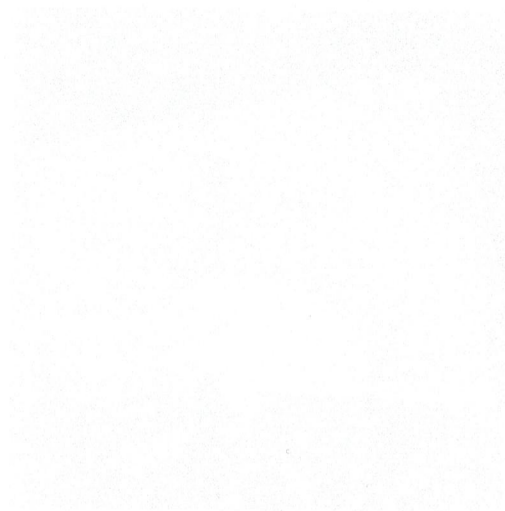
The fan is modelled after sectors of circles.

APB and CQD are arcs of circles centre O with radii 23 cm and 9.5 cm respectively.

The perimeter of $APBDQC$ is 106.5 cm.



- (a) Calculate angle COD , in degrees.



Answer ° [3]

- (b) Calculate the area of paper required to cover the region $APBDQC$.

Answer cm^2 [2]

- (c) Aisyah intends to make 59 of such identical paper fans to sell at her school's national day charity carnival. The materials needed to make a paper fan are

- 4 sheets of A4 coloured papers
- 25 flat bamboo sticks
- 1 metal ring
- a bottle of sticky glue (for making 15 fans)

The table below shows the prices of the materials needed.

	Material	Unit cost (subject to 9% GST)
1	A large pack of 50 sheets of A4 coloured papers	\$12.95
2	A small pack of 10 sheets of A4 coloured papers	\$2.75
3	A standard pack of 10 metal craft rings	\$2.40
4	A large pack of 48 flat bamboo sticks	\$7.05
5	A small pack of 12 flat bamboo sticks	\$ 1.85
6	A bottle of sticky glue	\$6.70
* GST stands for Goods and Service Tax		

Suggest a reasonable selling price, to the nearest dollar, for each fan such that a profit 105% of the total costs of the materials is earned.

Justify your decision and show your workings clearly.

Answer \$ [6]

END OF PAPER