Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME									
CENTER NUMBER						CANDIDATE NUMBER				

2219631040

MATHEMATICS (US) **0444/43**

Paper 4 (Extended) **October/November 2018**

2 hours 30 minutes

Candidates answer on the Question Paper.

Additional Materials: Geometrical instruments
Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Center number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
If work is needed for any question it must be shown in the space provided.
Electronic calculators should be used.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant digits.
Give answers in degrees to one decimal place.
For π, use either your calculator value or 3.142.

The number of points is given in parentheses [ ] at the end of each question or part question.
The total of the points for this paper is 130.

Write your calculator model in the box below.

This document consists of **20** printed pages.

CAMBRIDGE International Examinations

Formula List

For the equation $ax^2 + bx + c = 0$ $\quad x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Lateral surface area, A, of cylinder of radius r, height h. $\quad A = 2\pi rh$

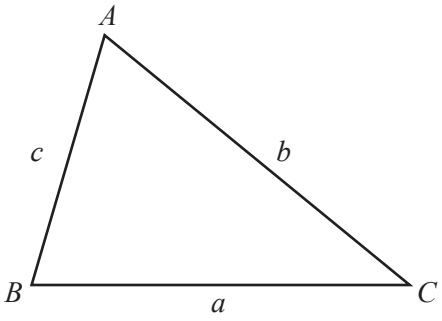
Lateral surface area, A, of cone of radius r, sloping edge l. $\quad A = \pi rl$

Surface area, A, of sphere of radius r. $\quad A = 4\pi r^2$

Volume, V, of pyramid, base area A, height h. $\quad V = \frac{1}{3}Ah$

Volume, V, of cone of radius r, height h. $\quad V = \frac{1}{3}\pi r^2 h$

Volume, V, of sphere of radius r. $\quad V = \frac{4}{3}\pi r^3$

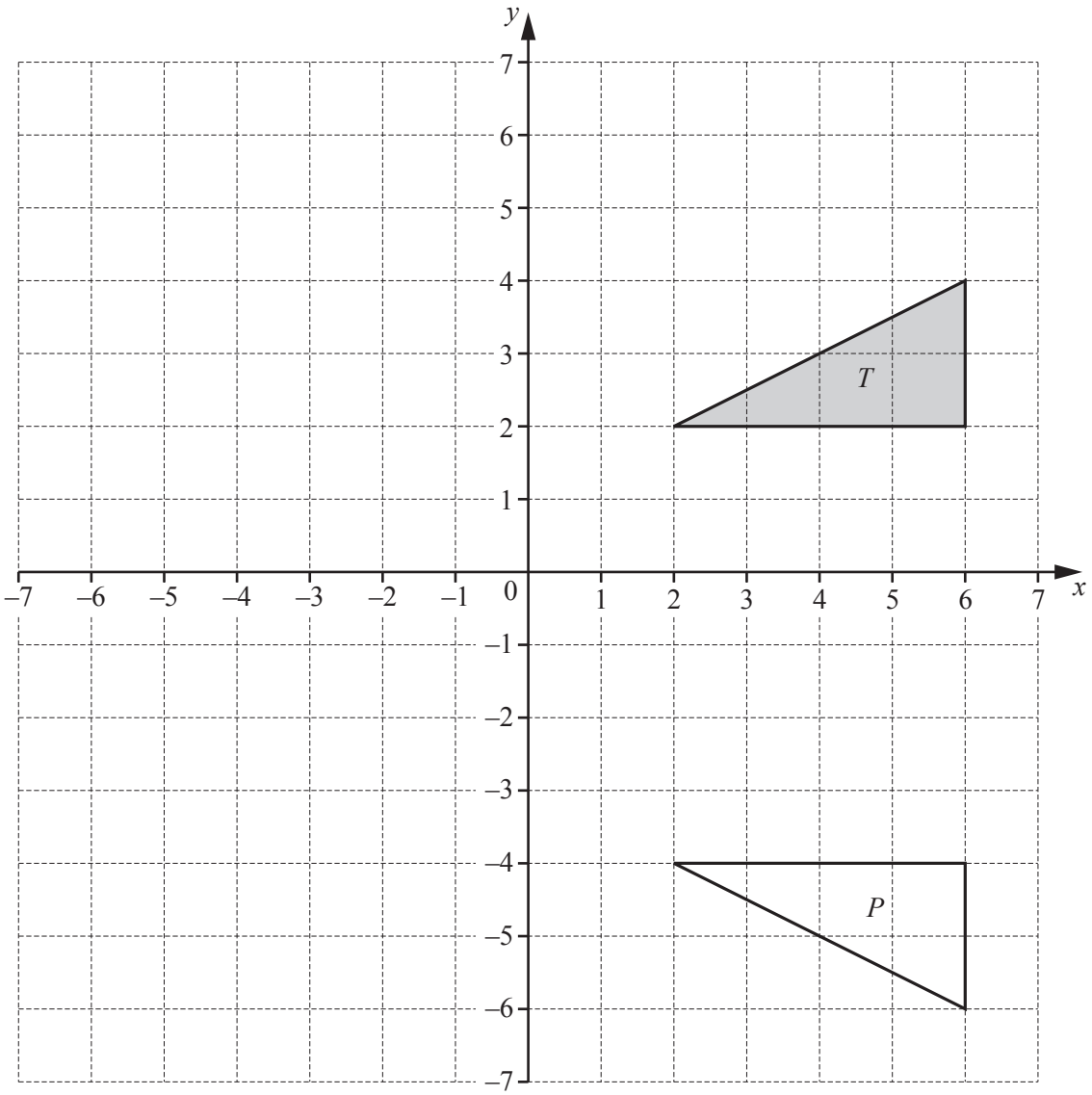


$\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

$a^2 = b^2 + c^2 - 2bc \cos A$

Area $= \frac{1}{2}bc \sin A$

1



(a) Describe fully the **single** transformation that maps triangle T onto triangle P.

.....

..... [2]

(b) Translate triangle T by the vector $\begin{pmatrix} -2 \\ -5 \end{pmatrix}$. [2]

(c) Rotate triangle T through 90° counterclockwise about (0, 0). [2]

(d) Enlarge triangle T by scale factor $-\frac{1}{2}$ with center (0, 0). [2]

2 **(a)** A school has 240 students.
The ratio girls : boys = 25 : 23.

(i) Show that the number of boys is 115.

[1]

(ii) One day, there are 15 girls absent and 15 boys absent.

Find the ratio girls : boys in school on this day.
Give your answer in its simplest form.

..... : ..... [2]

(iii) Next year, the number of students will increase by 15%.

Calculate the number of students next year.

..... [2]

(iv) Since the school was opened, the number of students has increased by 60%.
There are now 240 students.

Calculate the number of students when the school was opened.

..... [3]

(b) The population of a city is increasing exponentially at a rate of 2% each year.
The population now is 256 000.

Calculate the population after 30 years.
Give your answer correct to the nearest thousand.

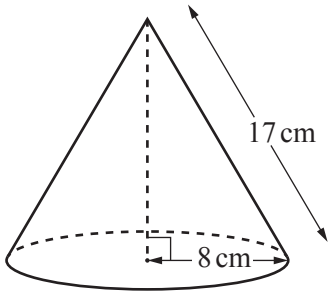
..... [3]

(c) A bacteria population increases exponentially at a rate of r% each day.
After 32 days, the population has increased by 309%.

Find the value of r.

r = ... [3]

3 (a)



NOT TO SCALE

The diagram shows a solid cone.
The radius is 8 cm and the slant height is 17 cm.

(i) Calculate the curved surface area of the cone.

..... cm^2 [2]

(ii) Calculate the volume of the cone.

..... cm^3 [4]

(iii) The cone is made of wood and 1 cm^3 of the wood has a mass of 0.8 g.

Calculate the mass of the cone.

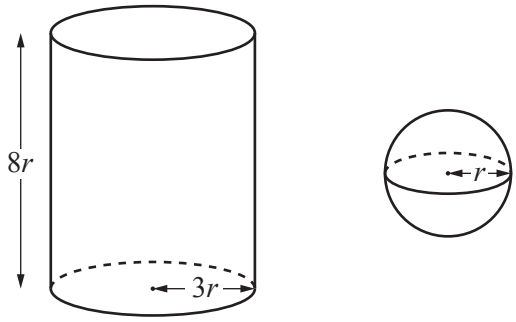
..... g [1]

(iv) The cone is placed in a box.
The total mass of the cone and the box is 1.2 kg.

Calculate the mass of the box.
Give your answer in grams.

..... g [1]

(b)



NOT TO SCALE

The diagram shows a solid cylinder and a solid sphere.
The cylinder has radius $3r$ and height $8r$.
The sphere has radius r.

(i) Find the volume of the sphere as a fraction of the volume of the cylinder.
Give your answer in its lowest terms.

..... [4]

(ii) The surface area of the sphere is $81\pi\,\text{cm}^2$.

Find the **curved** surface area of the cylinder.
Give your answer in terms of π.

..... cm^2 [4]

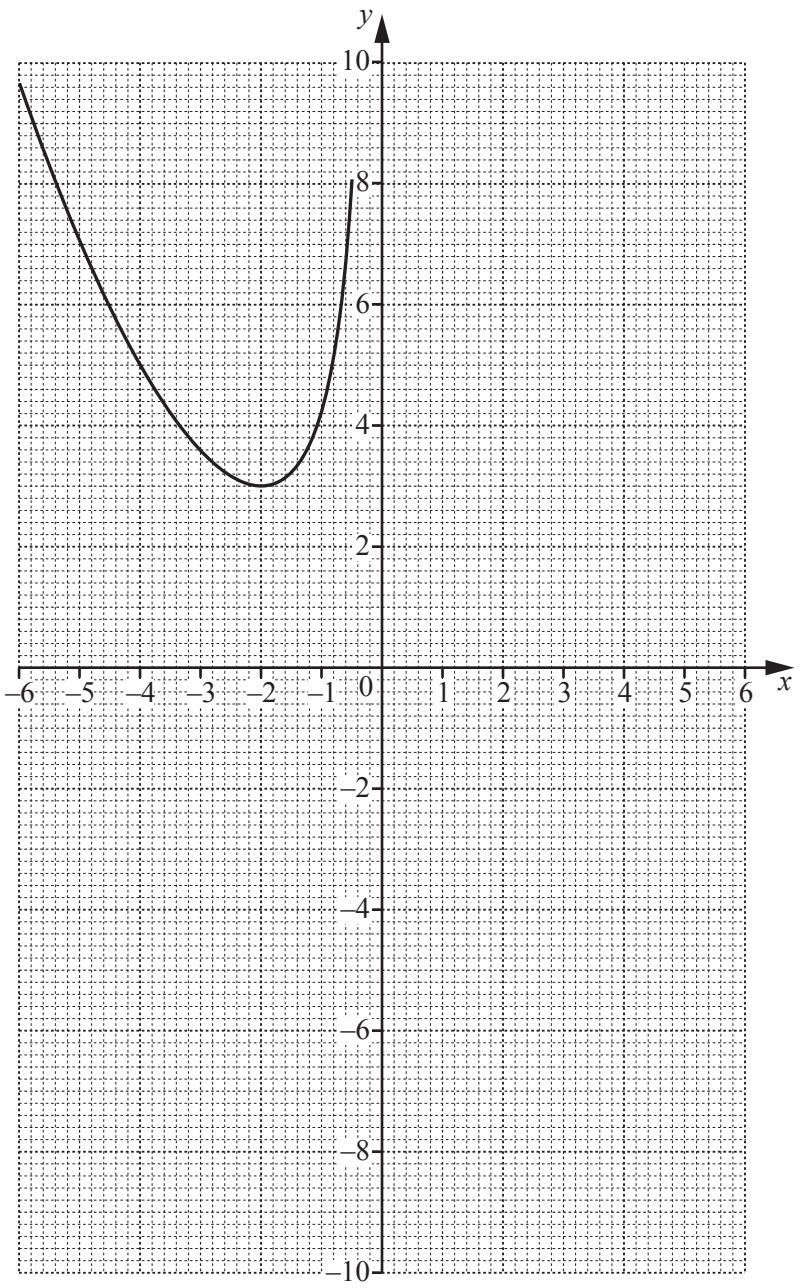
4 $f(x) = \frac{x^2}{4} - \frac{4}{x}$, $x \neq 0$

(a) Complete the table for $f(x)$.

x	0.5	1	2	3	4	5	6
$f(x)$	–7.9	–3.8		0.9		5.5	8.3

[2]

(b) The graph of $y = f(x)$ for $-6 \leqslant x \leqslant -0.5$ is drawn on the grid.



On the same grid, draw the graph of $y = f(x)$ for $0.5 \leqslant x \leqslant 6$. [3]

(c) By drawing a suitable tangent, estimate the slope of the graph of $y = f(x)$ at the point $(-4, 5)$.

..... [3]

(d) $g(x) = \frac{9}{x}$, $x \neq 0$

Complete the table for $g(x)$.

x	–4	–3	–2	–1		1	2	3	4
$g(x)$	–2.3		–4.5	–9		9	4.5		2.3

[1]

(e) On the same grid, draw the graph of $y = g(x)$ for $-4 \leqslant x \leqslant -1$ and $1 \leqslant x \leqslant 4$. [4]

(f) **(i)** Use your graphs to find the value of x when $f(x) = g(x)$.

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

(ii) Write down an inequality to show the **positive** values of x for which $f(x) > g(x)$.

..... [1]

(g) The exact answer to **part (f)(i)** is $\sqrt[3]{k}$.

Use algebra to find the value of k.

$k =$ ..... [2]

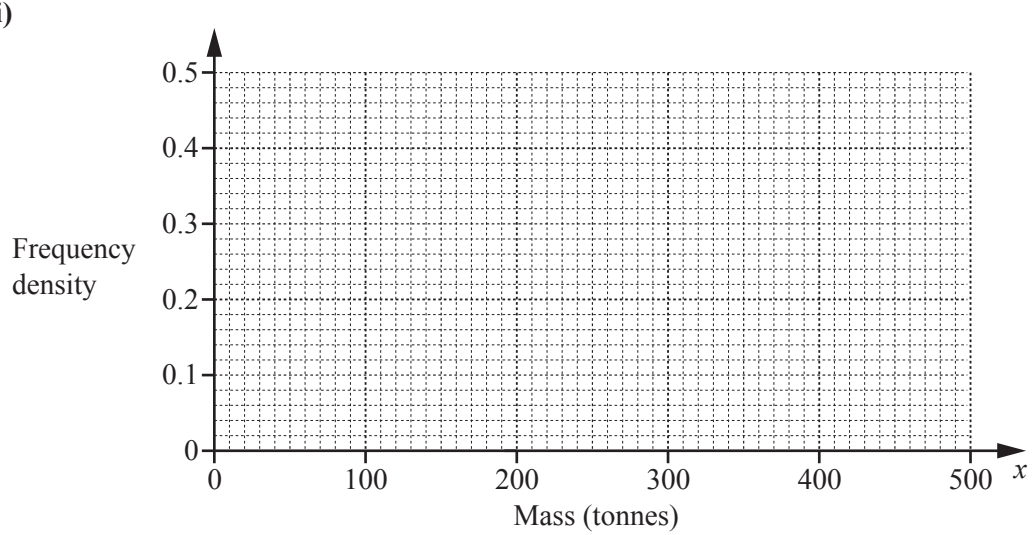
5 **(a)** A factory recycles metal.
The mass, x tonnes, of metal is measured each week.
The table shows the results for 52 weeks.

Mass (x tonnes)	$100 < x \leqslant 200$	$200 < x \leqslant 250$	$250 < x \leqslant 300$	$300 < x \leqslant 500$
Frequency	8	20	12	12

(i) Calculate an estimate of the mean.

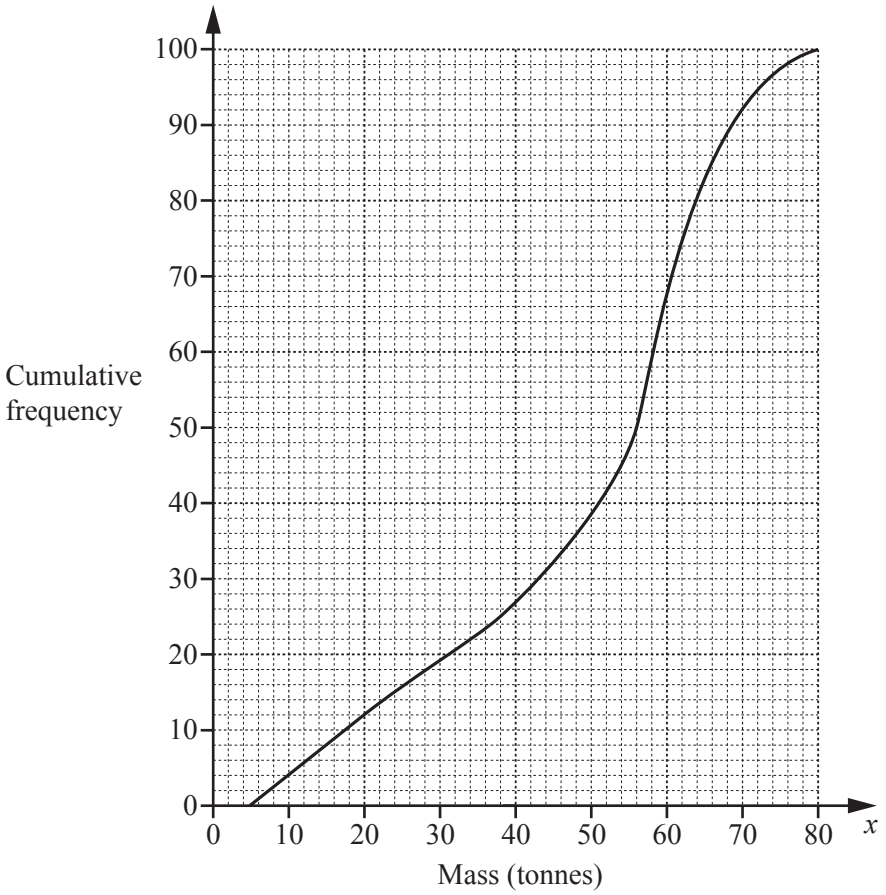
..... tonnes [4]

(ii)



On the grid, draw a histogram to show the information in the table. [4]

(b) Another factory also recycles metal.
The mass, x tonnes, of metal is measured each day for a number of days.
The cumulative frequency diagram shows the results.



(i) For how many days was the mass measured?

..... [1]

(ii) Find an estimate of the median.

..... tonnes [1]

(iii) Find an estimate of the upper quartile.

..... tonnes [1]

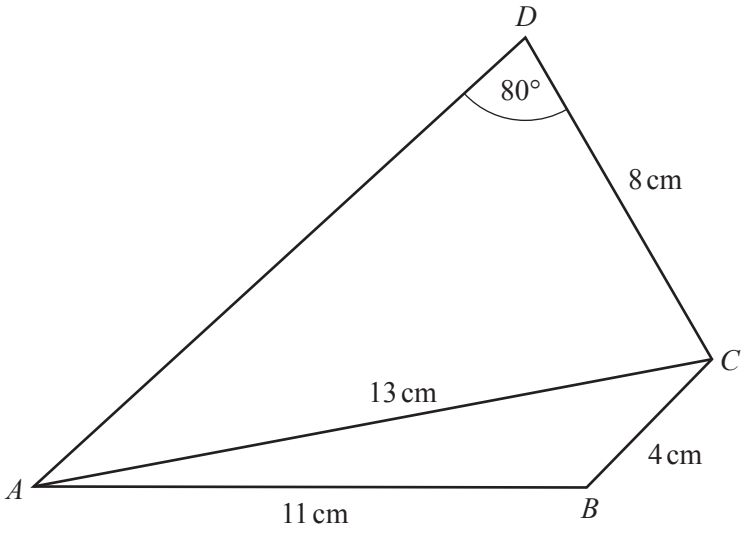
(iv) Find an estimate of the interquartile range.

.....tonnes [1]

(v) Find an estimate of the number of days when the mass was greater than 20 tonnes.

..... [2]

6



NOT TO SCALE

(a) Calculate angle *ACB*.

Angle *ACB* = ... [4]

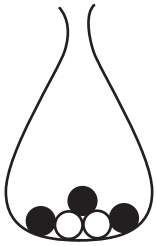
(b) Calculate angle *ACD*.

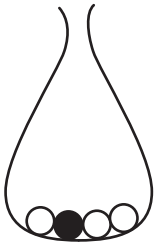
Angle *ACD* = ... [4]

(c) Calculate the area of the quadrilateral *ABCD*.

..... cm^2 [3]

7


Bag *A*


Bag *B*

Bag *A* contains 3 black balls and 2 white balls.
Bag *B* contains 1 black ball and 3 white balls.

(a) A ball is taken at random from each bag.

(i) Show that a black ball is more likely to be taken from bag *A* than from bag *B*.

[1]

(ii) Find the probability that the two balls have different colors.

..... [3]

(b) The balls are returned to their original bags.
Three balls are taken at random from bag *A*, without replacement.

Find the probability that

(i) they are all black,

..... [2]

(ii) they are all white.

..... [1]

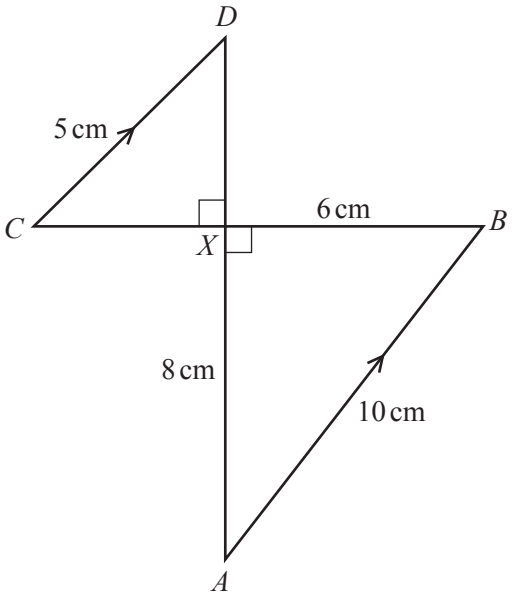
(c) The balls are returned to their original bags.

A ball is taken at random from bag *A* and its color is recorded.
This ball is then placed in bag *B*.
A ball is then taken at random from bag *B*.

Find the probability that the ball taken from bag *B* has a different color from the ball taken from bag *A*.

..... [3]

8 (a)



NOT TO SCALE

In the diagram, AB and CD are parallel.
AD and BC intersect at right angles at the point X.
$AB = 10$ cm, $CD = 5$ cm, $AX = 8$ cm, and $BX = 6$ cm.

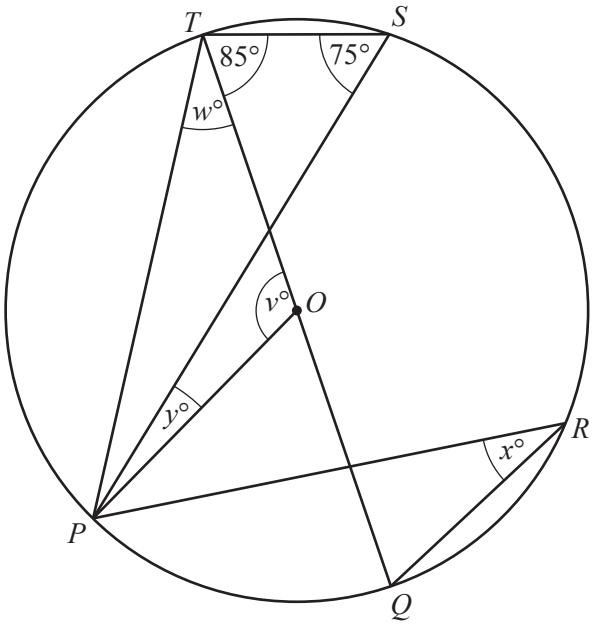
(i) Use similar triangles to calculate DX.

$DX =$ ..... cm [2]

(ii) Calculate angle XAB.

Angle $XAB =$ ..... [2]

(b)



NOT TO SCALE

P, Q, R, S, and T lie on the circle, center O.
Angle $PST = 75°$ and angle $QTS = 85°$.

Find the values of v, w, x, and y.

$v =$ .....

$w =$ .....

$x =$ .....

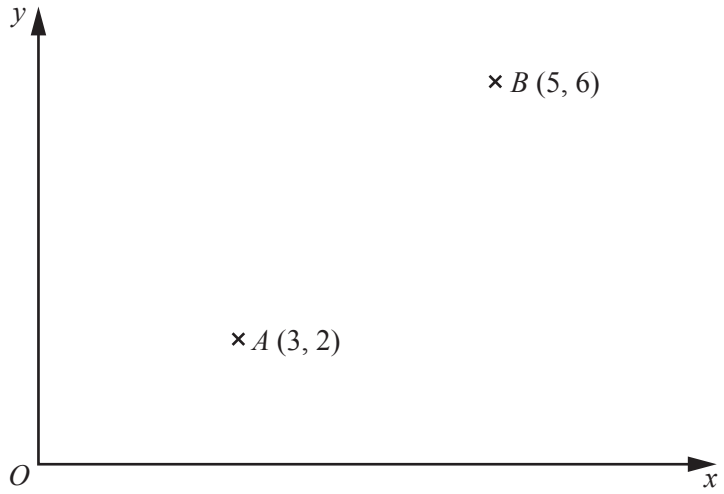
$y =$ ..... [6]

(c) Two containers are mathematically similar.
The surface area of the larger container is $226\,cm^2$ and the surface area of the smaller container is $94\,cm^2$.
The volume of the larger container is $680\,cm^3$.

Find the volume of the smaller container.

..... cm^3 [3]

9



(a) Find the column vector $\overrightarrow{AB}$.

$\overrightarrow{AB} = \begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [1]

(b) Find $\left|\overrightarrow{AB}\right|$.

$\left|\overrightarrow{AB}\right|$ = ... [2]

(c) B is the mid-point of the line AC.

Find the co-ordinates of C.

(..... , ...) [2]

(d) Find the equation of the straight line that passes through A and B.

..... [3]

(e) The straight line that passes through A and B cuts the y-axis at D.

Write down the co-ordinates of D.

(..... , ...) [1]

10 $f(x) = 3x + 4$ $g(x) = 2x - 1$ $h(x) = 3^x$

(a) Find $g\left(\frac{1}{2}\right)$.

..... [1]

(b) Find $f(h(-1))$.

..... [2]

(c) Find $g^{-1}(x)$.

$g^{-1}(x)$ = ... [2]

(d) Find $f(f(x))$ in its simplest form.

..... [2]

(e) Find $(f(x))^2$ in the form $ax^2 + bx + c$.

..... [2]

(f) Find x when $h^{-1}(x) = g(2)$.

x = ... [2]

Question 11 is printed on the next page.

11 **(a)** Find the next term and the nth term of this sequence.

$$\frac{3}{5}, \quad \frac{4}{7}, \quad \frac{5}{9}, \quad \frac{6}{11}, \quad \frac{7}{13}, \quad \ldots$$

Next term = ...

nth term = ... [3]

(b) Find the nth term of each sequence.

(i) –1, –3, –5, –7, –9, …

..... [2]

(ii) 2, 9, 28, 65, 126, …

..... [2]