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MATHEMATICS

0580/41

Paper 4 (Extended)

May/June 2020

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. Blank pages are indicated.

- 1 (a) In 2018, Gretal earned \$32 000.

- (i) She paid tax of 24% on these earnings.

Work out the amount she paid in tax in 2018.

\$ [2]

- (ii) In 2019, Gretal's earnings increased by 7%.

Work out her earnings in 2019.

\$ [2]

- (b) Gretal invests \$5000 at a rate of 2% per year compound interest.

Calculate the value of her investment at the end of 3 years.

\$ [2]

- (c) One month, Gretal spent a total of \$360 on presents.

She spent $\frac{1}{5}$ of this total on presents for her parents.

She spent $\frac{2}{3}$ of the remaining money on presents for her friends.

She spent the rest of the money on presents for her sisters.

Calculate the percentage of the \$360 that she spent on presents for her sisters.

..... % [4]

- (d) Arjun earned \$36 515 in 2019.
This was an increase of 9% on his earnings in 2018.

Work out his earnings in 2018.

\$ [2]

- (e) Arjun and Gretal each pay rent.

In 2018, the ratio of the amount each paid in rent was Arjun : Gretal = 5 : 7.

In 2019, the ratio of the amount each paid in rent was Arjun : Gretal = 9 : 13.

Arjun paid the same amount of rent in both 2018 and 2019.

Gretal paid \$290 more rent in 2019 than she did in 2018.

Work out the amount Arjun paid in rent in 2019.

\$ [4]

- 2 The heights, h metres, of the 120 boys in an athletics club are recorded.
The table shows information about the heights of the boys.

Height (h metres)	$1.3 < h \leq 1.4$	$1.4 < h \leq 1.5$	$1.5 < h \leq 1.6$	$1.6 < h \leq 1.7$	$1.7 < h \leq 1.8$	$1.8 < h \leq 1.9$
Frequency	7	18	30	24	27	14

- (a) (i) Write down the modal class.

..... $< h \leq$ [1]

- (ii) Calculate an estimate of the mean height.

..... m [4]

- (b) (i) One boy is chosen at random from the club.

Find the probability that this boy has a height greater than 1.8 m.

..... [1]

- (ii) Three boys are chosen at random from the club.

Calculate the probability that one of the boys has a height greater than 1.8 m and the other two boys each have a height of 1.4 m or less.

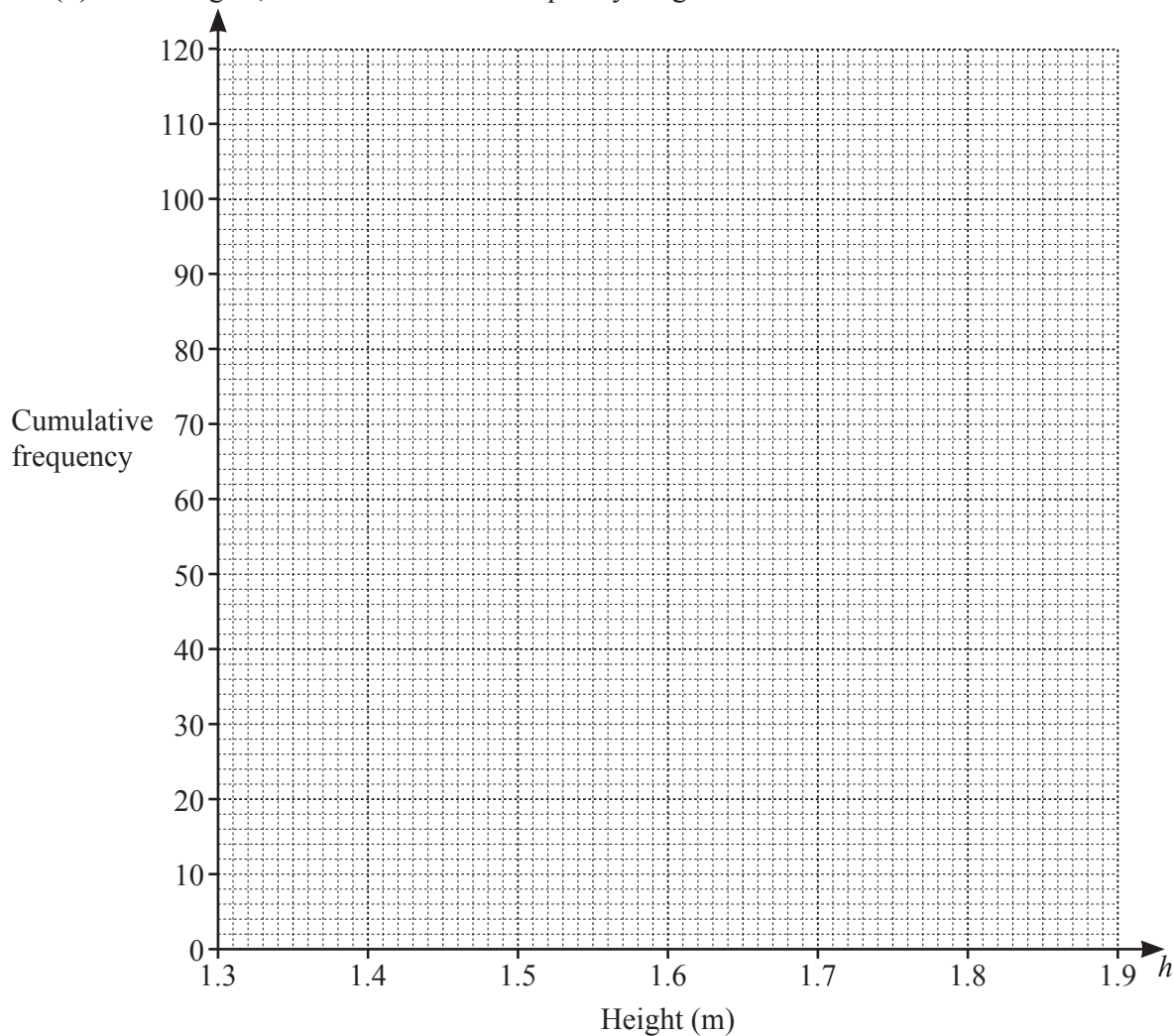
..... [4]

- (c) (i) Use the frequency table on page 4 to complete the cumulative frequency table.

Height (h metres)	$h \leq 1.4$	$h \leq 1.5$	$h \leq 1.6$	$h \leq 1.7$	$h \leq 1.8$	$h \leq 1.9$
Cumulative frequency	7	25				

[2]

- (ii) On the grid, draw a cumulative frequency diagram to show this information.



[3]

- (d) Use your diagram to find an estimate for

- (i) the median height,

..... m [1]

- (ii) the 40th percentile.

..... m [2]

3 (a) $s = ut + \frac{1}{2}at^2$

Find the value of s when $u = 5.2$, $t = 7$ and $a = 1.6$.

$s = \dots\dots\dots$ [2]

(b) Simplify.

(i) $3a - 5b - a + 2b$

$\dots\dots\dots$ [2]

(ii) $\frac{5}{3x} \times \frac{9x}{20}$

$\dots\dots\dots$ [2]

(c) Solve.

(i) $\frac{15}{x} = -3$

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

(ii) $4(5 - 3x) = 23$

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

(d) Simplify.

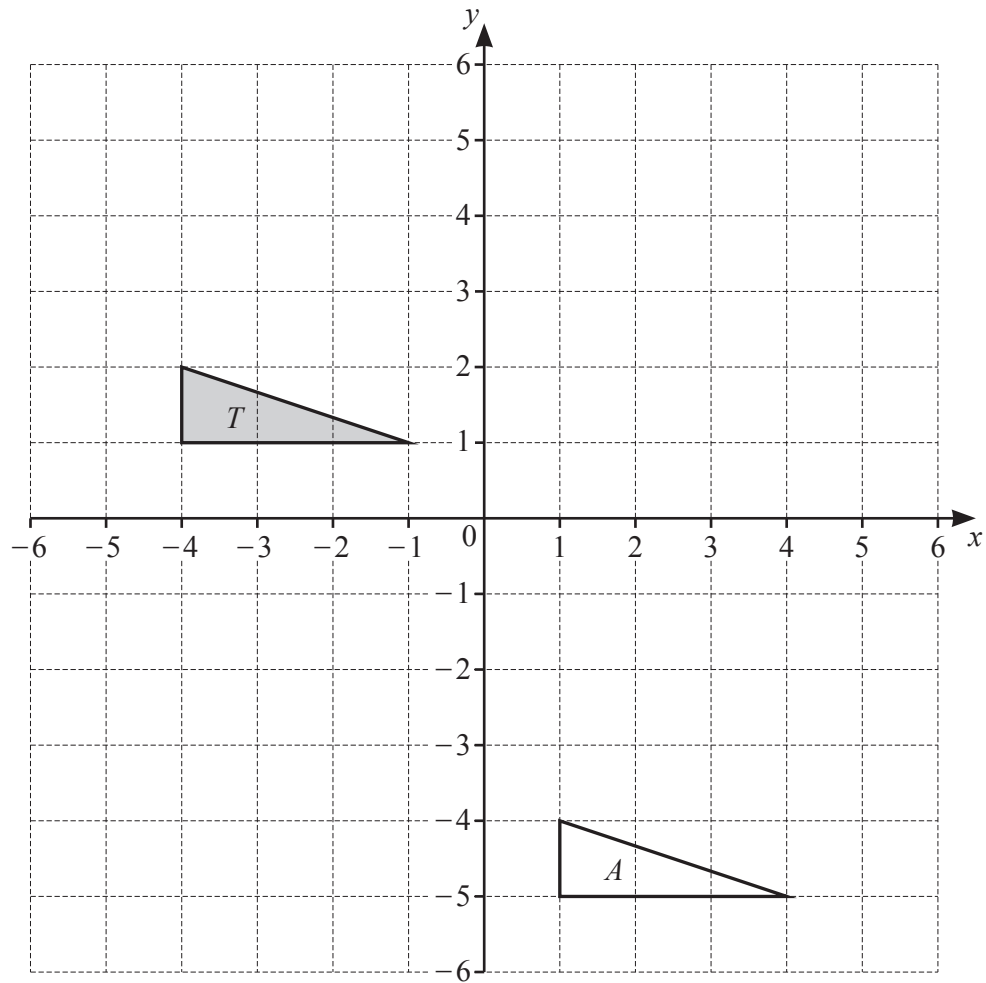
$$(27x^9)^{\frac{2}{3}}$$

..... [2]

(e) Expand and simplify.

$$(3x - 5y)(2x + y)$$

..... [2]



- (a) Draw the image of triangle T after a reflection in the line $y = -1$. [2]
- (b) Draw the image of triangle T after a rotation through 90° clockwise about $(0, 0)$. [2]
- (c) Describe fully the **single** transformation that maps triangle T onto triangle A .

.....

..... [2]

5 x is an integer.

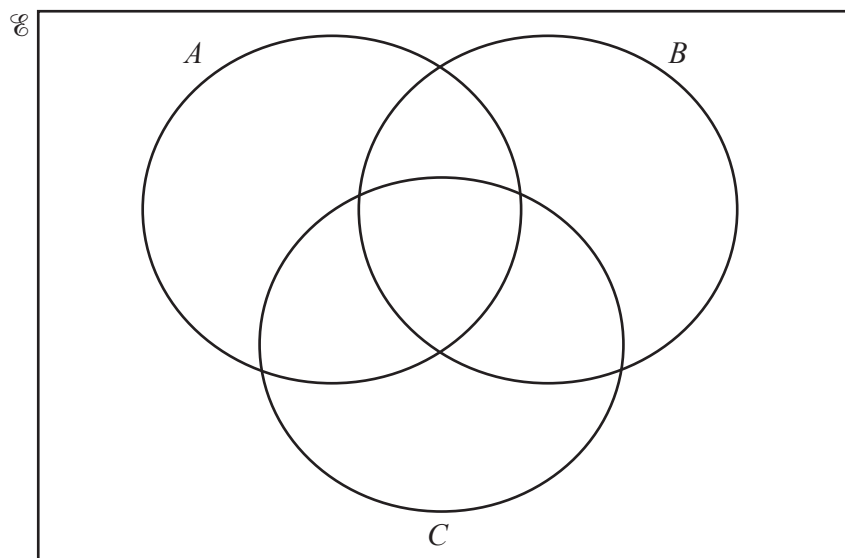
$$\mathcal{C} = \{x : 41 \leq x \leq 50\}$$

$$A = \{x : x \text{ is an odd number}\}$$

$$B = \{x : x \text{ is a multiple of } 3\}$$

$$C = \{x : x \text{ is a prime number}\}$$

(a) Complete the Venn diagram to show this information.



[3]

(b) List the elements of

(i) $A \cap C$,

..... [1]

(ii) $(B \cup C)'$.

..... [1]

(c) Find $n(A \cap B \cap C)$.

..... [1]

- 6 Raheem makes baskets and mats.
Each week he makes x baskets and y mats.

He makes fewer than 10 mats.

The number of mats he makes is greater than or equal to the number of baskets he makes.

- (a) One of the inequalities that shows this information is $y < 10$.

Write down the other inequality.

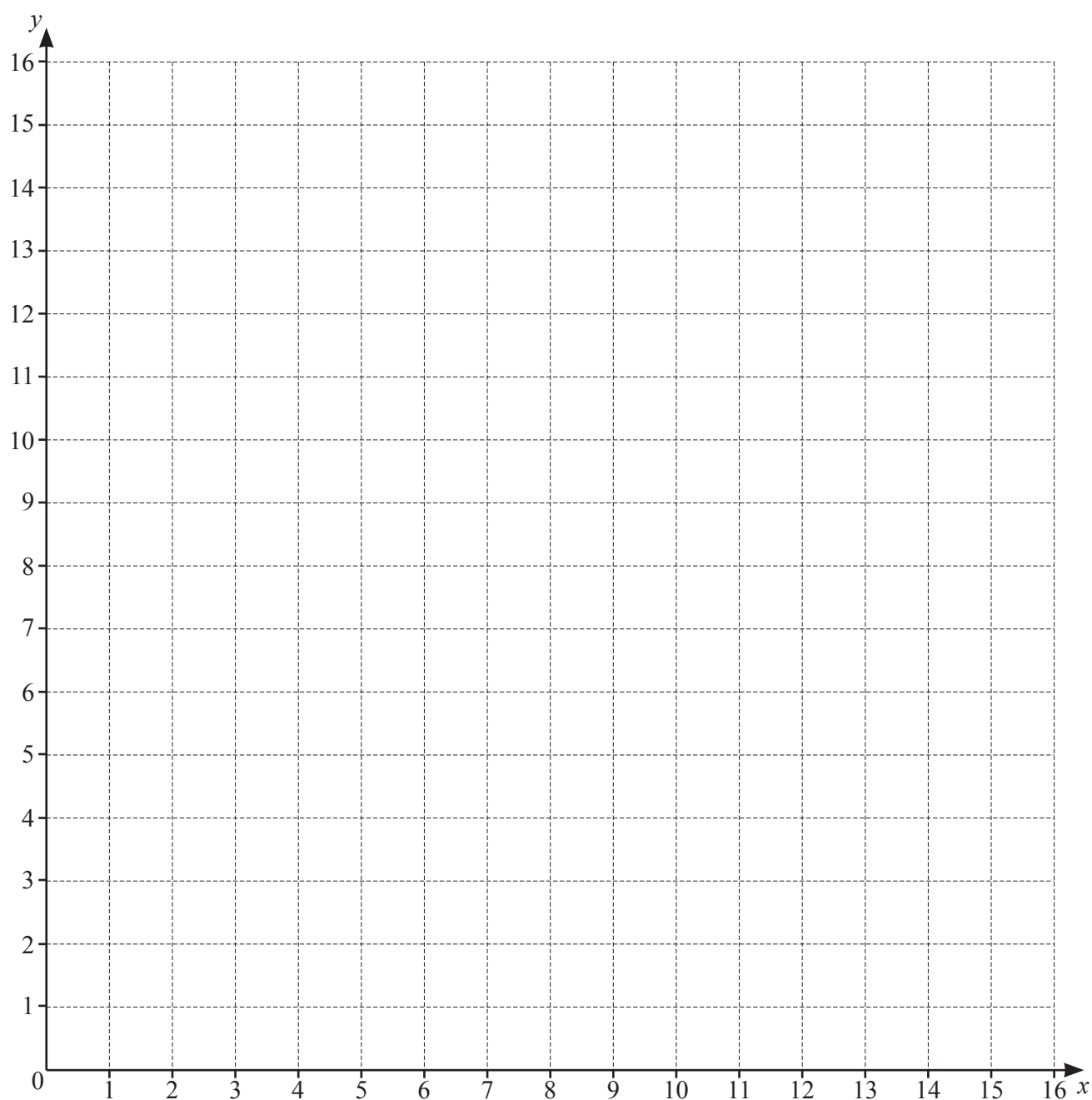
..... [1]

- (b) He takes $2\frac{1}{4}$ hours to make a basket and $1\frac{1}{2}$ hours to make a mat.
Each week he works for a maximum of 22.5 hours.

Show that $3x + 2y \leq 30$.

[2]

- (c) On the grid, draw three straight lines and shade the **unwanted** regions to show these inequalities.

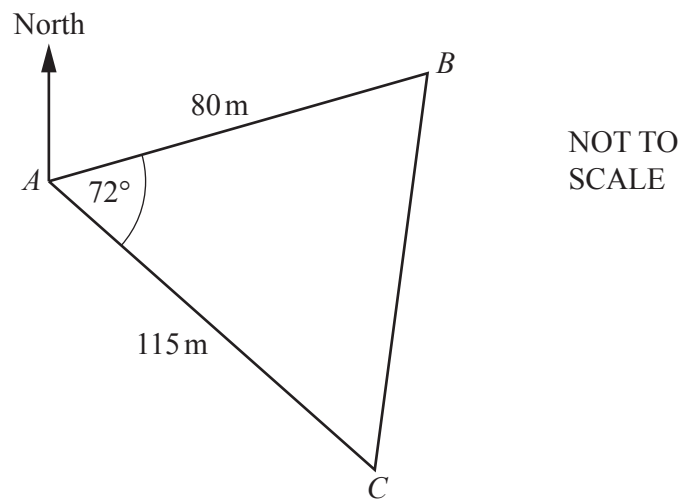


[5]

- (d) He makes \$40 profit on each basket he sells and \$28 profit on each mat he sells.

Calculate the maximum profit he can make each week.

\$ [2]



The diagram shows the positions of three points A , B and C in a field.

(a) Show that BC is 118.1 m, correct to 1 decimal place.

[3]

(b) Calculate angle ABC .

Angle $ABC = \dots\dots\dots$ [3]

- (c) The bearing of C from A is 147° .

Find the bearing of

- (i) A from B ,

..... [3]

- (ii) B from C .

..... [2]

- (d) Mitchell takes 35 seconds to run from A to C .

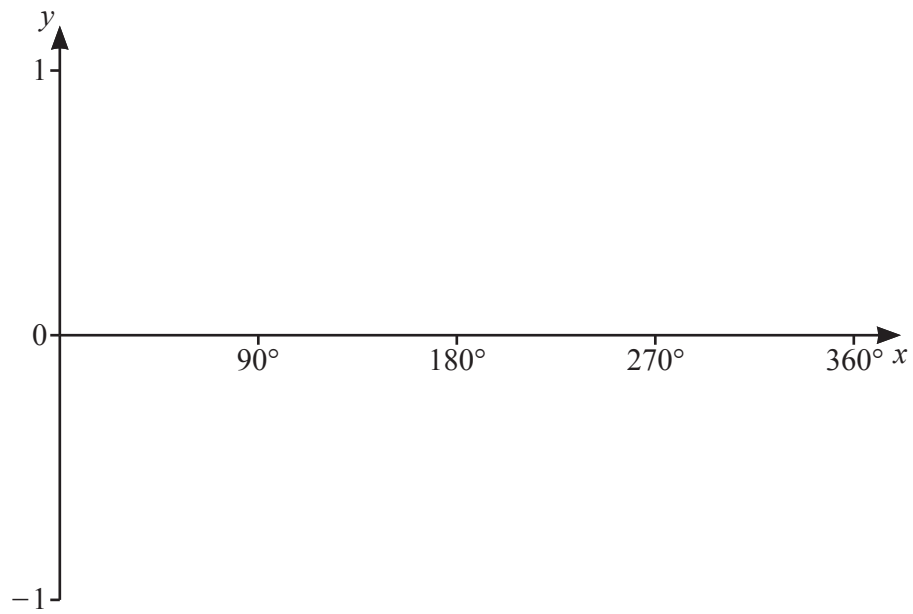
Calculate his average running speed in kilometres per hour.

..... km/h [3]

- (e) Calculate the shortest distance from point B to AC .

..... m [3]

- 8 (a) (i) On the axes, sketch the graph of $y = \sin x$ for $0^\circ \leq x \leq 360^\circ$.



[2]

- (ii) Describe fully the symmetry of the graph of $y = \sin x$ for $0^\circ \leq x \leq 360^\circ$.

.....

.....

[2]

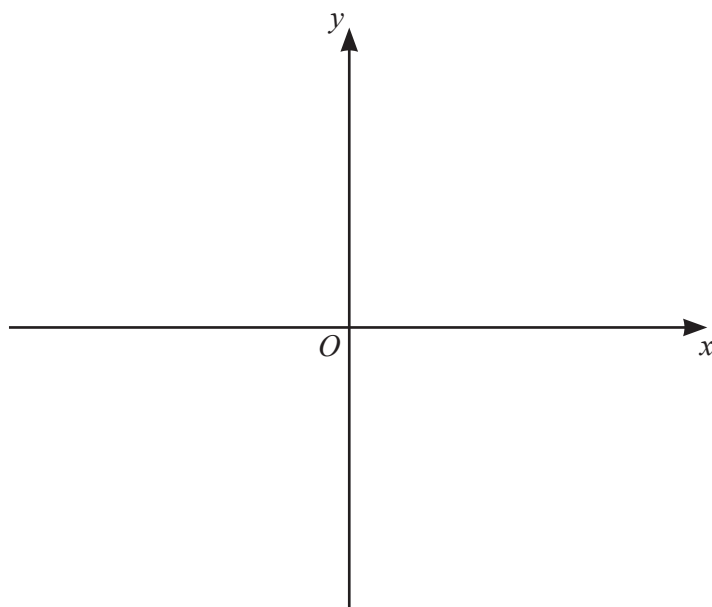
- (b) Solve $4 \sin x - 1 = 2$ for $0^\circ \leq x \leq 360^\circ$.

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

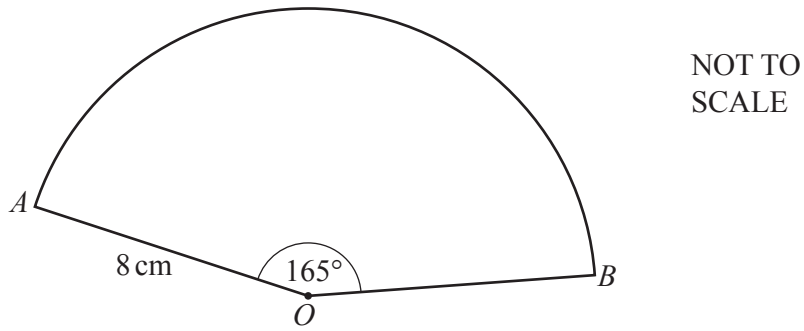
(c) (i) Write $x^2 + 10x + 14$ in the form $(x + a)^2 + b$.

..... [2]

(ii) On the axes, sketch the graph of $y = x^2 + 10x + 14$, indicating the coordinates of the turning point.



[3]



The diagram shows a sector of a circle with centre O , radius 8 cm and sector angle 165° .

- (a) Calculate the total perimeter of the sector.

..... cm [3]

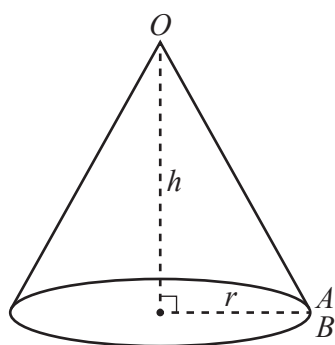
- (b) The surface area of a sphere is the same as the area of the sector.

Calculate the radius of the sphere.

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

..... cm [4]

(c)

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A cone is made from the sector by joining OA to OB .

- (i) Calculate the radius, r , of the cone.

$r = \dots\dots\dots$ cm [2]

- (ii) Calculate the volume of the cone.

[The volume, V , of a cone with radius r and height h is $V = \frac{1}{3}\pi r^2 h$.]

$\dots\dots\dots$ cm³ [4]

10 (a) A rhombus $ABCD$ has a diagonal AC where A is the point $(-3, 10)$ and C is the point $(4, -4)$.

(i) Calculate the length AC .

..... [3]

(ii) Show that the equation of the line AC is $y = -2x + 4$.

[2]

(iii) Find the equation of the line BD .

..... [4]

- (b) A curve has the equation $y = x^3 + 8x^2 + 5x$.
- (i) Work out the coordinates of the two turning points.

(..... ,) and (..... ,) [6]

- (ii) Determine whether each of the turning points is a maximum or a minimum.
Give reasons for your answers.

[3]

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