



# Cambridge IGCSE™

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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

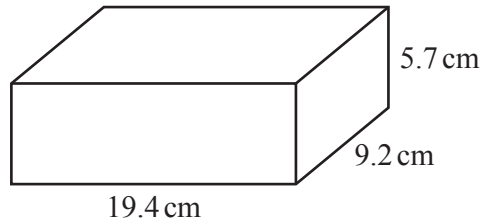
- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction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

.....  $\text{cm}^2$  [3]

(ii) The density of the brick is  $1.9 \text{ g/cm}^3$ .

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.

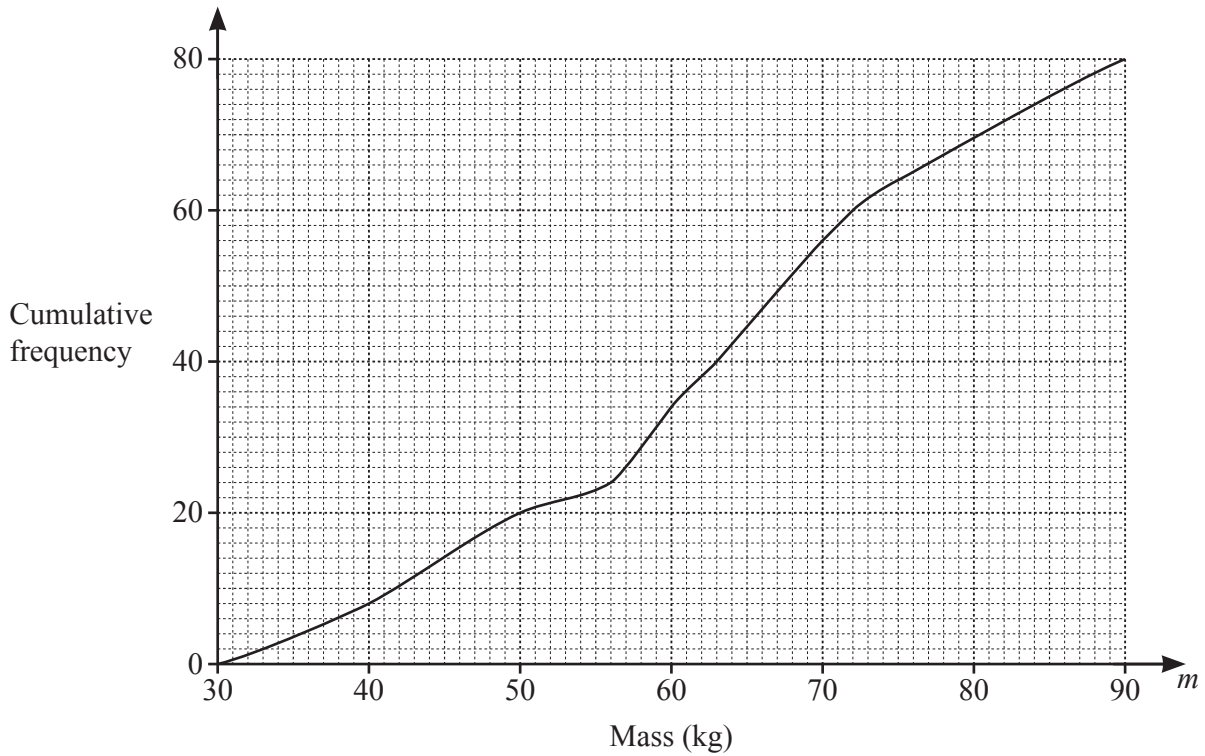
..... [4]

- (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.

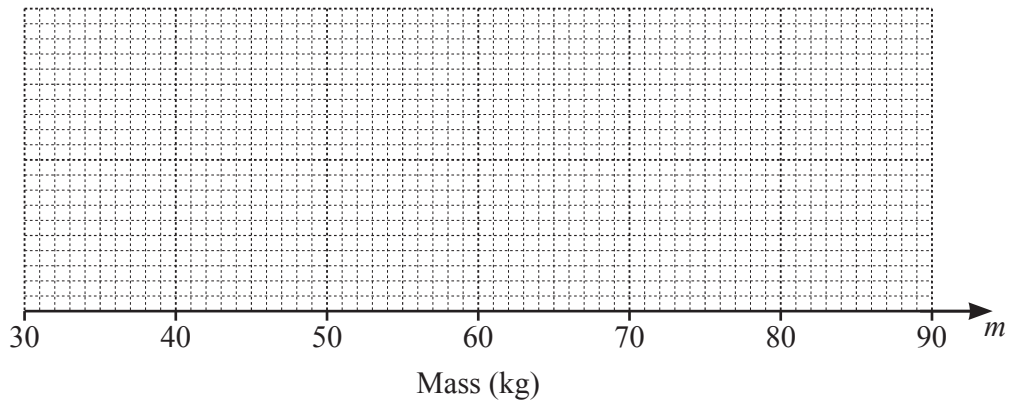
Work out the amount raised by the charity in 2020.

\$ ..... 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)  $5x^2 + 17x - 40$

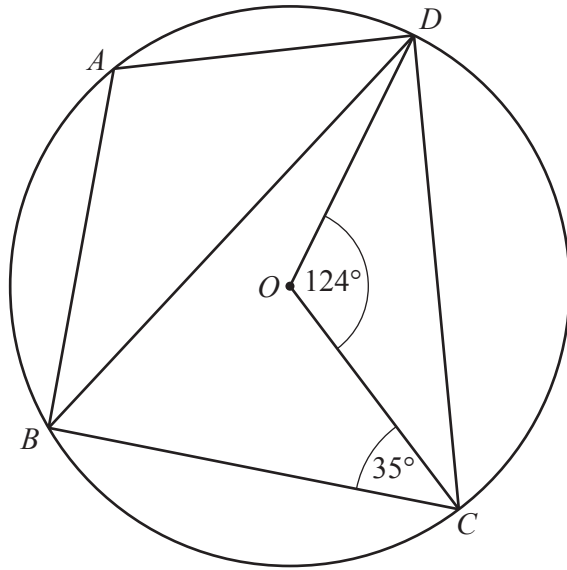
$\dots\dots\dots$  [2]



- (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  $BCO = 35^\circ$ .

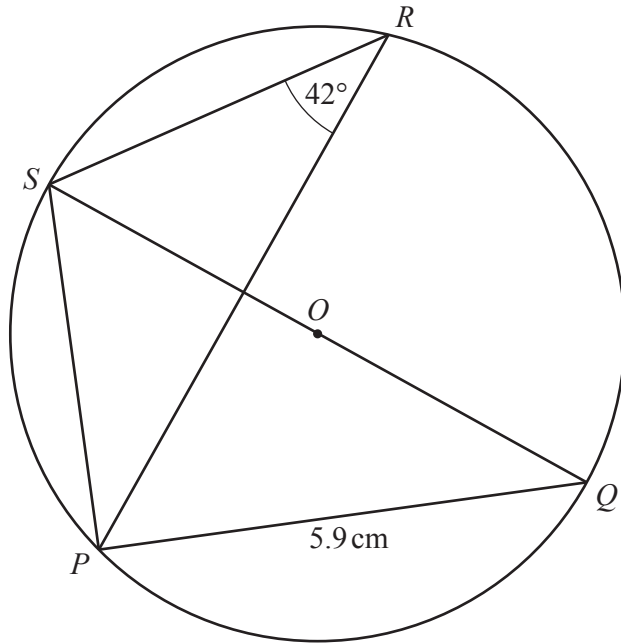
- (i) Work out angle  $CBD$ .  
 Give a geometrical reason for your answer.

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]

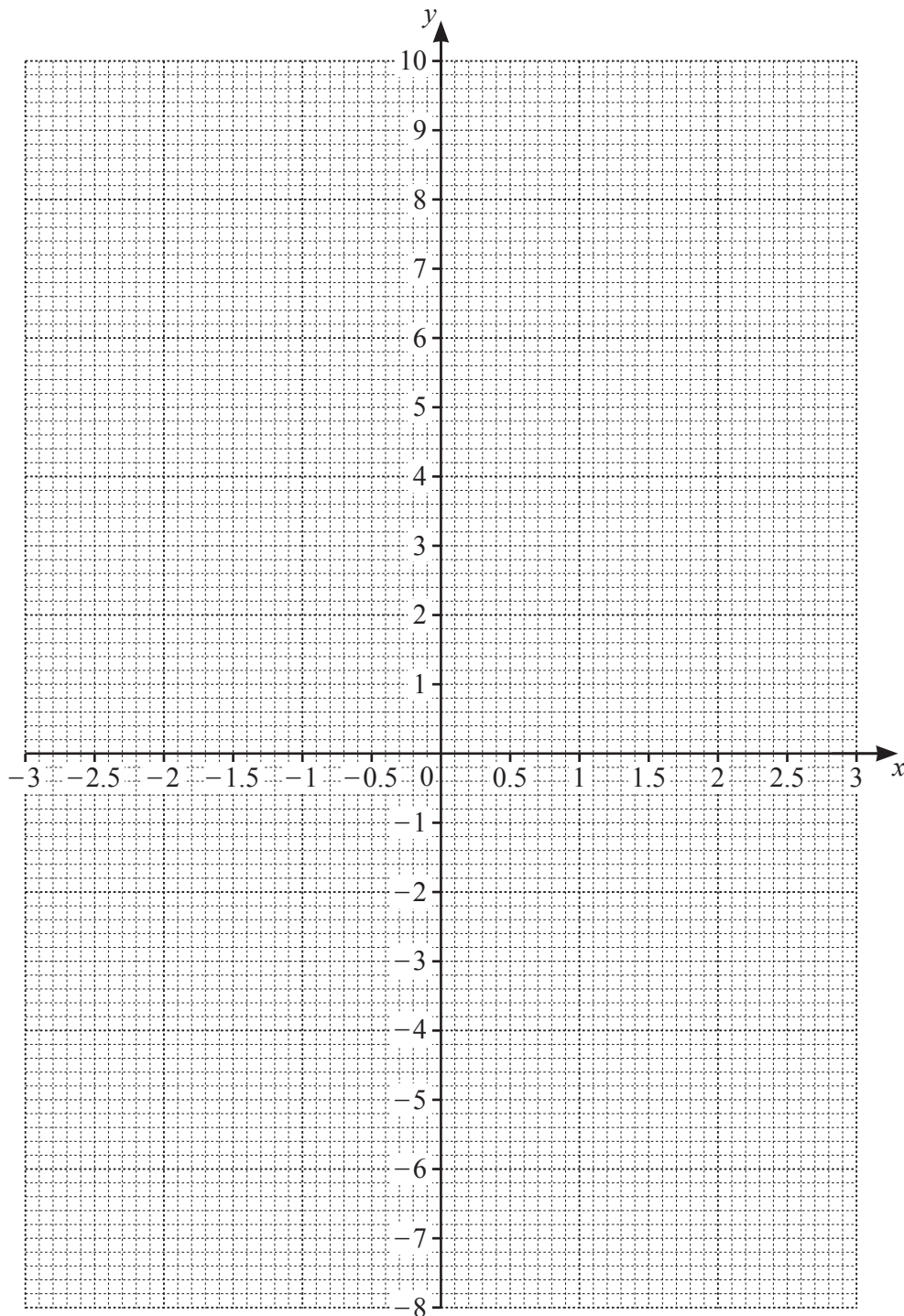
- 6 The table shows some values for  $y = x^2 - \frac{3}{2x}$ ,  $x \neq 0$ , given correct to 1 decimal place.

$x$	-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  $0.2 \leq x \leq 3$ .

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

- (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.

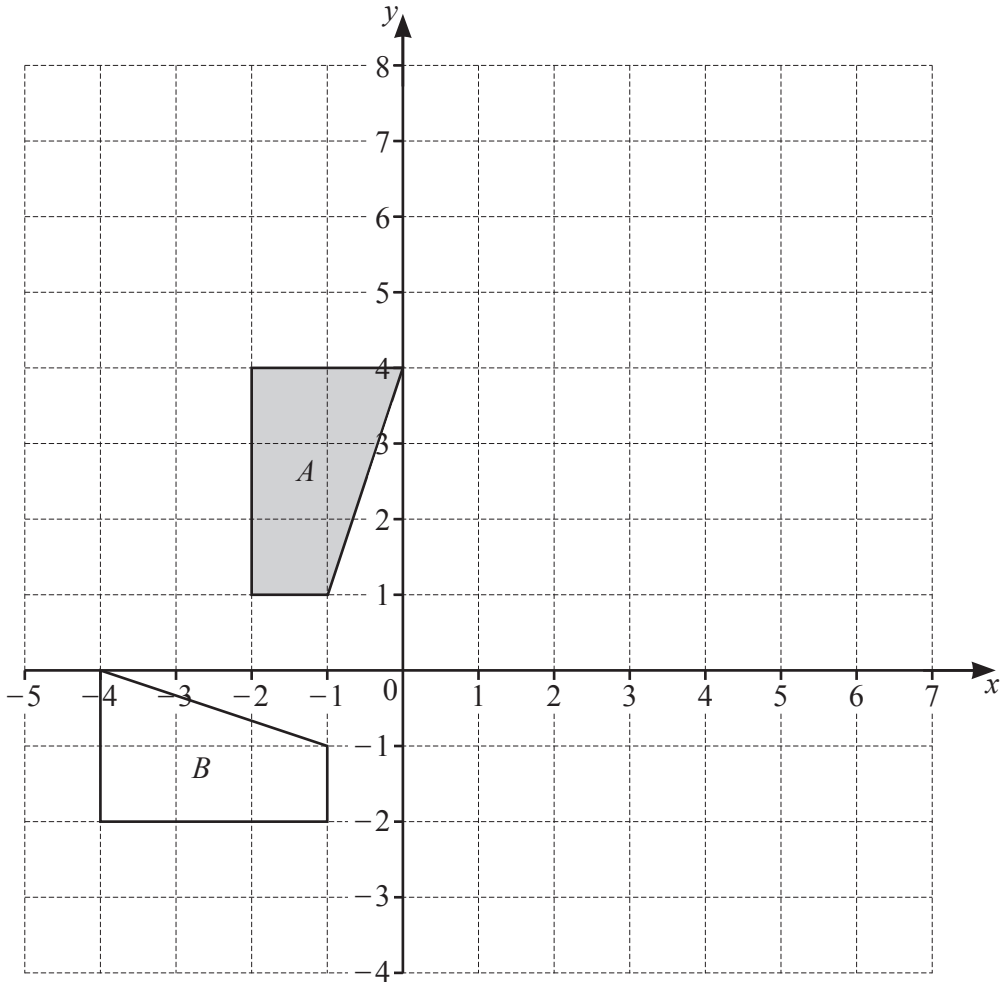
Find the values of  $a$ ,  $b$  and  $c$ .

$$a = \dots\dots\dots$$

$$b = \dots\dots\dots$$

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

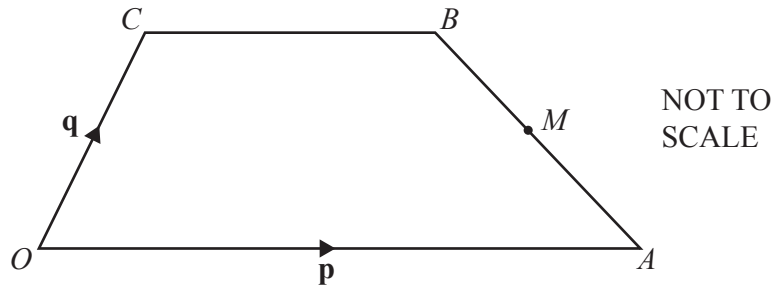
7 (a)



- (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  $AB$ .

$\vec{OA} = \mathbf{p}$ ,  $\vec{OC} = \mathbf{q}$  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  $f^{-1}(x)$ .

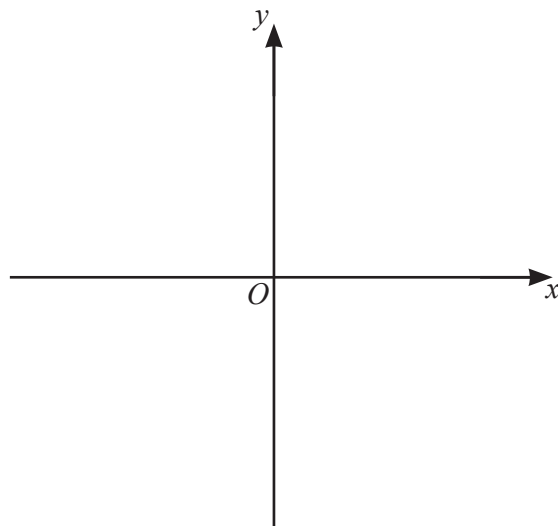
$$f^{-1}(x) = \dots\dots\dots [2]$$

(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.



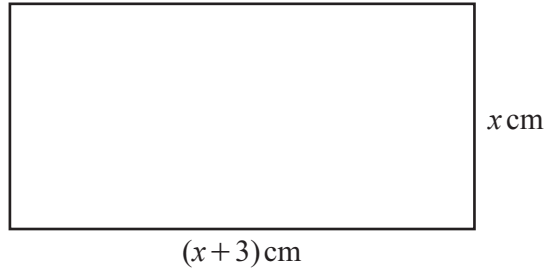
[3]



- (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)



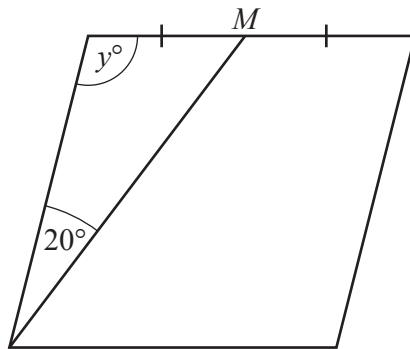
NOT TO SCALE

This rectangle has perimeter 20 cm.

Find the value of  $x$ .

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

(b)



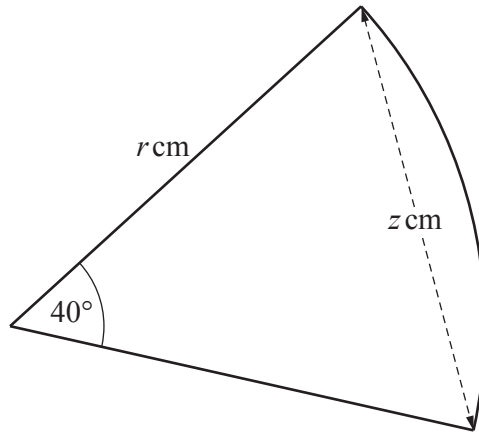
NOT TO SCALE

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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