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**MATHEMATICS****0580/43**

Paper 4 (Extended)

May/June 2023**2 hours 30 minutes**

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 130.
- The number of marks for each question or part question is shown in brackets [].

This document has **20** pages.

- 1 (a) Tomas sells a computer, a bike and a phone.

The amounts he receives are in the ratio computer : bike : phone = 14 : 17 : 9.

- (i) Calculate the amount he receives for the phone as a percentage of the total.

..... % [2]

- (ii) The total amount he receives is \$560.

Calculate how much he receives for the bike.

\$ [2]

- (iii) Tomas originally bought the bike for \$195.

He wanted to make a profit of at least 25% when he sold it.

Does Tomas make a profit of at least 25%?

You must show all your working to support your decision.

[3]

- (b) Ulla invests \$725 for 6 years in an account paying simple interest at a rate of 1.3% per year.

Calculate the total interest earned at the end of 6 years.

\$ [2]

- (c) In a sale, all prices are reduced by 24%.
Victor pays \$36.86 for a pair of shoes in the sale.

Calculate the original price of the shoes.

\$ [2]

- 2 (a)** Anna records the number of text messages she receives for 14 days.

17	15	31	38	31	22	13
18	21	27	28	21	31	29

- (i)** Complete the stem-and-leaf diagram.

1	
2	
3	

Key:

[3]

- (ii)** Find the median.

..... [1]

- (iii)** Find the mode.

..... [1]

- (iv)** Find the range.

..... [1]

- (b)** In a shop, there are 4 red and 8 grey phones.
Anna and Pete each pick one of these phones at random.

Work out the probability that they both pick a grey phone.

..... [2]

- 3 (a)** The scale drawing shows two sides, AB and BC , of a field.
The scale is 5 centimetres represents 200 metres.



Scale: 5 cm to 200 m

- (i)** Measure angle ABC .

Angle ABC = [1]

- (ii)** X is a point on BC .
 $BX = 332$ m.

Mark the point X on the diagram. [2]

- (iii)** Find the scale in the form $1 : n$.

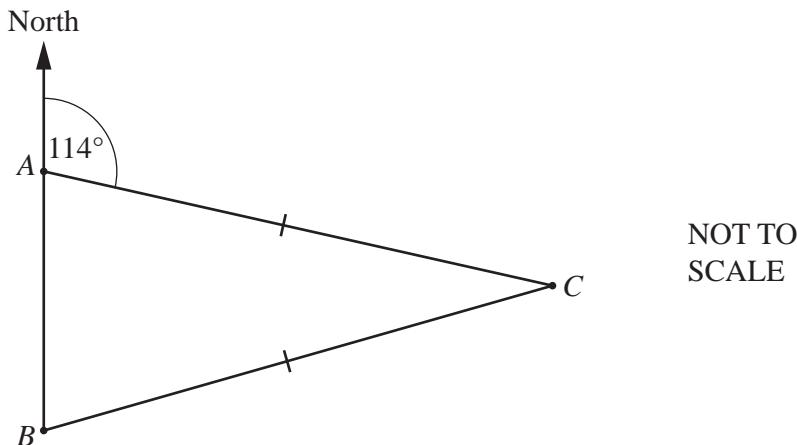
1: [2]

- (b)** A bronze statue is 4.5 m high and has a mass of 195 200 kg.
The density of bronze is 8000 kg/m^3 .
The volume of a mathematically similar model of the statue is 0.385 m^3 .

Calculate the height of the model.
[Density = Mass \div Volume]

..... m [5]

4 (a)

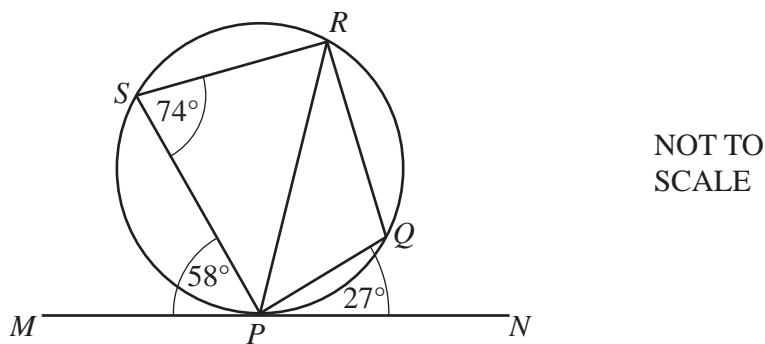


A , B and C are three towns and the bearing of C from A is 114° .
 B is due south of A and $AC = BC$.

Calculate the bearing of B from C .

..... [3]

(b)



P , Q , R and S lie on a circle.
 MPN is a tangent to the circle at P .
Angle $MPS = 58^\circ$, angle $PSR = 74^\circ$ and angle $QPN = 27^\circ$.

(i) Find angle PRS .

Angle $PRS =$ [1]

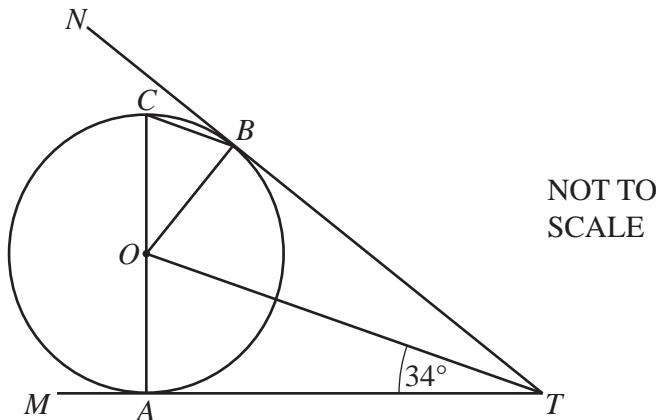
(ii) Find angle PQR .

Angle $PQR =$ [1]

(iii) Find angle RPQ .

Angle $RPQ =$ [2]

(c)



A , B and C lie on a circle, centre O , with diameter AC .
 TAM and TBN are tangents to the circle and angle $ATO = 34^\circ$.

Using values and geometrical reasons, complete these statements to show that CB is parallel to OT .

In triangles AOT and BOT , OT is common.

Angle $OAT = \text{angle } OBT = 90^\circ$ because

.....

$AT = BT$ because

.....

Triangle AOT is congruent to triangle BOT because of congruence criterion

Angle $AOT = \text{angle } BOT = 56^\circ$ because angles in a triangle add up to 180° .

Angle $BOC = \dots^\circ$ because

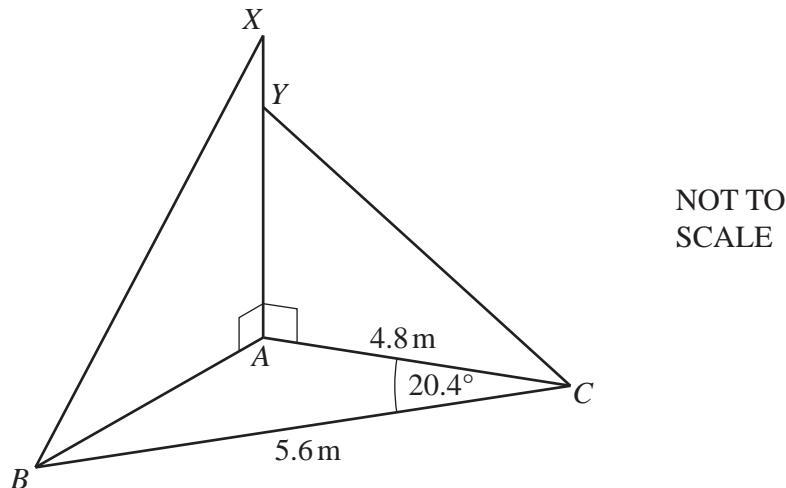
Angle $OBC = \dots^\circ$ because

.....

CB is parallel to OT because

[6]

5 (a)



ABC is a scalene triangle on horizontal ground.

AYX is a straight vertical post, held in place by two straight wires XB and YC .
 $AC = 4.8 \text{ m}$, $BC = 5.6 \text{ m}$ and angle $ACB = 20.4^\circ$.

(i) Calculate AB .

$$AB = \dots \text{ m} \quad [3]$$

(ii) Angle $XBA = 64^\circ$.

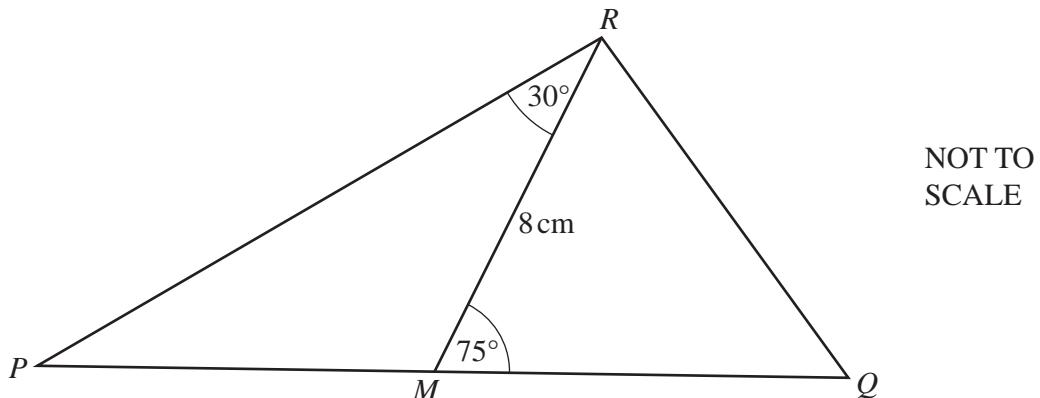
Calculate AX .

$$AX = \dots \text{ m} \quad [2]$$

(iii) $AY = 2.9 \text{ m}$.

Calculate the area of triangle YAC .

$$\dots \text{ m}^2 \quad [2]$$

(b)


In triangle PQR , M is the midpoint of PQ .
 $RM = 8\text{ cm}$, angle $PRM = 30^\circ$ and angle $RMQ = 75^\circ$.

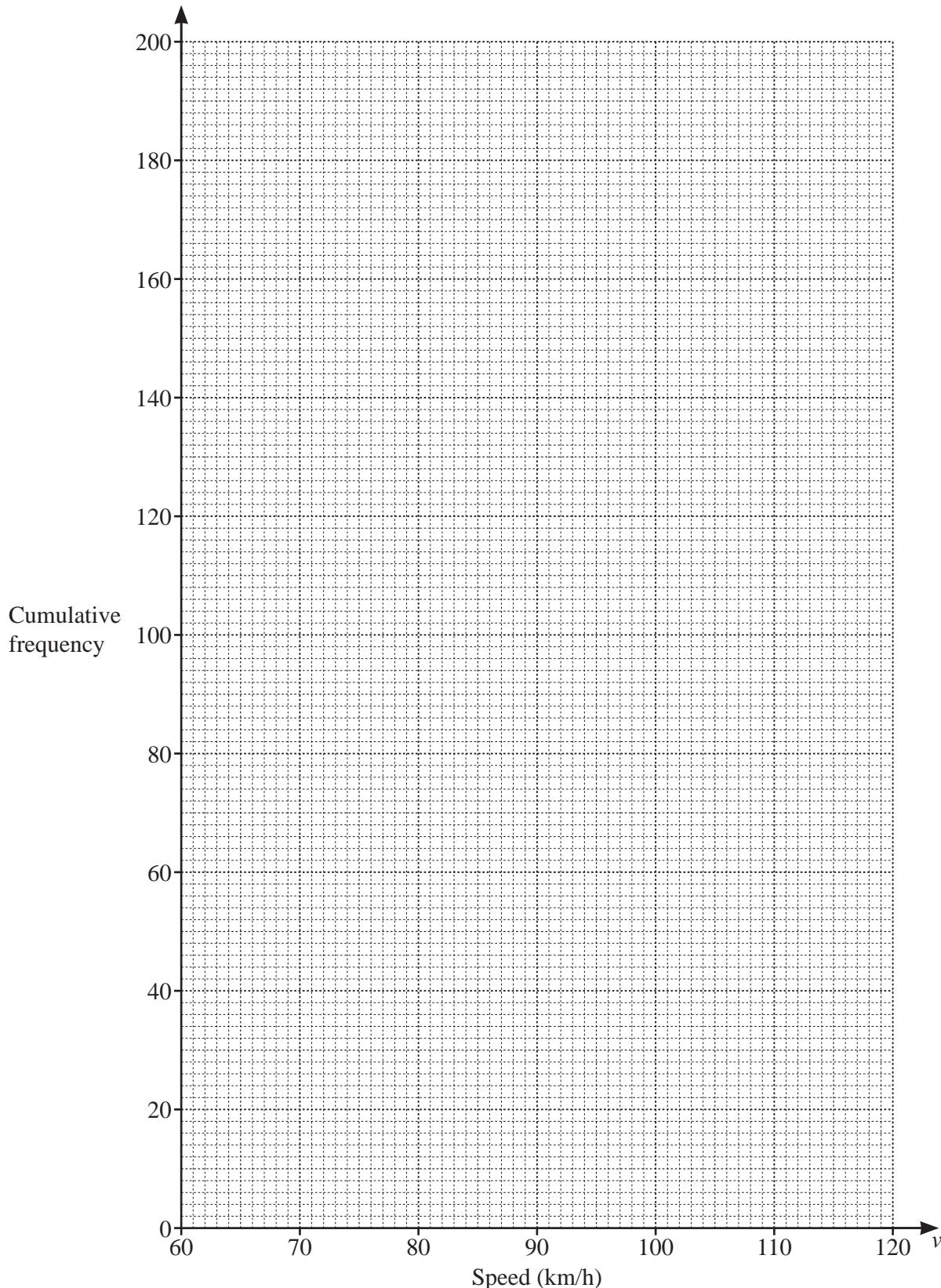
Calculate PQ .

$$PQ = \dots \text{ cm} \quad [5]$$

- 6 (a)** The cumulative frequency table shows information about the speed of each of 200 cars as they pass a speed camera.

Speed (v km/h)	$v \leq 70$	$v \leq 80$	$v \leq 90$	$v \leq 95$	$v \leq 100$	$v \leq 120$
Cumulative frequency	12	46	115	155	177	200

- (i)** On the grid, draw the cumulative frequency diagram.



[3]

(ii) Use your cumulative frequency diagram to find an estimate of

(a) the median

..... km/h [1]

(b) the interquartile range

..... km/h [2]

(c) the number of cars with a speed greater than 110 km/h.

..... [2]

(b) The frequency table shows information about the mass of each of 50 trucks.

Mass (m kg)	$2000 < m \leq 2600$	$2600 < m \leq 3500$	$3500 < m \leq 5000$	$5000 < m \leq 5700$
Frequency	12	15	16	7

(i) Calculate an estimate for the mean mass of the trucks.

..... kg [4]

(ii) In a histogram showing this information, the height of the first block is 6 cm.

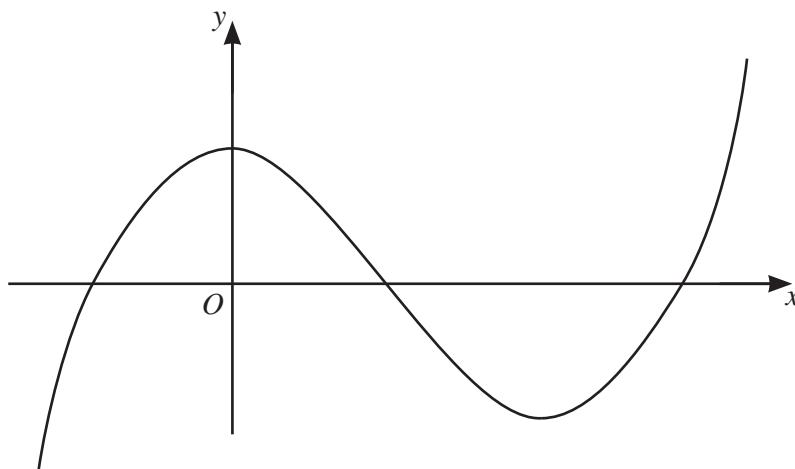
Calculate the heights of the remaining three blocks.

Height of block for $2600 < m \leq 3500$ cm

Height of block for $3500 < m \leq 5000$ cm

Height of block for $5000 < m \leq 5700$ cm [3]

- 7 (a)** The diagram shows the graph of a function.



Put a ring around the word which correctly identifies the type of function.

reciprocal

quadratic

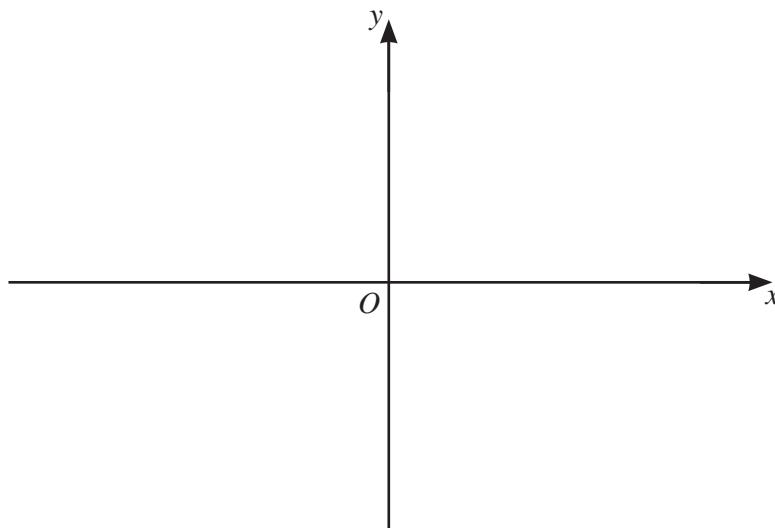
cubic

exponential

linear

[1]

- (b) (i)**



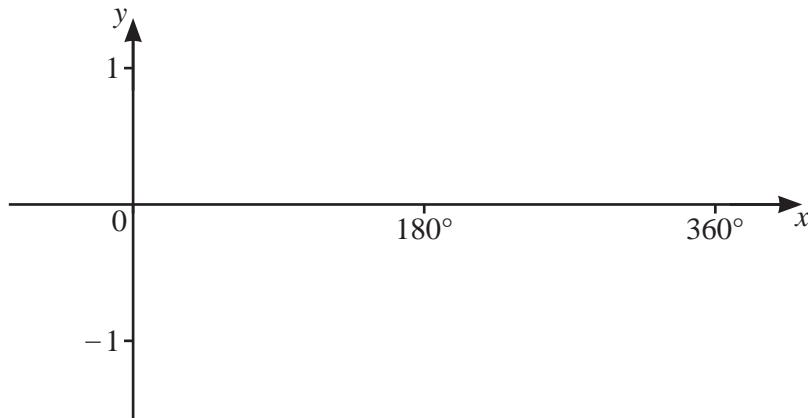
On the diagram, sketch the graph of $y = \frac{1}{2x}$, $x \neq 0$.

[2]

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

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

(c) (i)



On the diagram, sketch the graph of $y = \sin x$ for $0^\circ \leq x \leq 360^\circ$.

[2]

(ii) Solve the equation $3 \sin x + 1 = 0$ for $0^\circ \leq x \leq 360^\circ$.

$x = \dots$ and $x = \dots$ [3]

- 8 (a) A shop sells shirts for \$ x and jackets for \$(x + 27).
The shop sells 4 shirts and 3 jackets for a total of \$194.75.

Write down and solve an equation to find the cost of one shirt.

\$ [3]

- (b) Solve the simultaneous equations.
You must show all your working.

$$\begin{aligned}x^2 + 4y &= 37 \\5x + y &= -8\end{aligned}$$

$$x = \dots, y = \dots$$

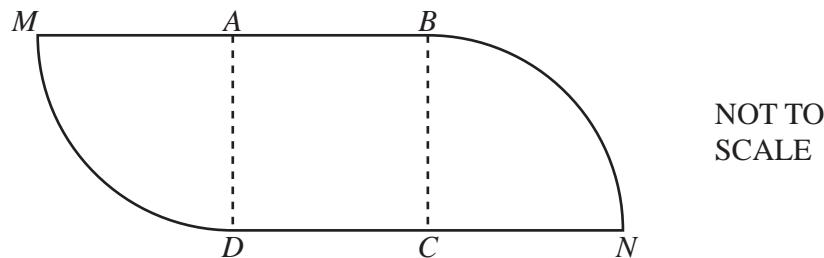
$$x = \dots, y = \dots [5]$$

- (c) A solid cylinder has radius x and height $6x$.
A sphere of radius r has the same surface area as the total surface area of the cylinder.

Show that $r^2 = \frac{7}{2}x^2$.

[The surface area, A , of a sphere with radius r is $A = 4\pi r^2$.]

[4]

9 (a)


The diagram shows a shape made from a square $ABCD$ and two equal sectors of a circle.

The square has side 11 cm.

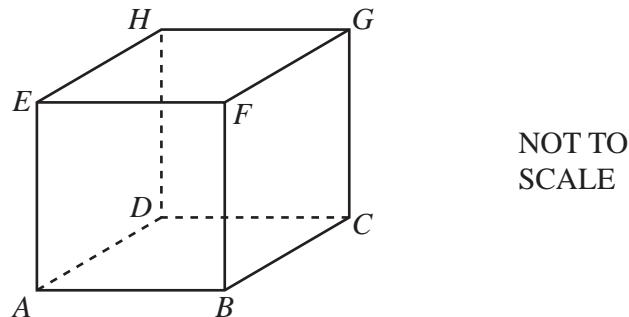
MAB and DCN are straight lines.

- (i) Calculate the area of the shape.

..... cm^2 [3]

- (ii) Calculate the perimeter of the shape.

..... cm [3]

(b)


The diagram shows a cube $ABCDEFGH$ of edge 7 cm.

Calculate the angle between AG and the base of the cube.

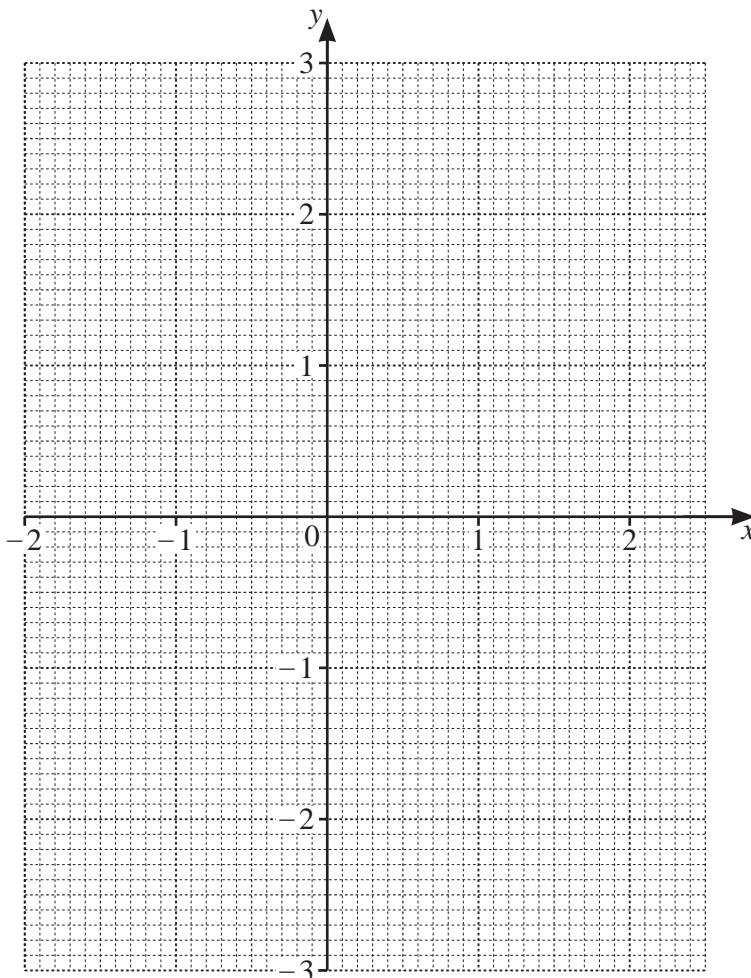
..... [4]

- 10 The table shows some values for $y = 2^x - 3$.

x	-2	-1	0	0.5	1	1.5	2	2.5
y	-2.75			-1.58		-0.17	1	2.66

(a) Complete the table. [3]

(b) On the grid, draw the graph of $y = 2^x - 3$ for $-2 \leq x \leq 2.5$.



[4]

(c) Use your graph to solve the equation $2^x - 3 = 2$.

$$x = \dots \quad [1]$$

(d) By drawing a suitable straight line, solve the equation $2^x - x - 1.5 = 0$.

$$x = \dots \text{ or } x = \dots \quad [4]$$

11 M has coordinates $(4, 1)$ and N has coordinates $(-2, -7)$.

- (a) Find the length of MN .

..... [3]

- (b) Find the gradient of MN .

..... [2]

- (c) Find the equation of the perpendicular bisector of MN .

..... [4]

Question 12 is printed on the next page.

12 The equation of a curve is $y = x^4 - 8x^2 + 5$.

- (a) Find the derivative, $\left(\frac{dy}{dx}\right)$, of $y = x^4 - 8x^2 + 5$.

..... [2]

- (b) Find the coordinates of the three turning points.
You must show all your working.

(.....,) and (.....,) and (.....,) [4]

- (c) Determine which one of these turning points is a maximum.
Justify your answer.

[2]

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