



CANDIDATE  
NAME

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CENTRE  
NUMBER

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CANDIDATE  
NUMBER

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## 0580/42

February/March 2021

**2 hours 30 minutes**

You will need: Geometrical instruments

- 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.

- 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

|                                                                                                    |
|----------------------------------------------------------------------------------------------------|
| <p style="text-align: center;"><b>Painter</b></p> <p style="text-align: center;">\$35 per hour</p> |
|----------------------------------------------------------------------------------------------------|

|                                                                                                                                                                                                    |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p style="text-align: center;"><b>Plumber</b></p> <p style="text-align: center;">Fixed charge \$40</p> <p style="text-align: center;">plus</p> <p style="text-align: center;">\$26.50 per hour</p> |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                                                                                                                                                                                                                           |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p style="text-align: center;"><b>Electrician</b></p> <p style="text-align: center;">\$48 per hour<br/>for the first 2 hours</p> <p style="text-align: center;">then</p> <p style="text-align: center;">\$32 per hour</p> |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

These are the rates charged by a painter, a plumber and an electrician who do some work for Mr Sharma.

- (a) The painter works for 7 hours.

Calculate the amount Mr Sharma pays the painter.

\$ ..... [1]

- (b) Mr Sharma pays the plumber \$252.

Calculate how many hours the plumber works.

..... hours [2]

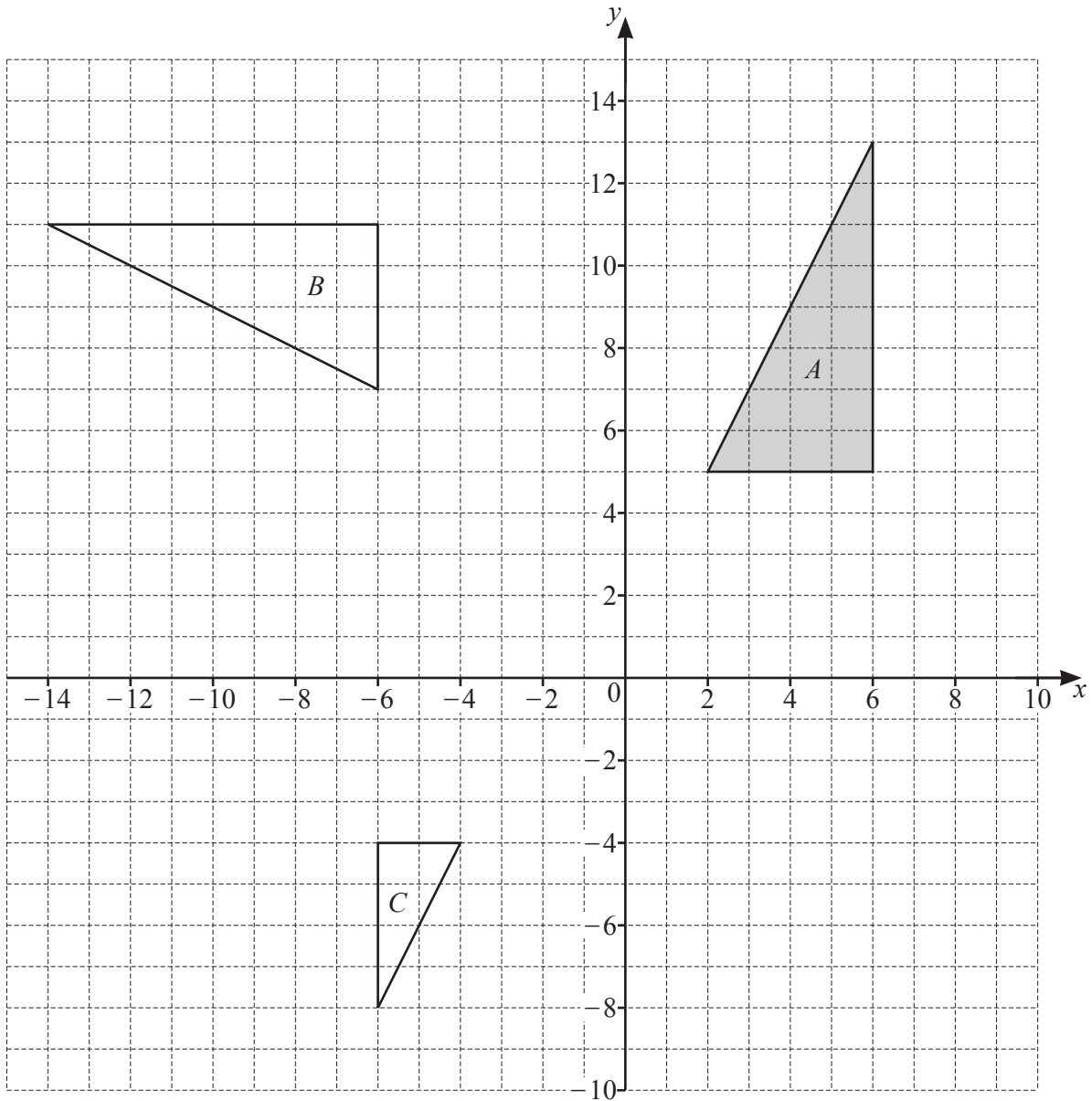
- (c) Mr Sharma pays the electrician \$224.

Calculate how many hours the electrician works.

..... hours [2]

- (d) Write down the ratio of the amount Mr Sharma pays to the painter, the plumber and the electrician.  
Give your answer in its lowest terms.

painter : plumber : electrician = ..... : ..... : ..... [2]



(a) Describe fully the **single** transformation that maps

(i) triangle  $A$  onto triangle  $B$ ,

..... [3]

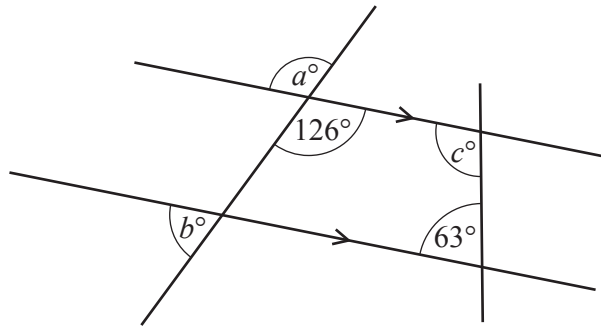
(ii) triangle  $A$  onto triangle  $C$ .

..... [3]

(b) Draw the image of triangle  $A$  after a translation by the vector  $\begin{pmatrix} -5 \\ -10 \end{pmatrix}$ . [2]

(c) Draw the image of triangle  $A$  after a reflection in the line  $y = 4$ . [2]

3 (a)

NOT TO  
SCALE

The diagram shows two straight lines intersecting two parallel lines.

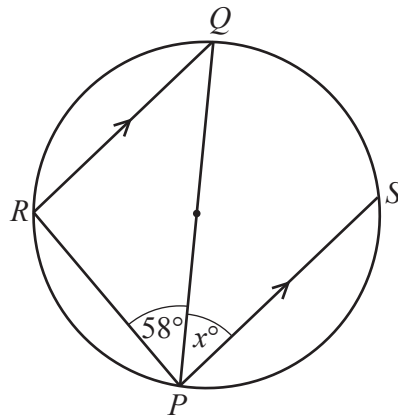
Find the values of  $a$ ,  $b$  and  $c$ .

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

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

$$c = \dots\dots\dots [3]$$

(b)

NOT TO  
SCALE

Points  $R$  and  $S$  lie on a circle with diameter  $PQ$ .

$RQ$  is parallel to  $PS$ .

Angle  $RPQ = 58^\circ$ .

Find the value of  $x$ , giving a geometrical reason for each stage of your working.

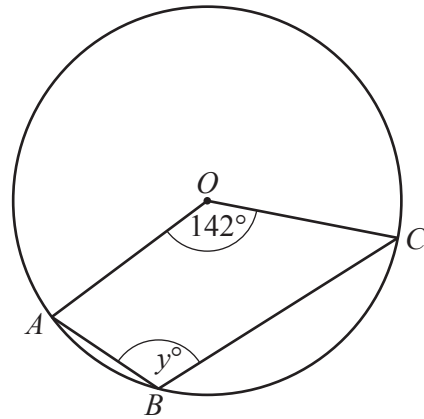
.....

.....

.....

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

(c)

NOT TO  
SCALE

Points  $A$ ,  $B$  and  $C$  lie on a circle, centre  $O$ .  
Angle  $AOC = 142^\circ$ .

Find the value of  $y$ .

$y = \dots\dots\dots$  [2]

- 4 (a) A shop gives each of 1000 people a voucher.  
28 people use their voucher.  
The shop now gives each of 16 500 people a voucher.

Calculate how many of these 16 500 people are expected to use their voucher.

..... [1]

- (b) In a class activity, all the 15 students wear hats.  
7 students wear red hats, 6 students wear green hats and 2 students wear white hats.

- (i) One of these students is picked at random.

Find the probability that this student wears a red hat.

..... [1]

- (ii) Two of the 15 students are picked at random.

Show that the probability that these two students wear hats of the same colour is  $\frac{37}{105}$ .

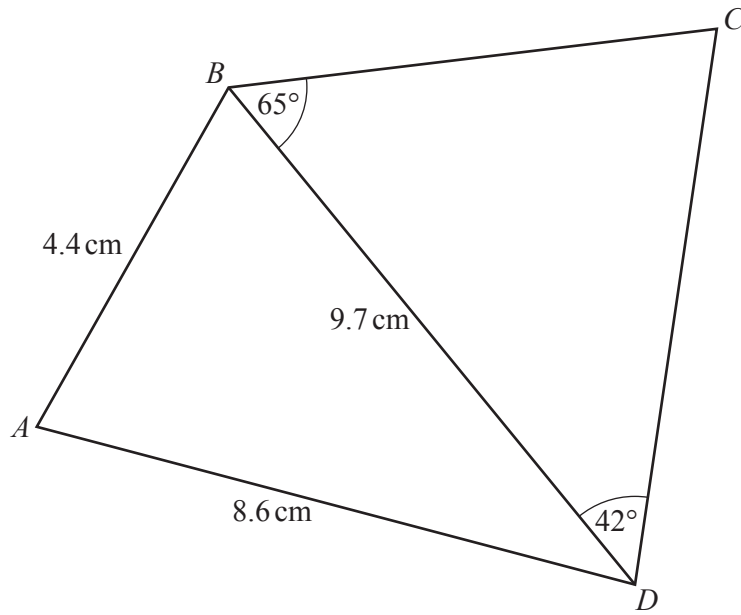
[3]

- (iii) Three of the 15 students are picked at random.

Find the probability that at least two of these three students wear red hats.

..... [4]

5

NOT TO  
SCALE

- (a) Calculate angle  $ADB$ .

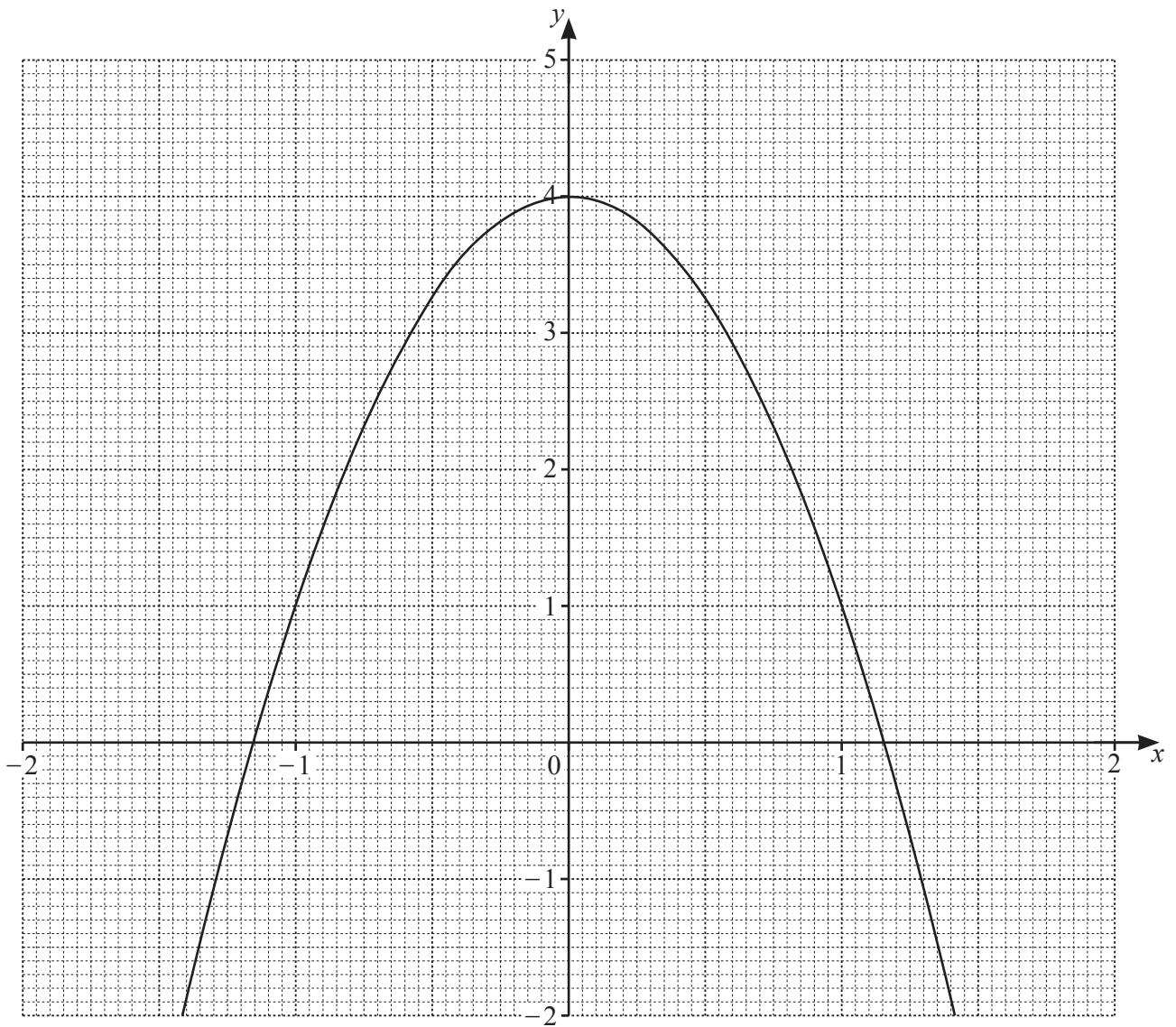
Angle  $ADB = \dots\dots\dots$  [3]

- (b) Calculate  $DC$ .

$DC = \dots\dots\dots \text{ cm}$  [4]

- (c) Calculate the shortest distance from  $C$  to  $BD$ .

$\dots\dots\dots \text{ cm}$  [3]



- (a) The grid shows the graph of  $y = a + bx^2$ .

The graph passes through the points with coordinates (0, 4) and (1, 1).

- (i) Find the value of  $a$  and the value of  $b$ .

$a =$  .....

$b =$  ..... [2]

- (ii) Write down the equation of the tangent to the graph at  $(0, 4)$ .

..... [1]

- (iii) The equation of the tangent to the graph at  $x = -1$  is  $y = 6x + 7$ .

Find the equation of the tangent to the graph at  $x = 1$ .

..... [2]

- (b) The table shows some values for  $y = 1 + \frac{5}{3-x}$  for  $-2 \leq x \leq 1.5$ .

|     |    |      |    |      |   |     |   |      |
|-----|----|------|----|------|---|-----|---|------|
| $x$ | -2 | -1.5 | -1 | -0.5 | 0 | 0.5 | 1 | 1.5  |
| $y$ | 2  | 2.11 |    | 2.43 |   | 3   |   | 4.33 |

- (i) Complete the table. [3]

- (ii) On the grid, draw the graph of  $y = 1 + \frac{5}{3-x}$  for  $-2 \leq x \leq 1.5$ . [4]

- (c) (i) Write down the values of  $x$  where the two graphs intersect.

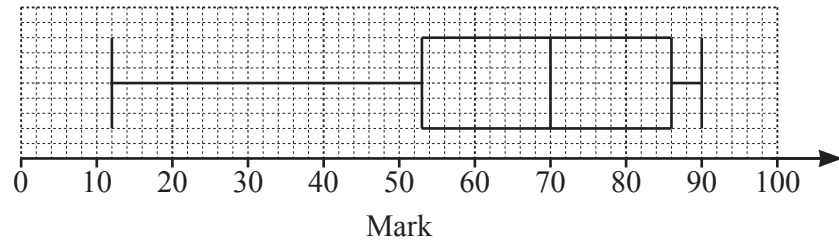
$x =$  ..... or  $x =$  ..... [2]

- (ii) The answers to **part(c)(i)** are two solutions of a cubic equation in terms of  $x$ .

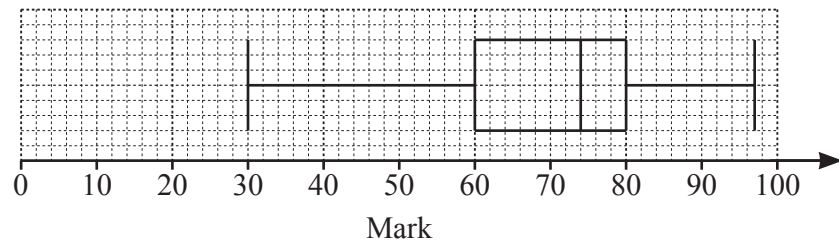
Find this equation in the form  $ax^3 + bx^2 + cx + d = 0$ , where  $a, b, c$  and  $d$  are integers.

..... [4]

- 7 (a) The box-and-whisker plot shows information about the marks scored by some students in a test.



- (i) Write down the median mark. .... [1]
- (ii) Work out the range. .... [1]
- (iii) Jais scored a mark in the test that was higher than the marks scored by 75% of the students.  
Write down a possible mark for Jais. .... [1]
- (iv) This box-and-whisker plot shows information about the marks scored by the same students in a second test.



Make one comparison between the distributions of marks in the two tests.

..... [1]

- (b) The table shows information about the height,  $h$  cm, of each of 50 plants.

| Height ( $h$ cm) | $0 < h \leq 20$ | $20 < h \leq 30$ | $30 < h \leq 34$ | $34 < h \leq 40$ | $40 < h \leq 60$ |
|------------------|-----------------|------------------|------------------|------------------|------------------|
| Frequency        | 4               | 9                | 20               | 15               | 2                |

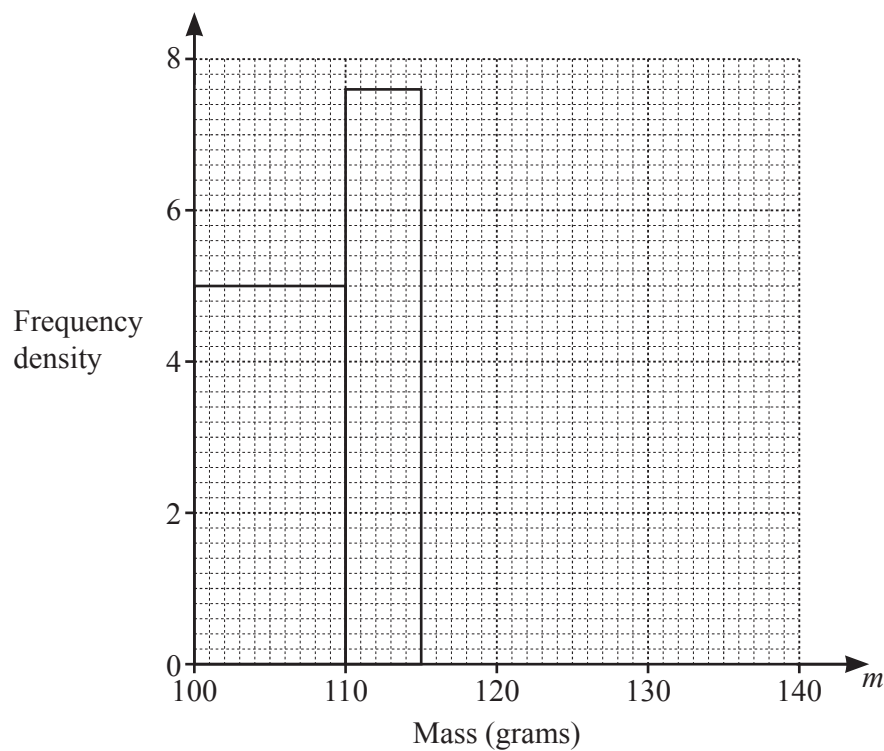
Calculate an estimate of the mean.

..... cm [4]

- (c) Some apples are weighed and the mass,  $m$  grams, of each apple is recorded.  
The table shows the results.

| Mass ( $m$ grams) | $100 < m \leq 110$ | $110 < m \leq 115$ | $115 < m \leq 125$ | $125 < m \leq 140$ |
|-------------------|--------------------|--------------------|--------------------|--------------------|
| Frequency         | 50                 | $x$                | 44                 | 51                 |

The histogram shows some of the information from the table.



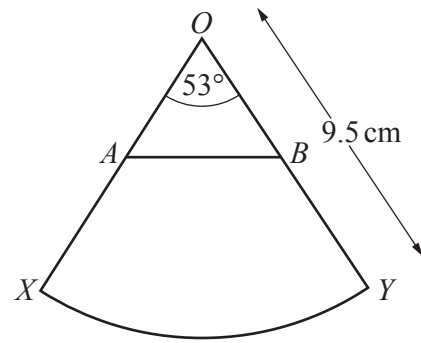
- (i) Work out the value of  $x$ .

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

- (ii) Complete the histogram.

[2]

8 (a)

NOT TO  
SCALE

The diagram shows a sector  $OXY$  of a circle with centre  $O$  and radius  $9.5$  cm.  
The sector angle is  $53^\circ$ .

$A$  lies on  $OX$ ,  $B$  lies on  $OY$  and  $OA = OB$ .

- (i) Show that the area of the sector is  $41.7 \text{ cm}^2$ , correct to 1 decimal place.

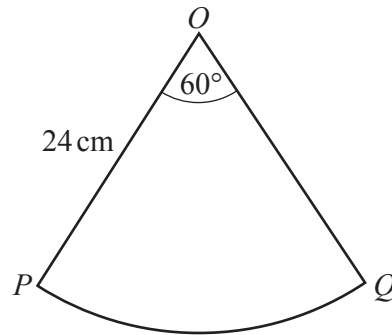
[2]

- (ii) The area of triangle  $OAB$  is  $\frac{1}{3}$  of the area of sector  $OXY$ .

Calculate  $OA$ .

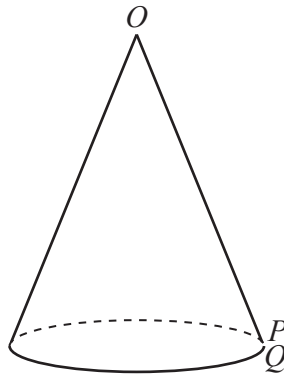
$OA = \dots\dots\dots \text{ cm}$  [4]

(b)

NOT TO  
SCALE

The diagram shows a sector  $OPQ$  of a circle with centre  $O$  and radius 24 cm. The sector angle is  $60^\circ$ .

A cone is made from this sector by joining  $OP$  to  $OQ$ .

NOT TO  
SCALE

Calculate the volume of the cone.

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

.....  $\text{cm}^3$  [6]

9 (a) Factorise.

(i)  $5am + 10ap - bm - 2bp$

..... [2]

(ii)  $15(k+g)^2 - 20(k+g)$

..... [2]

(iii)  $4x^2 - y^4$

..... [2]

(b) Expand and simplify.

$$(x-3)(x+1)(3x-4)$$

..... [3]

(c)  $(x+a)^2 = x^2 + 22x + b$

Find the value of  $a$  and the value of  $b$ .

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

$$b = \dots\dots\dots [2]$$

- 10 (a)** A box is a cuboid with length 45 cm, width 30 cm and height 42 cm.  
The box is completely filled with 90.72 kg of sand.

Calculate the density of this sand in  $\text{kg/m}^3$ .  
[Density = mass  $\div$  volume]

.....  $\text{kg/m}^3$  [3]

- (b)** A bag contains  $15000\text{cm}^3$  of sand.  
Some of this sand is used to completely fill a hole in the shape of a cylinder.  
The hole is 30 cm deep and has radius 10 cm.

Calculate the percentage of the sand from the bag that is used.

..... % [3]

- (c)** Sand costs \$98.90 per tonne.  
This cost includes a tax of 15%.

Calculate the amount of tax paid per tonne of sand.

\$ ..... [3]

- (d)** Raj buys some sand for 3540 rupees.

Calculate the cost in dollars when the exchange rate is \$1 = 70.8 rupees.

\$ ..... [2]

**11** Gaya spends \$48 to buy books that cost \$ $x$  each.

**(a)** Write down an expression, in terms of  $x$ , for the number of books Gaya buys.

..... [1]

**(b)** Myra spends \$60 to buy books that cost \$( $x + 2$ ) each.  
Gaya buys 4 more books than Myra.

Show that  $x^2 + 5x - 24 = 0$ .

**(c)** Solve by factorisation.

$$x^2 + 5x - 24 = 0$$

[4]

$x =$  ..... or  $x =$  ..... [3]

**(d)** Find the number of books Myra buys.

..... [1]

- 12 (a) Find the gradient of the curve  $y = 2x^3 - 7x + 4$  when  $x = -2$ .

..... [3]

- (b)  $A$  is the point  $(7, 2)$  and  $B$  is the point  $(-5, 8)$ .

- (i) Calculate the length of  $AB$ .

..... [3]

- (ii) Find the equation of the line that is perpendicular to  $AB$  and that passes through the point  $(-1, 3)$ .  
Give your answer in the form  $y = mx + c$ .

$y =$  ..... [4]

(iii)  $AB$  is one side of the parallelogram  $ABCD$  and

- $\overrightarrow{BC} = \begin{pmatrix} -a \\ -b \end{pmatrix}$  where  $a > 0$  and  $b > 0$
- the gradient of  $BC$  is 1
- $|\overrightarrow{BC}| = \sqrt{8}$ .

Find the coordinates of  $D$ .

( ..... , ..... ) [4]

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