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MATHEMATICS

0580/41

Paper 4 (Extended)

October/November 2021

2 hours 30 minutes

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

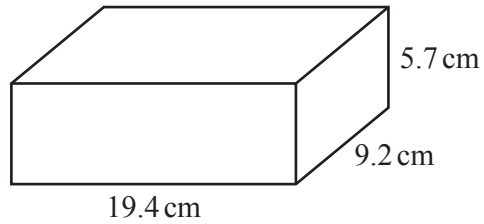
- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction 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. Any blank pages are indicated.

1 (a)

NOT TO
SCALE

The diagram shows a brick in the shape of a cuboid.

(i) Calculate the total surface area of the brick.

..... cm^2 [3]

(ii) The density of the brick is 1.9 g/cm^3 .

Work out the mass of the brick.
Give your answer in kilograms.
[Density = mass $\div$ volume]

..... kg [3]

(b) 9000 bricks are needed to build a house.
200 bricks cost \$175.

Work out the cost of the bricks needed to build 5 houses.

\$ [3]

- (c) Saskia builds a wall using 1500 bricks.
She can build at the rate of 40 bricks each hour.
She works for 9 hours each day.
Saskia starts work on 6 July and works every day until the wall is completed.

Find the date when she completes the wall.

..... [3]

- (d) Rafa has a cylindrical tank.
The cylinder has a height of 105 cm and a diameter of 45 cm.

Calculate the capacity of the tank in litres.

..... litres [3]

2 Bob, Chao and Mei take part in a run for charity.

(a) Their times to complete the run are in the ratio Bob : Chao : Mei = 4 : 5 : 7.

(i) Find Chao's time as a percentage of Mei's time.

..... % [1]

(ii) Bob's time for the run is 55 minutes 40 seconds.

Find Mei's time for the run.

Give your answer in minutes and seconds.

..... min s [3]

(b) Chao collects \$47.50 for charity.

(i) Bob collects 28% more than Chao.

Find the amount Bob collects.

\$ [2]

(ii) Chao collects 60% less than Mei.

Find how much more money Mei collects than Chao.

\$ [3]

- (c) When running, Chao has a stride length of 70 cm, correct to the nearest 5 cm.
Chao runs a distance of 11.2 km, correct to the nearest 0.1 km.

Work out the minimum number of strides that Chao could take to complete this distance.

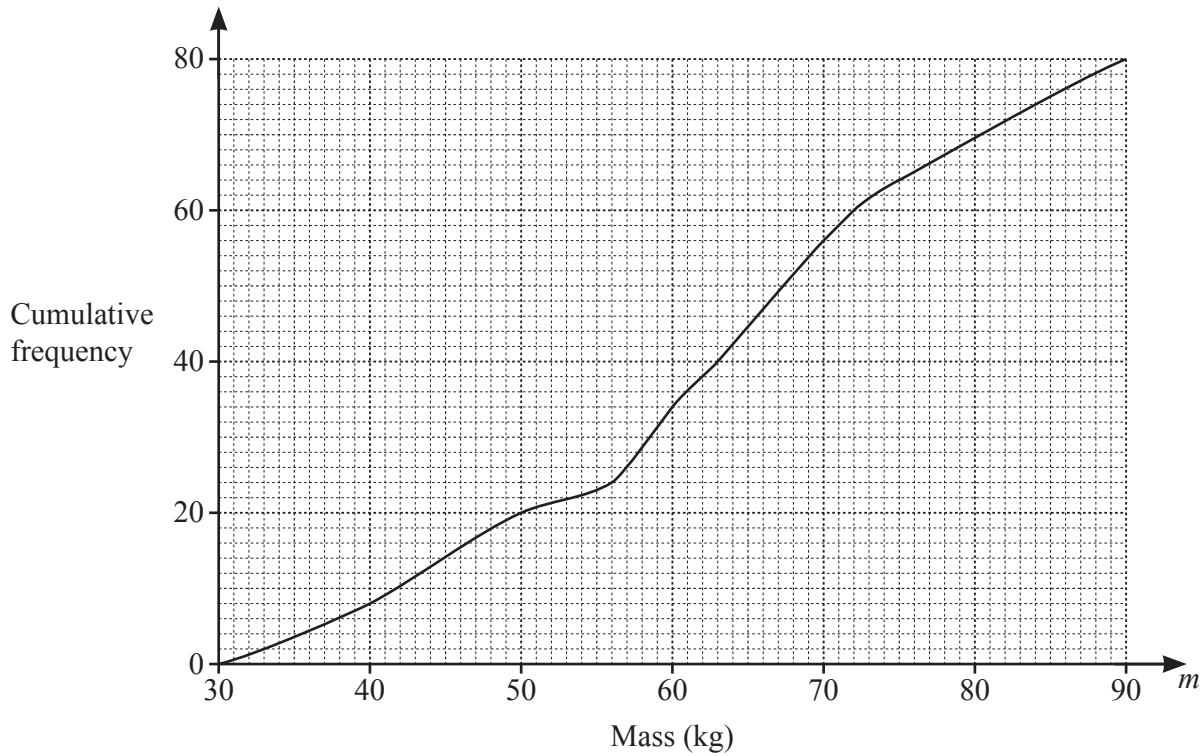
..... [4]

- (d) In 2015, a charity raised a total of \$1.6 million.
After 2015, this amount increased exponentially by 2.4% each year for the next 5 years.

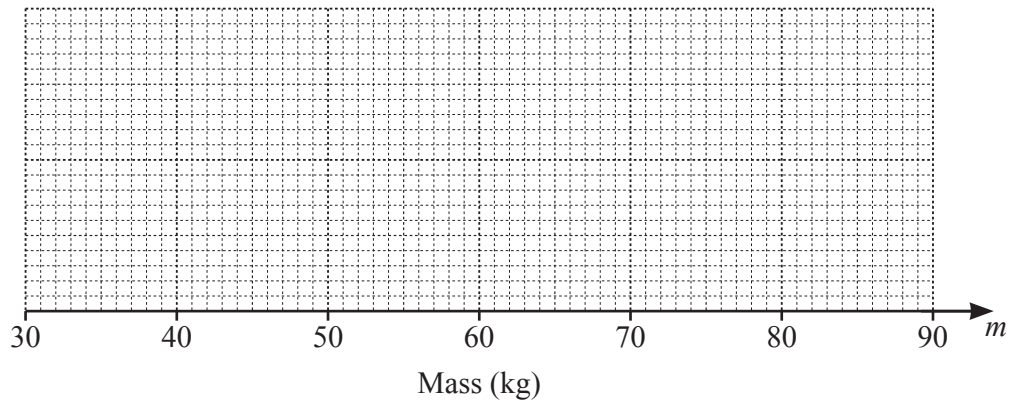
Work out the amount raised by the charity in 2020.

\$ million [2]

- 3 The cumulative frequency diagram shows information about the mass, m kg, of each of 80 boys.



(a)



On the grid, draw a box-and-whisker plot to show the information in the cumulative frequency diagram. [4]

- (b) Use the cumulative frequency diagram to find an estimate of

(i) the 30th percentile,

..... kg [2]

(ii) the number of boys with a mass greater than 75 kg.

..... [2]

- (c) (i) Use the cumulative frequency diagram to complete this frequency table.

Mass (m kg)	$30 < m \leq 40$	$40 < m \leq 50$	$50 < m \leq 60$	$60 < m \leq 70$	$70 < m \leq 80$	$80 < m \leq 90$
Frequency	8	12			14	10

[1]

- (ii) Calculate an estimate of the mean mass of the boys.

..... kg [4]

- (iii) Two boys are chosen at random from those with a mass greater than 70 kg.

Find the probability that one of them has a mass greater than 80 kg and the other has a mass of 80 kg or less.

..... [3]

4 (a) Solve.

(i) $6(7-2x) = 3x-8$

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

(ii) $\frac{2x}{x-5} = \frac{2}{3}$

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

(b) Factorise completely.

(i) $2x^2 - 288y^2$

$\dots\dots\dots$ [3]

(ii) $5x^2 + 17x - 40$

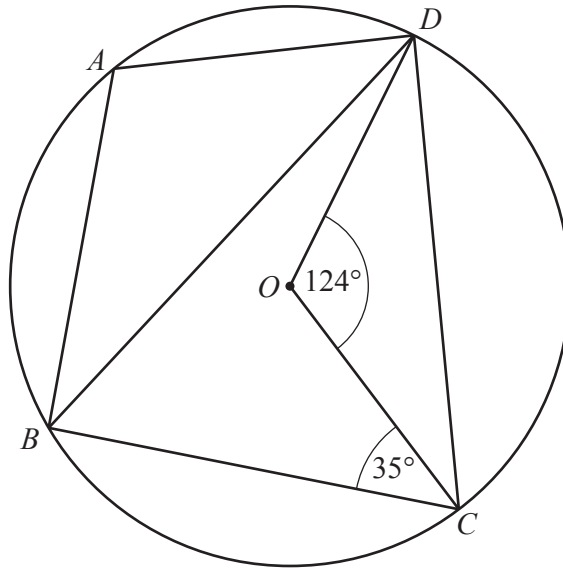
$\dots\dots\dots$ [2]

- (c) Solve $x^3 + 4x^2 - 17x = x^3 - 9$.

You must show all your working and give your answers correct to 2 decimal places.

$x = \dots\dots\dots$ or $x = \dots\dots\dots$ [5]

5 (a)

NOT TO
SCALE

A, B, C and D are points on a circle, centre O .
Angle $COD = 124^\circ$ and angle $BCO = 35^\circ$.

- (i) Work out angle CBD .
Give a geometrical reason for your answer.

Angle $CBD = \dots\dots\dots$ because $\dots\dots\dots$

$\dots\dots\dots$ [2]

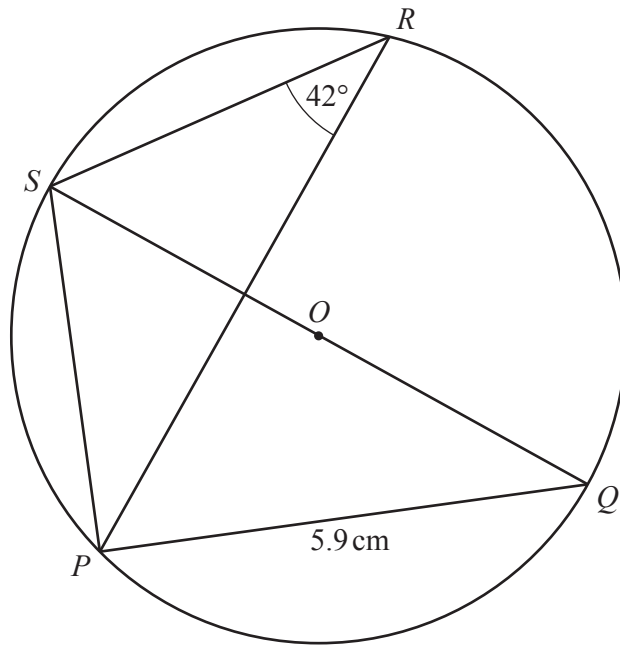
- (ii) Work out angle BAD .
Give a geometrical reason for each step of your working.

Angle $BAD = \dots\dots\dots$ because $\dots\dots\dots$

$\dots\dots\dots$

$\dots\dots\dots$ [4]

(b)

NOT TO
SCALE

P , Q , R and S are points on a circle, centre O .
 QS is a diameter.
 Angle $PRS = 42^\circ$ and $PQ = 5.9\text{ cm}$.

Calculate the circumference of the circle.

..... cm [5]

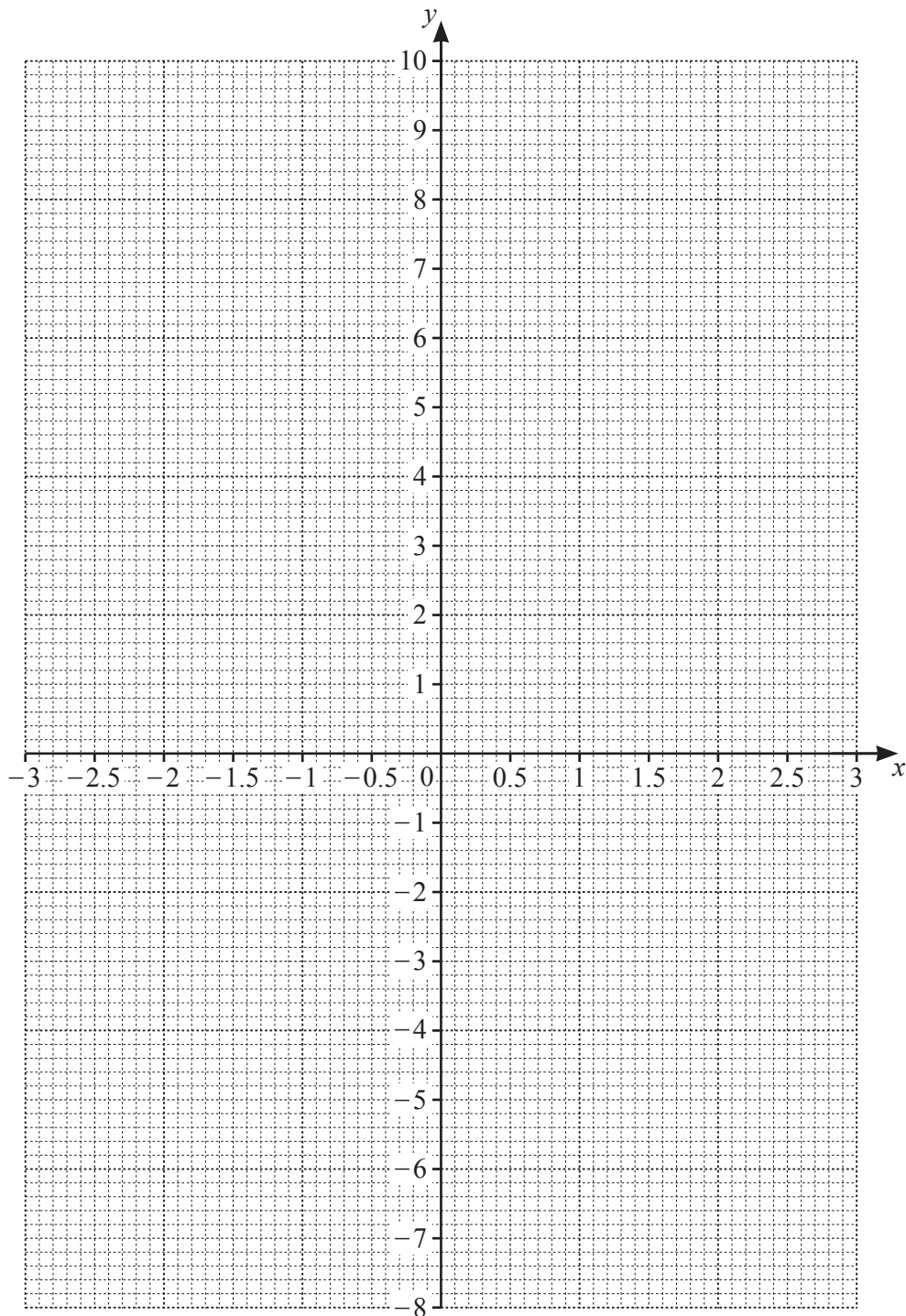
- 6 The table shows some values for $y = x^2 - \frac{3}{2x}$, $x \neq 0$, given correct to 1 decimal place.

x	-3	-2	-1	-0.5	-0.2		0.2	0.5	1	2	3
y			2.5	3.3	7.5		-7.5	-2.8	-0.5	3.3	

- (a) (i) Complete the table.

[3]

- (ii) On the grid, draw the graph of $y = x^2 - \frac{3}{2x}$ for $-3 \leq x \leq -0.2$ and $0.2 \leq x \leq 3$.



[5]

- (b) By drawing a suitable straight line on the grid, solve the equation $x^2 - \frac{3}{2x} = \frac{24}{5} - 2x$ for $-3 \leq x \leq -0.2$ and $0.2 \leq x \leq 3$.

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

- (c) The solutions to the equation $x^2 - \frac{3}{2x} = \frac{24}{5} - 2x$ are also the solutions to an equation of the form $ax^3 + bx^2 + cx - 15 = 0$ where a , b and c are integers.

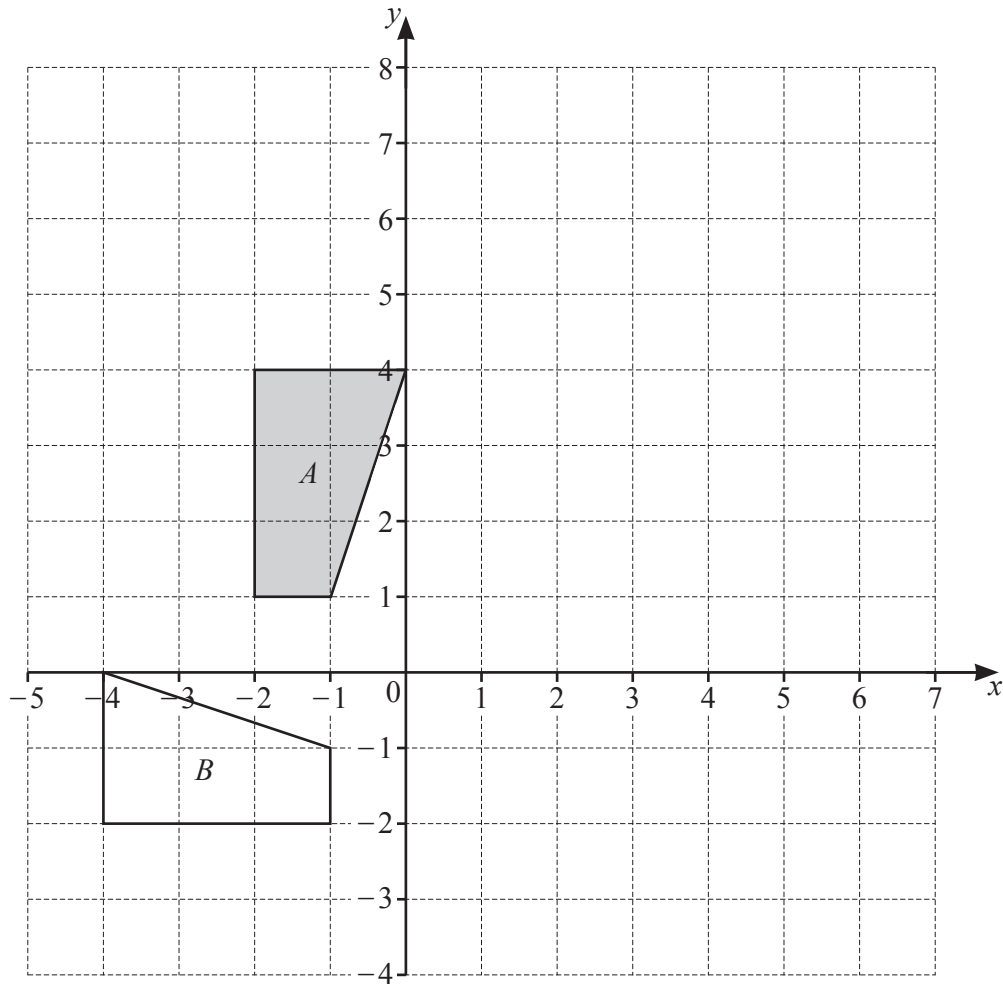
Find the values of a , b and c .

$a = \dots\dots\dots$

$b = \dots\dots\dots$

$c = \dots\dots\dots$ [4]

7 (a)



(i) On the grid, draw the image of

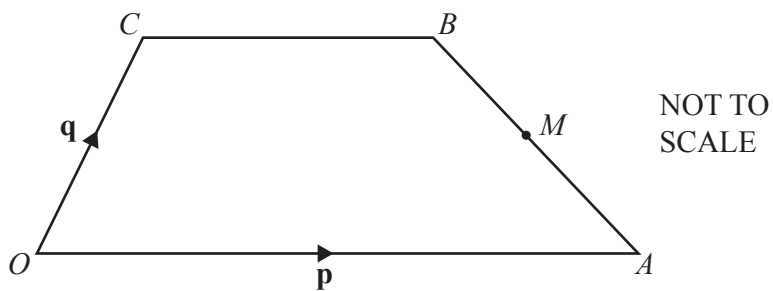
(a) shape A after an enlargement, scale factor 2, centre $(0, 1)$, [2]

(b) shape A after a reflection in the line $y = x - 1$. [3]

(ii) Describe fully the **single** transformation that maps shape A onto shape B .

.....
 [3]

(b)



$OABC$ is a trapezium and O is the origin.

M is the midpoint of AB .

$\overrightarrow{OA} = \mathbf{p}$, $\overrightarrow{OC} = \mathbf{q}$ and $OA = 2CB$.

Find, in terms of $\mathbf{p}$ and $\mathbf{q}$, the position vector of M .
Give your answer in its simplest form.

..... [3]

8 (a) $f(x) = 3 - 5x$

(i) Find x when $f(x) = -5$.

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

(ii) Find $f^{-1}(x)$.

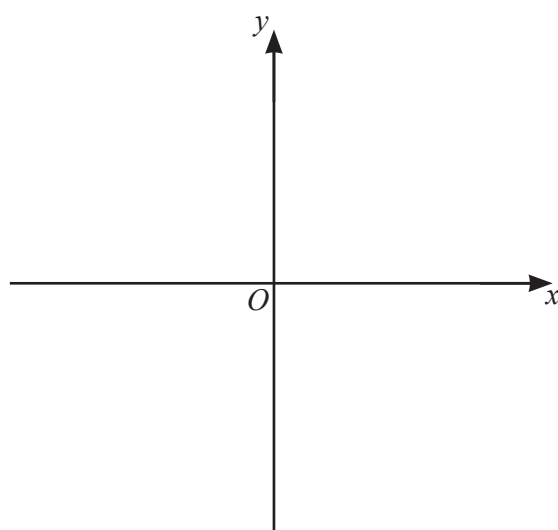
$$f^{-1}(x) = \dots\dots\dots [2]$$

(b) $g(x) = 18 - 3x - x^2$

(i) Write $g(x)$ in the form $b - (a + x)^2$.

$$\dots\dots\dots [3]$$

(ii) Sketch the graph of $y = g(x)$.
On your sketch, show the coordinates of the turning point.

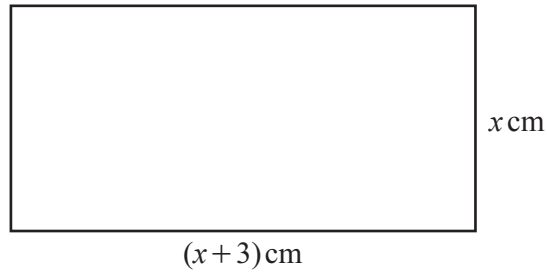


[3]

- (iii) Find the equation of the tangent to the graph of $y = 18 - 3x - x^2$ at $x = 4$.
Give your answer in the form $y = mx + c$.

$y = \dots\dots\dots$ [6]

9 (a)

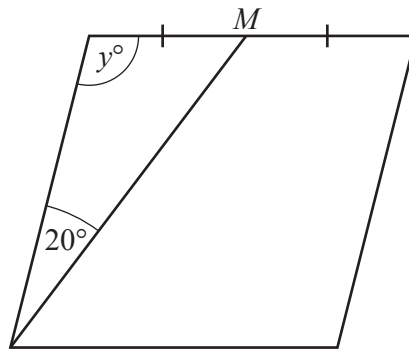
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This rectangle has perimeter 20 cm.

Find the value of x .

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

(b)

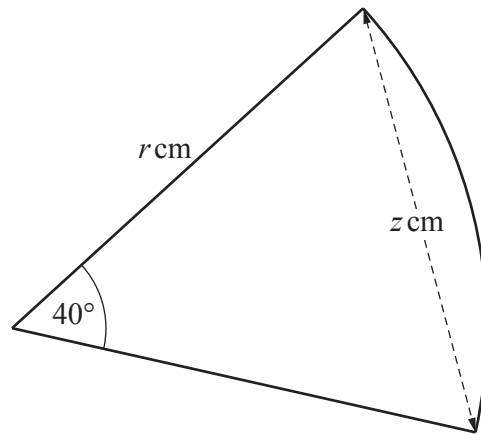
NOT TO
SCALE

This rhombus has perimeter 20 cm and angle y is obtuse.
 M is the midpoint of one of the sides.

Find the value of y .

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

(c)

NOT TO
SCALE

This sector of a circle has radius r and perimeter 20 cm.

Find the value of z .

$z = \dots\dots\dots$ [6]

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