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0580/43

October/November 2018

2 hours 30 minutes

Additional Materials: Electronic calculator Geometrical instruments
Tracing paper (optional)

READ THESE INSTRUCTIONS FIRST

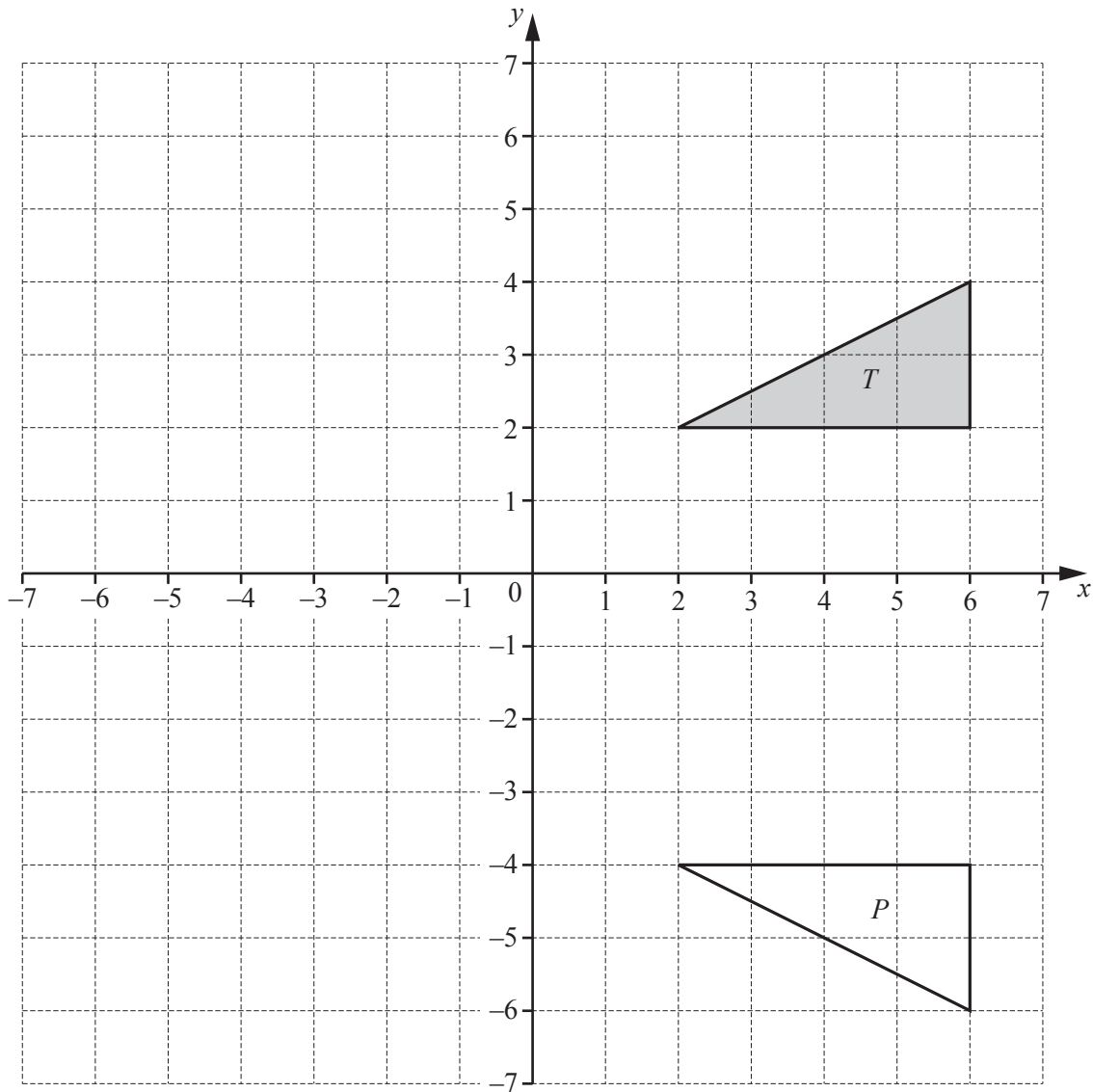
DO **NOT** WRITE IN ANY BARCODES.

For π , use either your calculator value or 3.142.

The total of the marks for this paper is 130.

This document consists of **19** printed pages and **1** blank page.

1 (a)



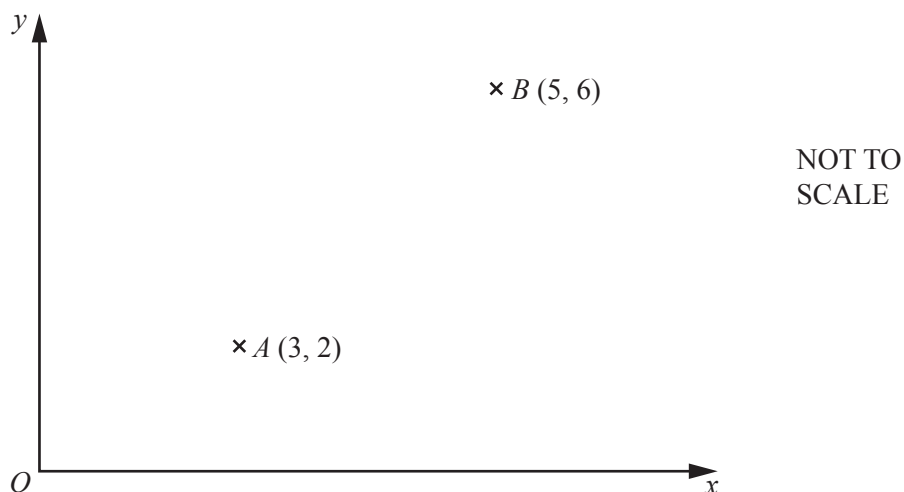
- (i) Describe fully the **single** transformation that maps triangle T onto triangle P .

.....

..... [2]

- (ii) Translate triangle T by the vector $\begin{pmatrix} -2 \\ -5 \end{pmatrix}$. [2]
- (iii) Rotate triangle T through 90° anticlockwise about $(0, 0)$. [2]
- (iv) Enlarge triangle T by scale factor $-\frac{1}{2}$ with centre $(0, 0)$. [2]

(b)



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

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

- (ii) Find $|\overrightarrow{AB}|$.

$$|\overrightarrow{AB}| = \dots\dots\dots [2]$$

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

Find the co-ordinates of C .

$$(\dots\dots\dots, \dots\dots\dots) [2]$$

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

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

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

Write down the co-ordinates of D .

$$(\dots\dots\dots, \dots\dots\dots) [1]$$

- 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.

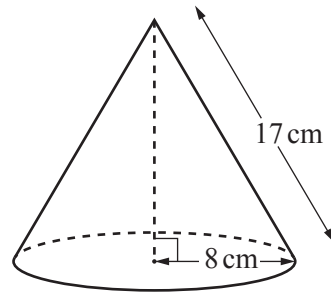
..... [3]

- (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.

[The curved surface area, A , of a cone with radius r and slant height l is $A = \pi r l$.]

..... cm² [2]

- (ii) Calculate the volume of the cone.

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

..... cm³ [4]

- (iii) The cone is made of wood and 1 cm³ of the wood has a mass of 0.8 g.

Calculate the mass of the cone.

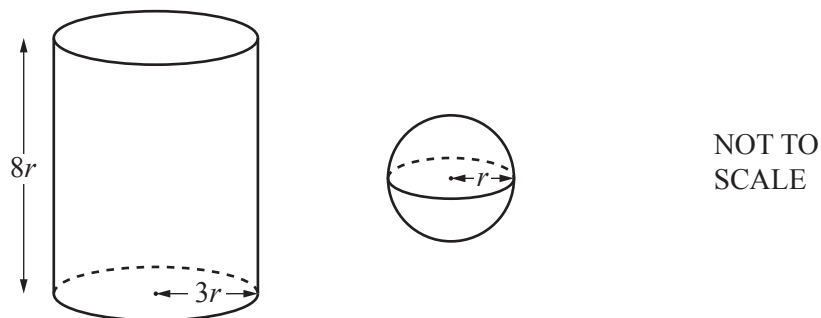
..... g [1]

- (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)



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.

[The volume, V , of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

..... [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 .

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

..... cm^2 [4]

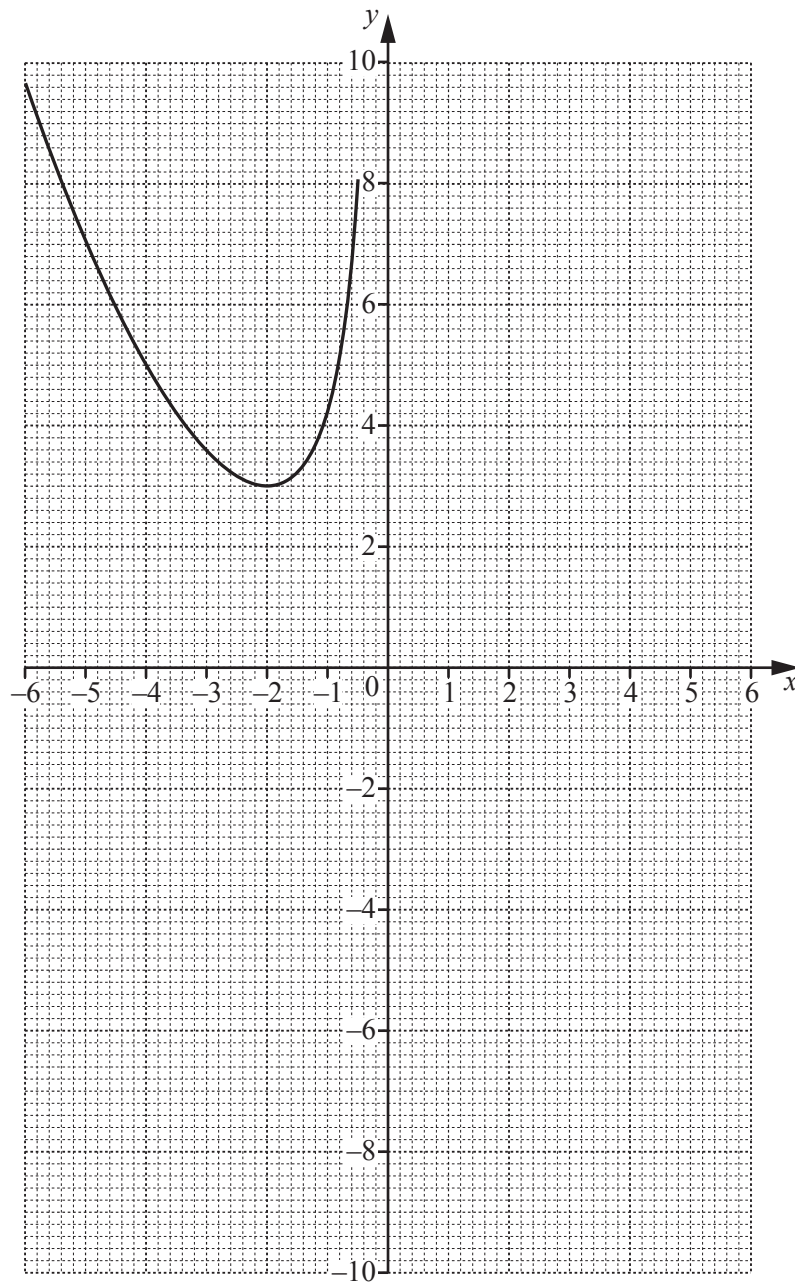
4 $f(x) = \frac{x^2}{4} - \frac{4}{x}, x \neq 0$

(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 $-6 \leq x \leq -0.5$ is drawn on the grid.



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

[3]

- (c) By drawing a suitable tangent, estimate the gradient 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 $-4 \leq x \leq -1$ and $1 \leq x \leq 4$. [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 .

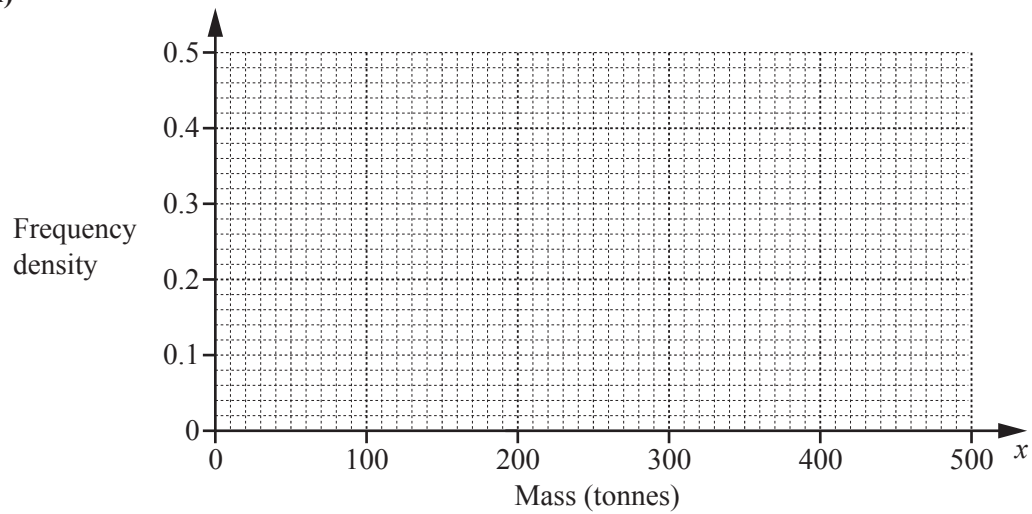
$k =$ [2]

- 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)	$100 < x \leq 200$	$200 < x \leq 250$	$250 < x \leq 300$	$300 < x \leq 500$
Frequency	8	20	12	12

- (i) Calculate an estimate of the mean.

(ii)



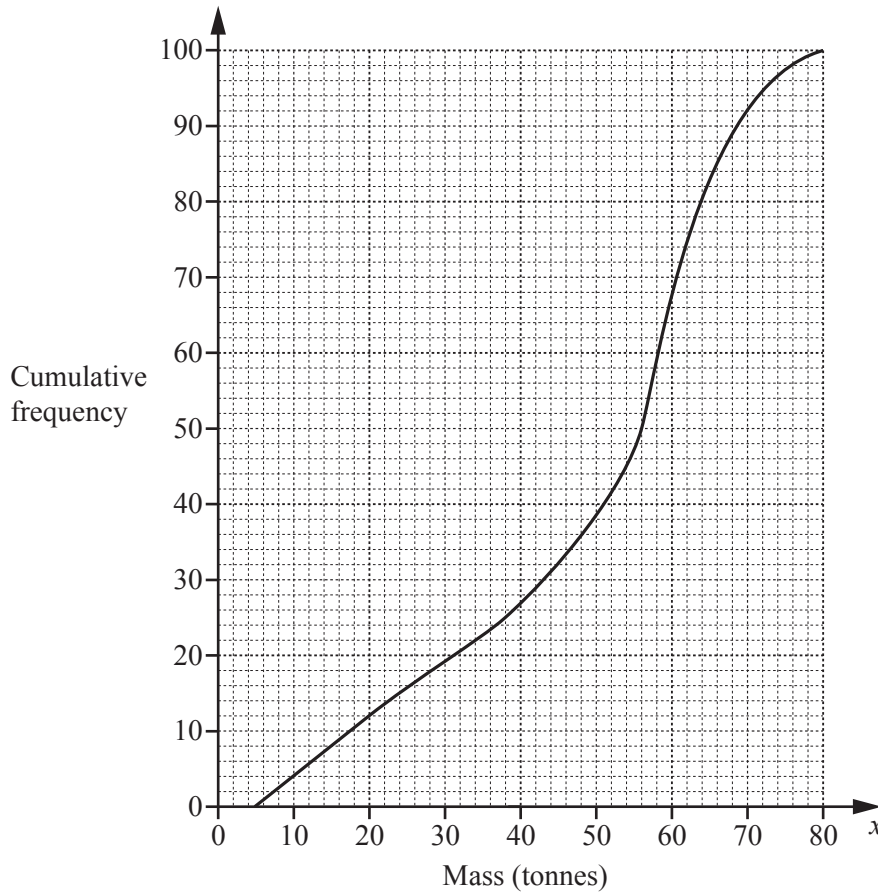
On the grid, draw a histogram to show the information in the table.

[4]

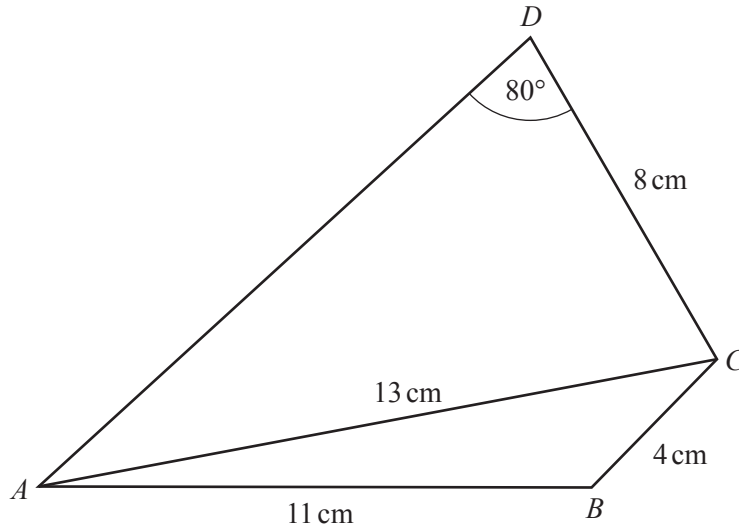
- (b) Another factory also recycles metal.

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]



NOT TO
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- (a) Calculate angle ACB .

Angle $ACB = \dots\dots\dots$ [4]

- (b) Calculate angle ACD .

Angle $ACD = \dots\dots\dots$ [4]

- (c) Calculate the area of the quadrilateral $ABCD$.

..... cm^2 [3]

7



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 colours.

..... [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 colour is recorded.

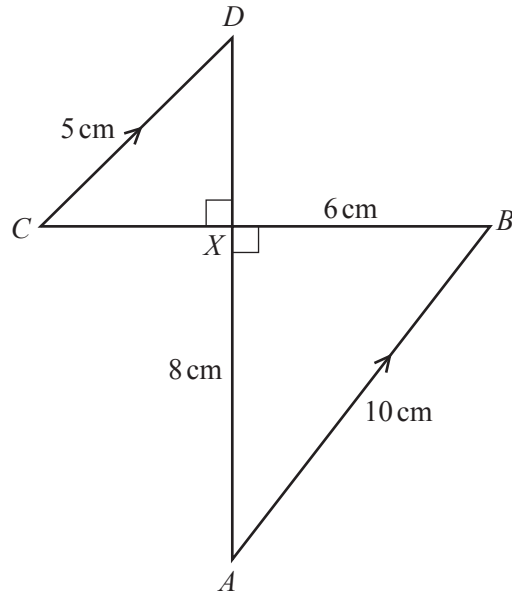
This ball is then placed in bag B .

A ball is then taken at random from bag B .

Find the probability that the ball taken from bag B has a different colour to 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.

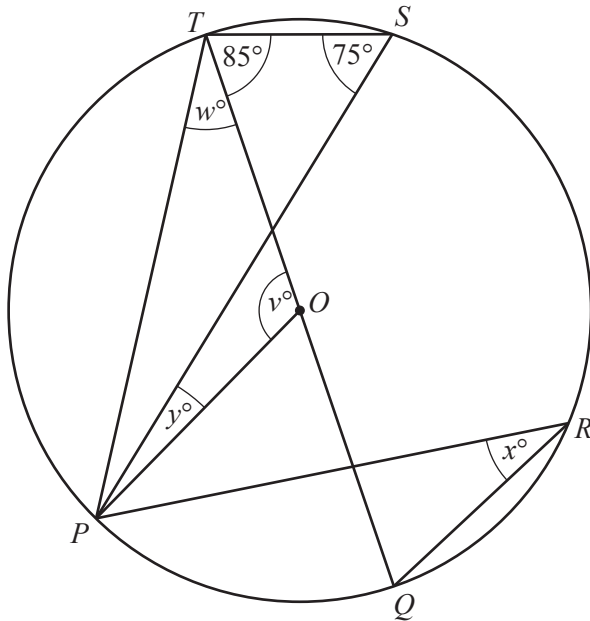
(i) Use similar triangles to calculate DX .

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

(ii) Calculate angle XAB .

Angle $XAB = \dots\dots\dots$ [2]

(b)

NOT TO
SCALE

P, Q, R, S and T lie on the circle, centre O .
Angle $PST = 75^\circ$ and angle $QTS = 85^\circ$.

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

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

..... [1]

(b) Find $fh(-1)$.

..... [2]

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

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

(d) Find $ff(x)$ 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]

- 10 (a) Find the next term and the n th term of this sequence.

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

Next term =

n th term = [3]

- (b) Find the n th term of each sequence.

(i) $-1, \quad -3, \quad -5, \quad -7, \quad -9, \quad \dots$

..... [2]

(ii) $2, \quad 9, \quad 28, \quad 65, \quad 126, \quad \dots$

..... [2]

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