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6642892723

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.

DC (LK/SG) 312592/3

[Turn over

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.

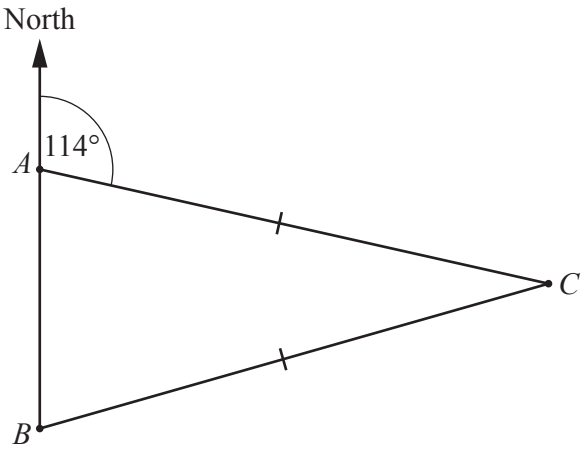
1: ..... [2]

(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 ÷ Volume]

..... m [5]

4 **(a)**



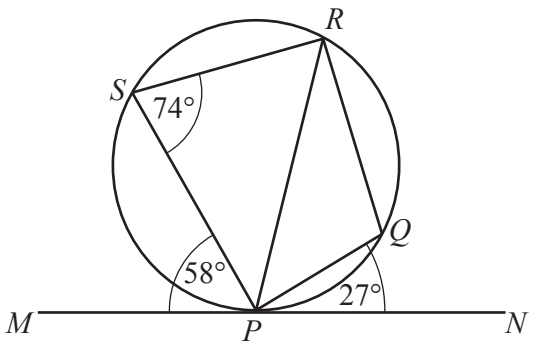
NOT TO SCALE

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)



NOT TO SCALE

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

(i) Find angle PRS.

Angle PRS = ... [1]

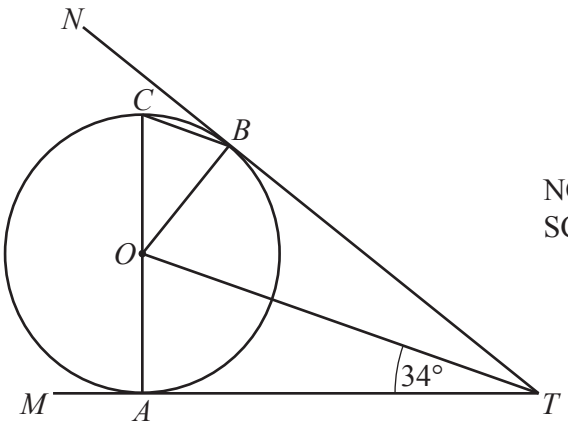
(ii) Find angle PQR.

Angle PQR = ... [1]

(iii) Find angle RPQ.

Angle RPQ = ... [2]

(c)



NOT TO SCALE

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

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 = angle $OBT = 90°$ because .....

.....

$AT = BT$ because .....

.....

Triangle AOT is congruent to triangle BOT because of congruence criterion .....

Angle AOT = angle BOT = $56°$ because angles in a triangle add up to 180°.

Angle BOC = ... ° because .....

Angle OBC = ... ° because .....

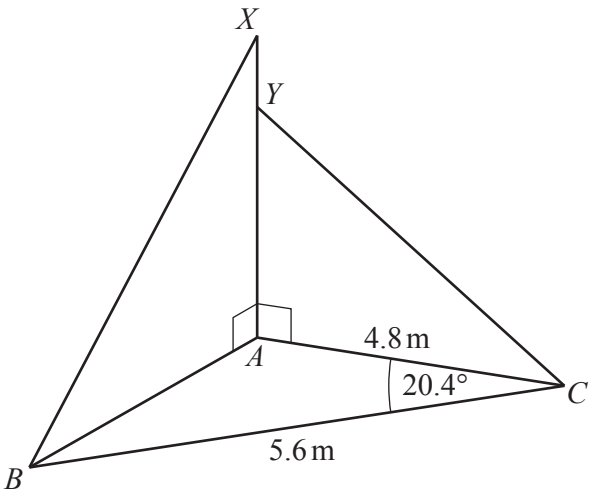
.....

CB is parallel to OT because .....

[6]

[Turn over

5 (a)



NOT TO SCALE

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 m, *BC* = 5.6 m and angle *ACB* = 20.4°.

(i) Calculate *AB*.

AB = ... m [3]

(ii) Angle *XBA* = 64°.

Calculate *AX*.

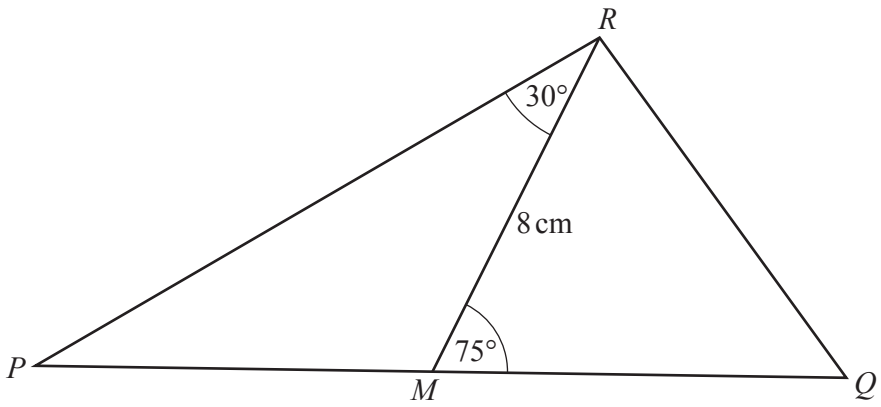
AX = ... m [2]

(iii) *AY* = 2.9 m.

Calculate the area of triangle *YAC*.

..... m^2 [2]

(b)



NOT TO SCALE

In triangle PQR, M is the midpoint of PQ.
$RM = 8$ cm, angle $PRM = 30°$ and angle $RMQ = 75°$.

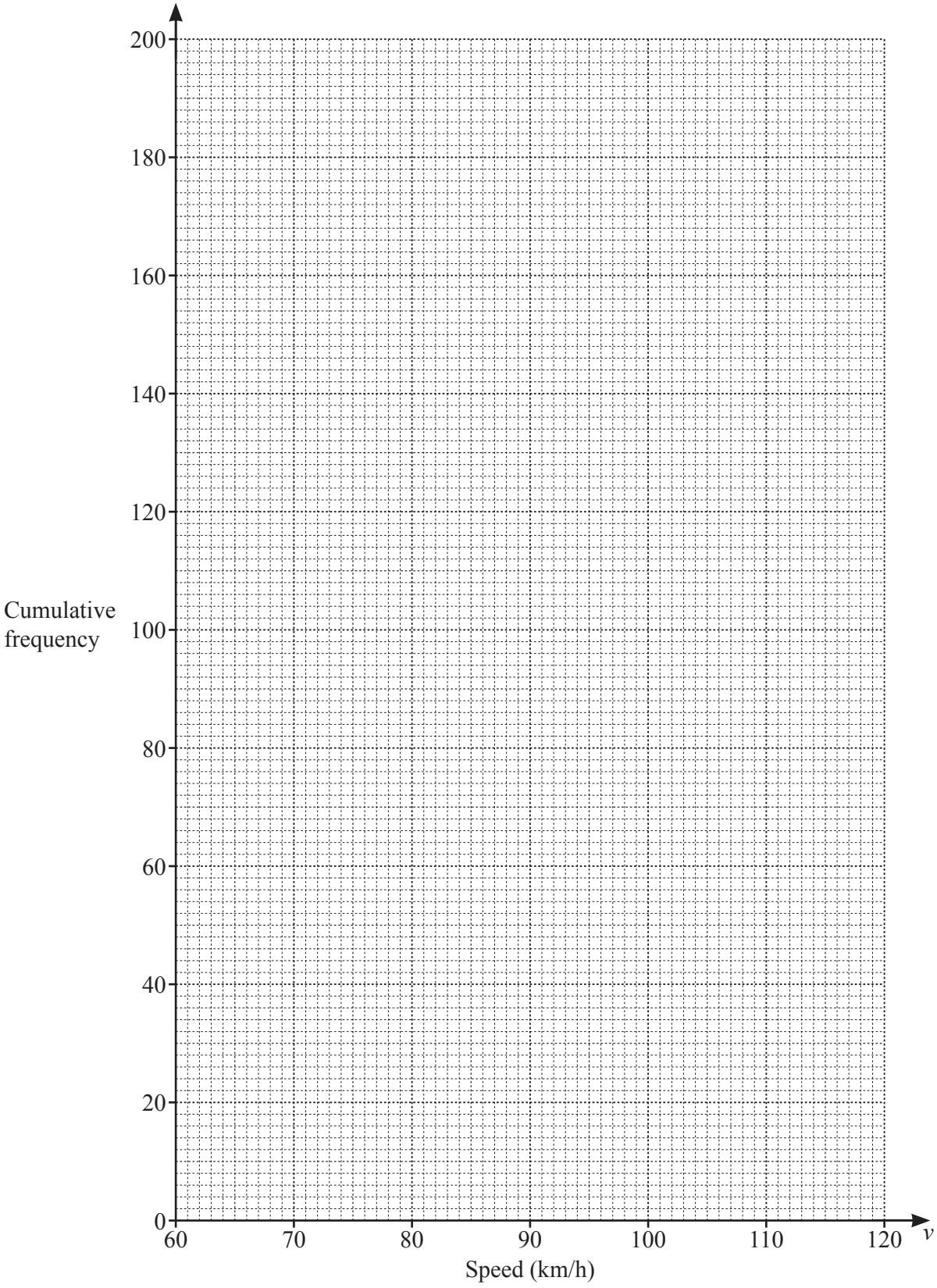
Calculate PQ.

$PQ =$ ..... cm [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)	$v \leqslant 70$	$v \leqslant 80$	$v \leqslant 90$	$v \leqslant 95$	$v \leqslant 100$	$v \leqslant 120$
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)	$2000 < m \leqslant 2600$	$2600 < m \leqslant 3500$	$3500 < m \leqslant 5000$	$5000 < m \leqslant 5700$
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.

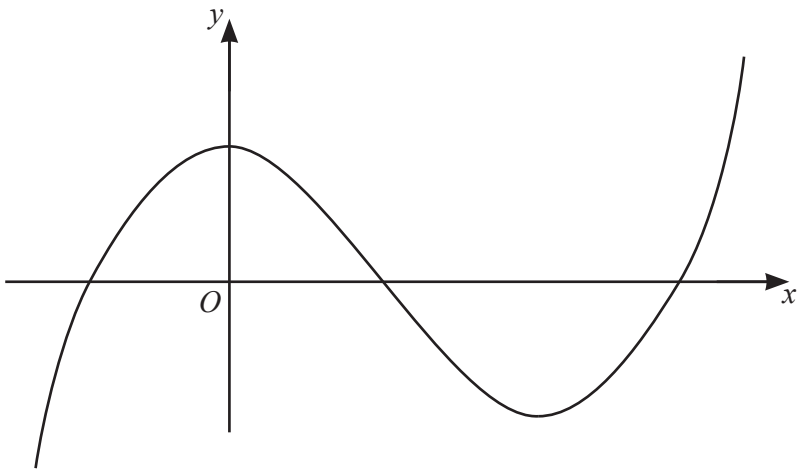
Height of block for $2600 < m \leqslant 3500$ ..... cm

Height of block for $3500 < m \leqslant 5000$ ..... cm

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

[Turn over

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

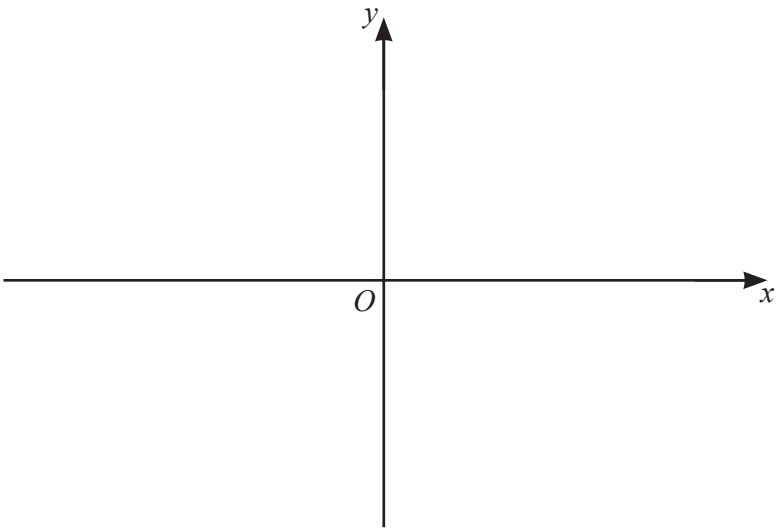


Put a ring around the word which correctly identifies the type of function.

reciprocal quadratic cubic exponential linear

[1]

(b) (i)

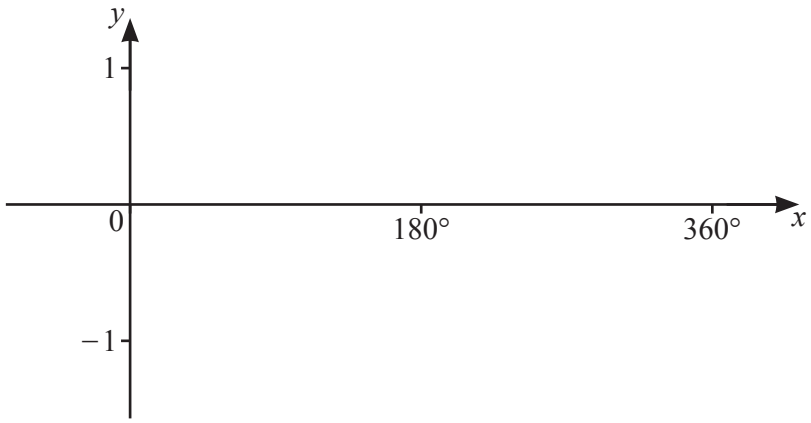


On the diagram, sketch the graph of $y = \frac{1}{2x}$, $x \neq 0$. [2]

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

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

(c) (i)



On the diagram, sketch the graph of $y = \sin x$ for $0° \leqslant x \leqslant 360°$. [2]

(ii) Solve the equation $3\sin x + 1 = 0$ for $0° \leqslant x \leqslant 360°$.

$x =$ ..... and $x =$ ..... [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.

$$x^2 + 4y = 37$$
$$5x + y = -8$$

$x =$ ..... , $y =$ .....

$x =$ ..... , $y =$ ..... [5]

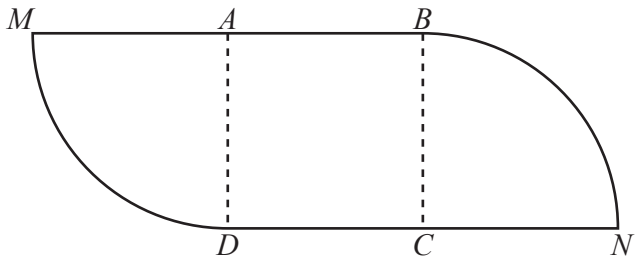
(c) A solid cylinder has radius x and height $6x$.
A sphere of radius r has the same surface area as the total surface area of the cylinder.

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)



NOT TO SCALE

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.

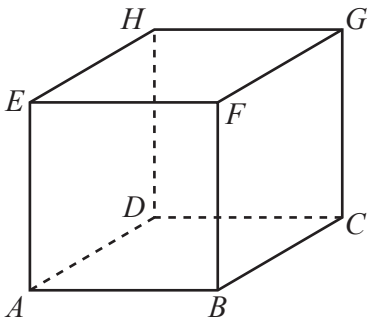
(i) Calculate the area of the shape.

..... cm^2 [3]

(ii) Calculate the perimeter of the shape.

..... cm [3]

(b)



NOT TO SCALE

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

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

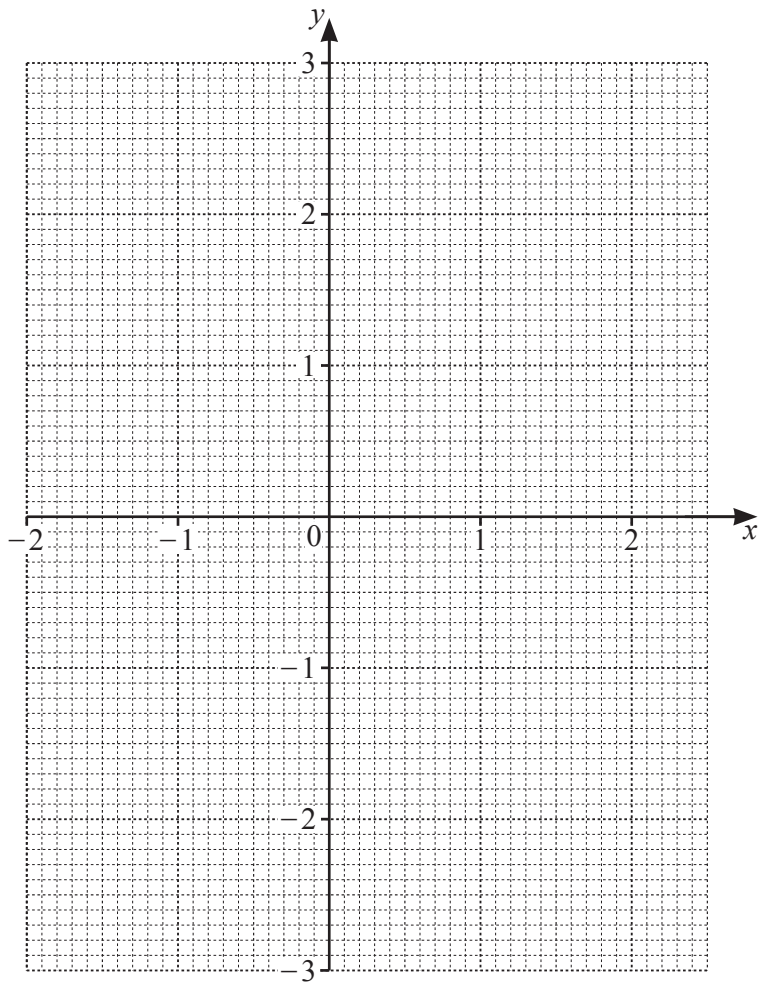
..... [4]

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 $-2 \leqslant x \leqslant 2.5$.



[4]

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

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

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

$x =$ ..... or $x =$ ..... [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]