



CANDIDATE  
NAME

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CENTRE  
NUMBER

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CANDIDATE  
NUMBER

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## 4024/22

May/June 2020

**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 100.
- 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) Stefan had an annual income of \$21 500 in 2018.  
His annual income increased to \$22 790 in 2019.

Calculate the percentage increase.

..... % [2]

- (b) Stefan invests \$1260 in a bank.  
The bank pays simple interest at a rate of 2.5% per year.

Calculate the amount Stefan has in the bank at the end of 3 years.

\$ ..... [2]

- (c) Stefan changes 4300 Indian Rupees (INR) into dollars (\$).  
The exchange rate is \$1 = 67.8 INR.

Work out how much he receives.

Give your answer correct to the nearest dollar.

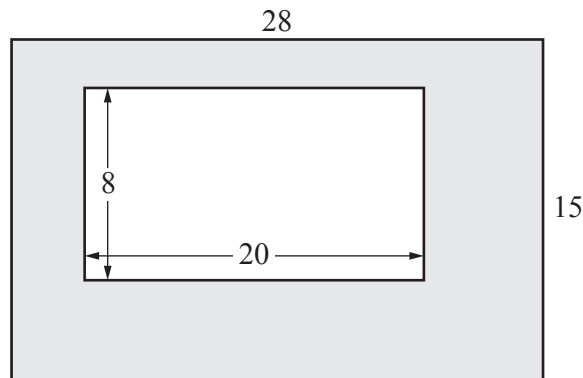
\$ ..... [2]

- 2 (a) The length of a rectangle is 6 cm more than its width,  $w$  cm.  
The perimeter of the rectangle is 37 cm.

Form an equation in  $w$  and solve it to find the width of the rectangle.

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

(b)



NOT TO  
SCALE

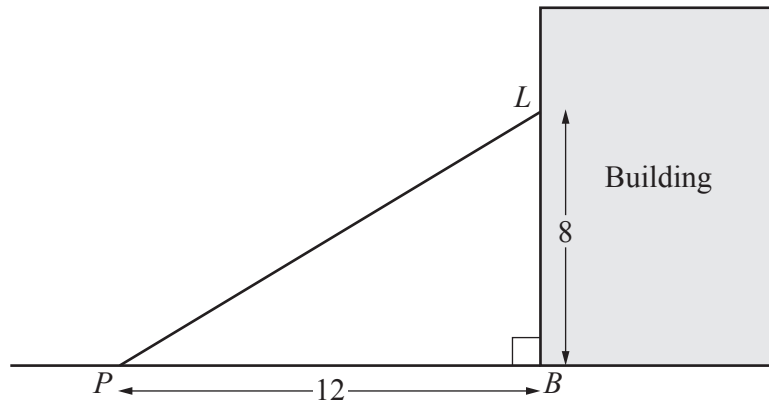
A rectangle 20 cm by 8 cm is cut from a rectangle 28 cm by 15 cm.  
Each measurement is given correct to the nearest centimetre.

Calculate the upper bound for the area of the shaded region.

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

- 3 A light,  $L$ , is fixed on a building 8 m above the base,  $B$ , of the building.

(a)



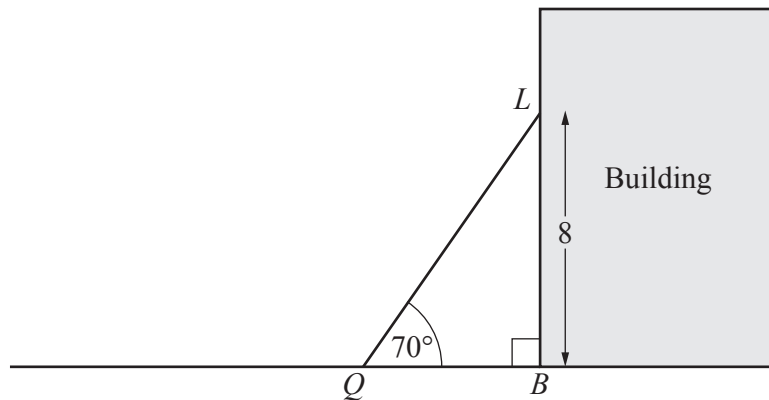
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A point,  $P$ , is on the horizontal ground 12 m from  $B$ .

Calculate the angle of elevation of  $L$  from  $P$ .

..... [2]

(b)



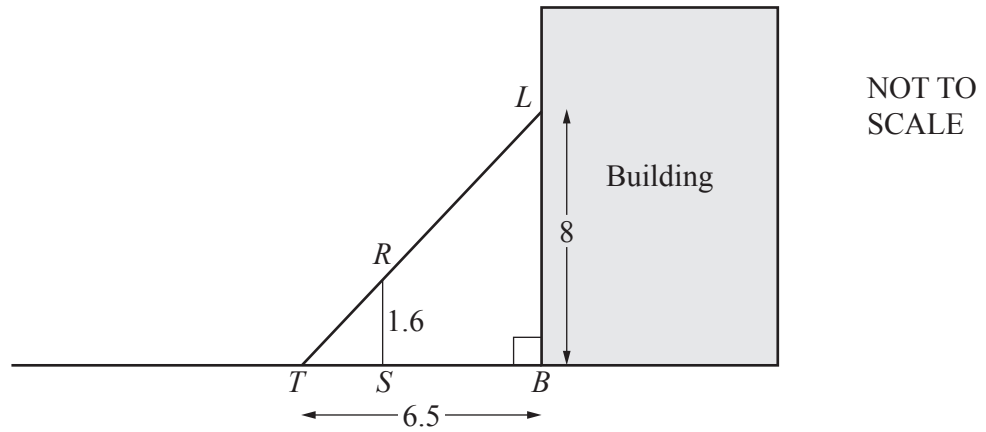
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A ladder is placed on the ground at  $Q$  to reach the light,  $L$ .  
The ladder makes an angle of  $70^\circ$  with the ground.

Calculate  $QL$ .

$QL =$  ..... m [2]

(c)



A vertical pole,  $RS$ , of length 1.6 m is placed touching the horizontal ground.  
 The light produces a shadow,  $TS$ , of the pole on the horizontal ground.  
 $LRT$  is a straight line and  $TB = 6.5$  m.

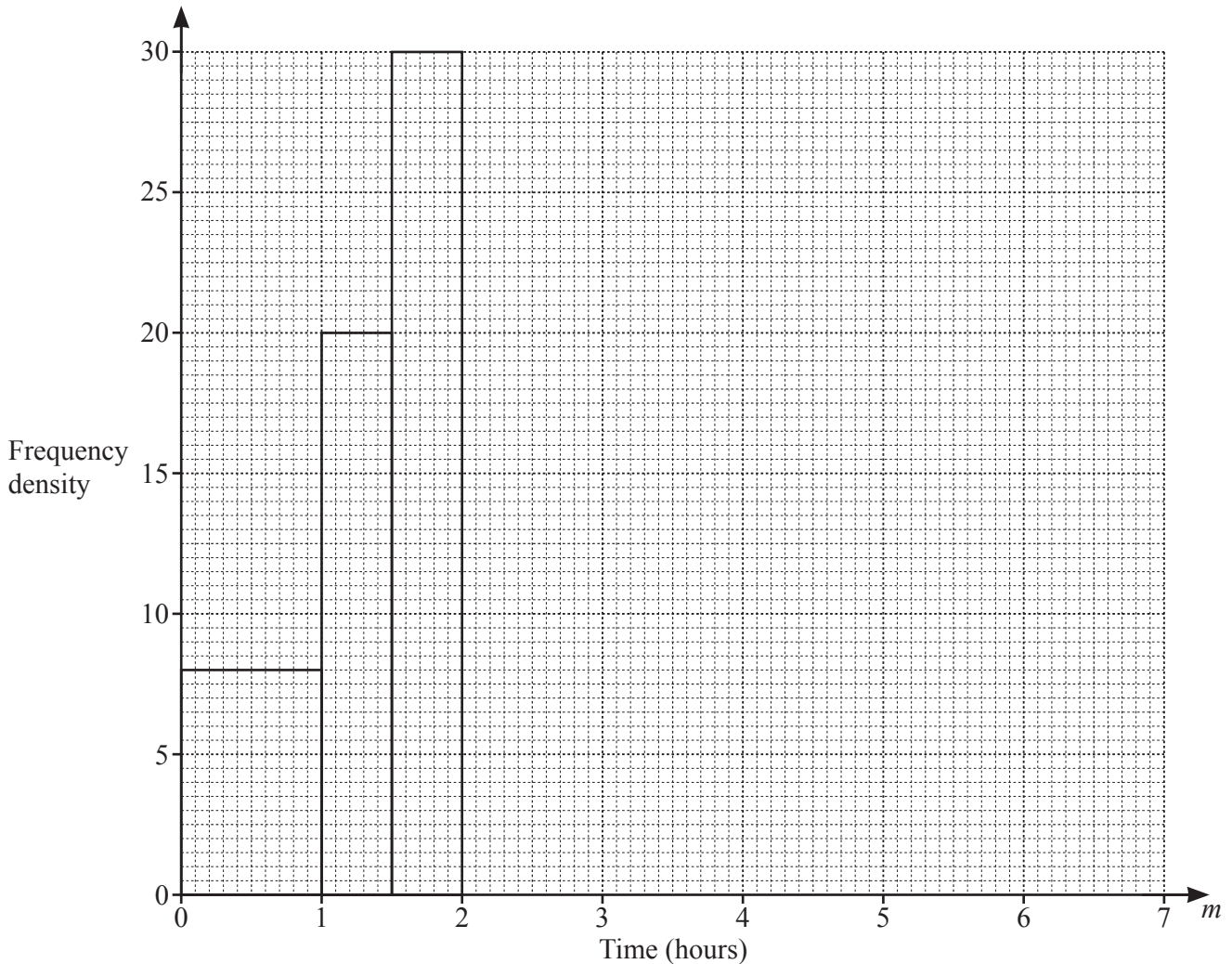
Calculate  $TS$ .

$TS = \dots\dots\dots$  m [2]

- 4 (a) The table summarises the time,  $m$  hours, that each student in a year group spent listening to music in one day.

Some of the results are shown on the histogram.

Time ( $m$ hours)	Frequency
$0 < m \leq 1$	8
$1 < m \leq 1\frac{1}{2}$	10
$1\frac{1}{2} < m \leq 2$	$p$
$2 < m \leq 2\frac{1}{2}$	14
$2\frac{1}{2} < m \leq 3\frac{1}{2}$	23
$3\frac{1}{2} < m \leq 5$	18
$5 < m \leq 7$	12



- (i) Use the histogram to find the value of  $p$ .

$p = \dots\dots\dots$  [1]

- (ii) Complete the histogram.

[3]

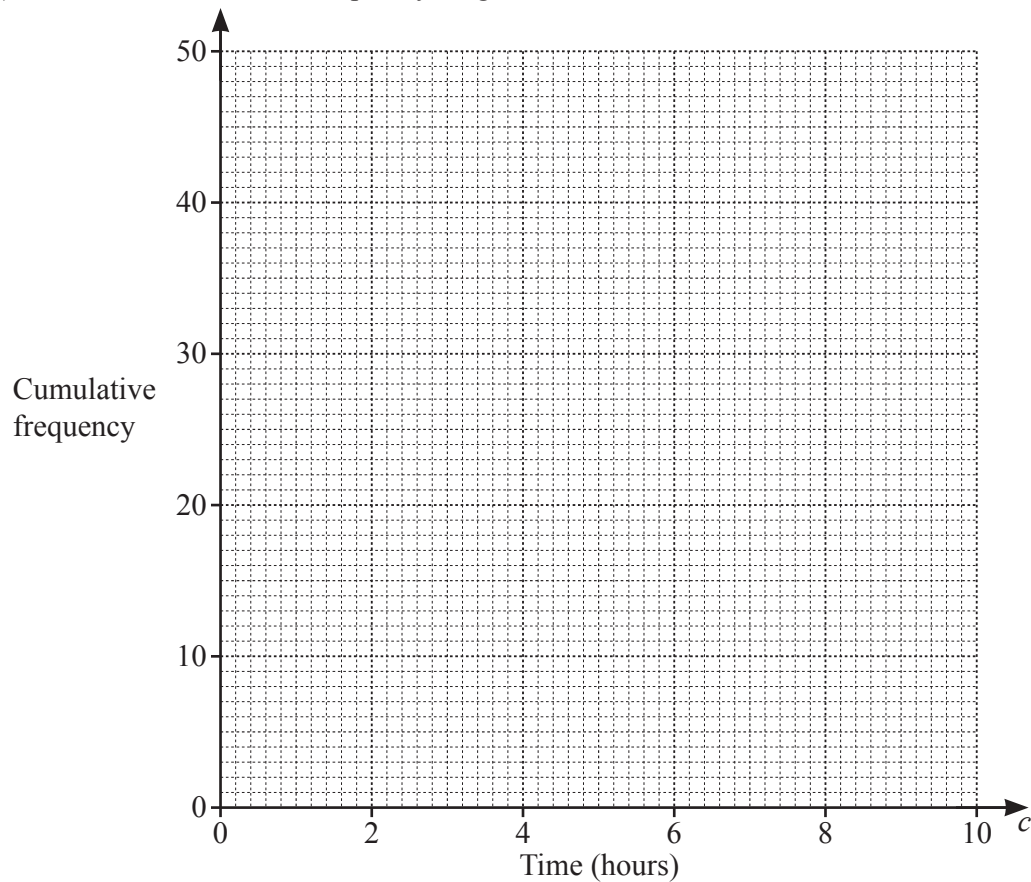
- (b) This table summarises the time,  $c$  hours, that each student in a group of 50 students spent cooking in one week.

Time ( $c$ hours)	Frequency
$0 < c \leq 2$	8
$2 < c \leq 4$	16
$4 < c \leq 6$	15
$6 < c \leq 8$	7
$8 < c \leq 10$	4

- (i) Calculate an estimate of the mean time spent cooking.

..... hours [3]

- (ii) Draw the cumulative frequency diagram.



[3]

- (iii) Use the cumulative frequency diagram to find an estimate for the median.

..... hours [1]

[Turn over]

- 5 (a) Solve these simultaneous equations.  
Show your working.

$$\begin{aligned} 2x - 4y &= 11 \\ 3x + 3y &= -6 \end{aligned}$$

$$x = \dots\dots\dots$$

$$y = \dots\dots\dots [4]$$

- (b) Solve the equation  $2x^2 = 3(8 - x)$ .  
Show all your working and give your answers correct to 2 decimal places.

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



- (c)  $h$  is inversely proportional to the cube of  $g$ .  
 $h = 4.5$  when  $g = 2$ .

(i) Find the formula for  $h$  in terms of  $g$ .

$$h = \dots\dots\dots [2]$$

- (ii) Find the value of  $g$  when  $h = \frac{32}{3}$ .

$$g = \dots\dots\dots [2]$$

6 (a)

5

2

4

6

3

Two of these cards are chosen at random.

They are placed next to each other to give a two-digit number.

(i) Find the probability that the two-digit number is less than 30.

..... [1]

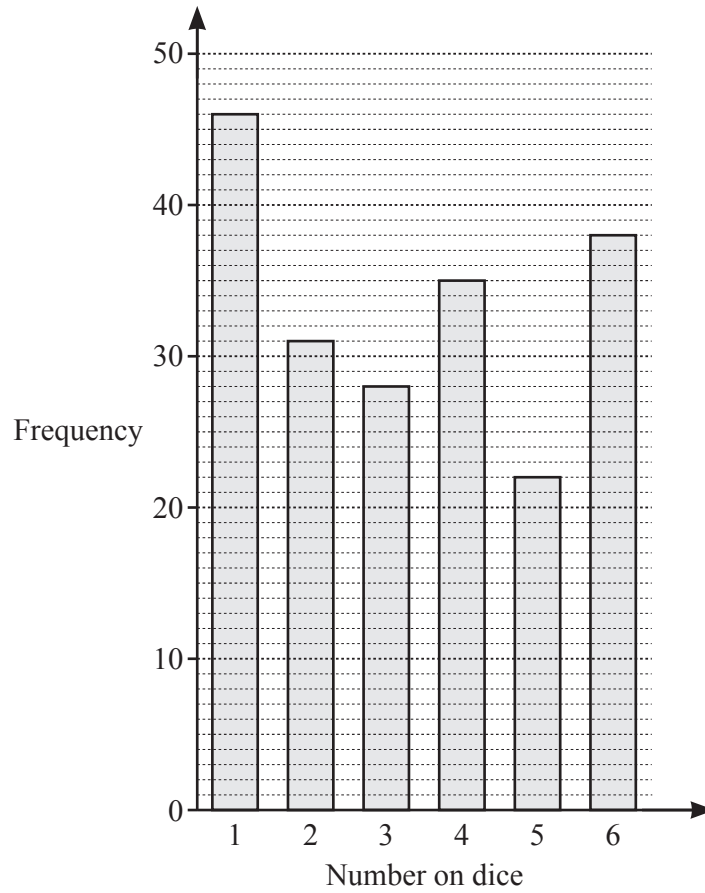
(ii) List all the possible two-digit numbers that are prime.

..... [2]

(iii) Find the probability that the two-digit number is a multiple of 4.

..... [2]

- (b) Rowan throws a dice 200 times.  
The bar chart shows his results.



- (i) Use the bar chart to complete the table of results.

Number on dice	1	2	3	4	5	6
Frequency	46	31	28			

[1]

- (ii) Using Rowan's results, find the relative frequency that he threw a number less than 3.

..... [2]

- (iii) Rowan says that the dice he has thrown is not a fair dice.

Make two comments to explain why the dice may not be fair.

.....

..... [2]

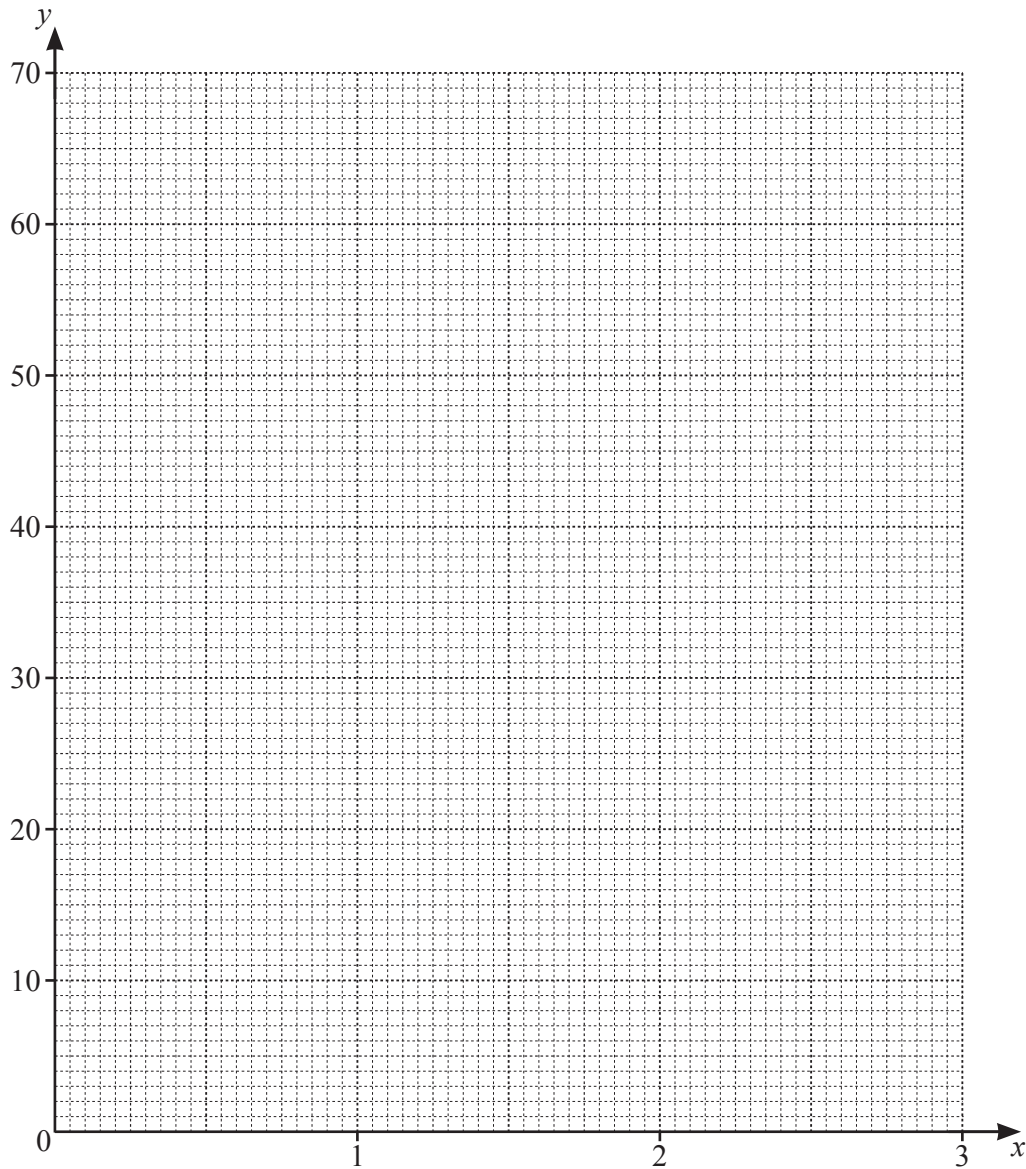
- 7 (a) The table shows some values for  $y = 4^x$ .

$x$	0	0.5	1	1.5	2	2.5	3
$y$			4	8	16	32	64

- (i) Complete the table.

[1]

- (ii) Draw the graph of  $y = 4^x$  for  $0 \leq x \leq 3$ .



[3]

- (iii) By drawing a tangent, estimate the gradient of the curve when  $x = 2$ .

..... [2]

- (iv) The solutions of the equation  $3(4^x) + ax + b = 0$  can be found from the points of intersection of  $y = 4^x$  and  $y = 20x - 12$ .

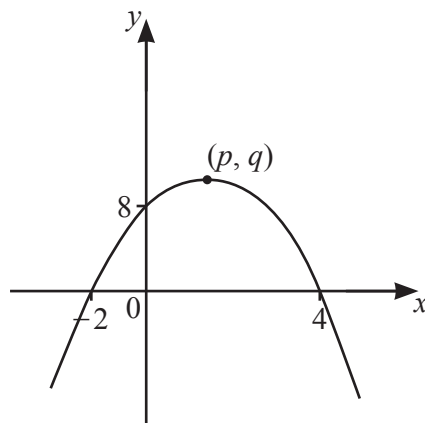
(a) Find the value of  $a$  and the value of  $b$ .

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

- (b) By drawing the line  $y = 20x - 12$  on the grid opposite, find all the solutions of  $3(4^x) + ax + b = 0$ .

$\dots\dots\dots$  [3]

- (b) Here is a sketch of the graph of a quadratic function.



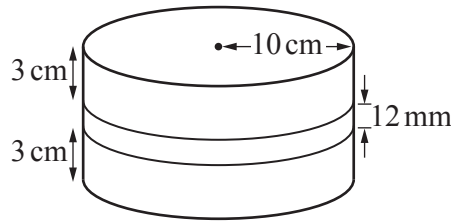
NOT TO  
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The curve has a maximum point  $(p, q)$ .

Find the value of  $p$  and the value of  $q$ .

$p = \dots\dots\dots q = \dots\dots\dots$  [3]

- 8 A birthday cake is in the shape of a cylinder.  
There are two layers of cake and one layer of icing.



Each layer of cake has radius 10 cm and height 3 cm.  
The icing, between the two layers of cake, has radius 10 cm and height 12 mm.

- (a) Calculate the volume of **icing** in the birthday cake.  
Give your answer in  $\text{cm}^3$ .

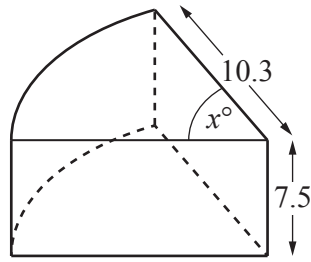
.....  $\text{cm}^3$  [2]

- (b) The top and curved surface of the birthday cake are now covered with chocolate.

Calculate the area of the birthday cake that is covered with chocolate.

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

- (c) Anil has a slice of this chocolate-covered birthday cake.



His slice is a prism of height 7.5 cm.

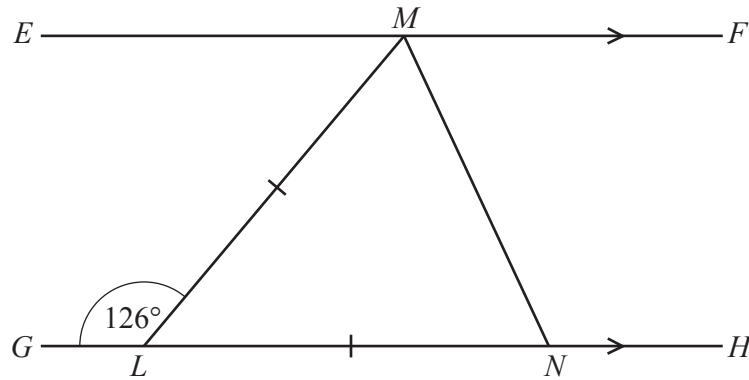
The top of the cake is a sector, radius 10.3 cm and angle  $x^\circ$ .

The volume of his slice is  $200 \text{ cm}^3$ .

Calculate the value of  $x$ .

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

9 (a)

NOT TO  
SCALE

$EMF$  and  $GLNH$  are parallel lines.  
 $LM = LN$  and  $\hat{GLM} = 126^\circ$ .

Find  $\hat{FMN}$ .

Give a reason for each step of your working.

.....

.....

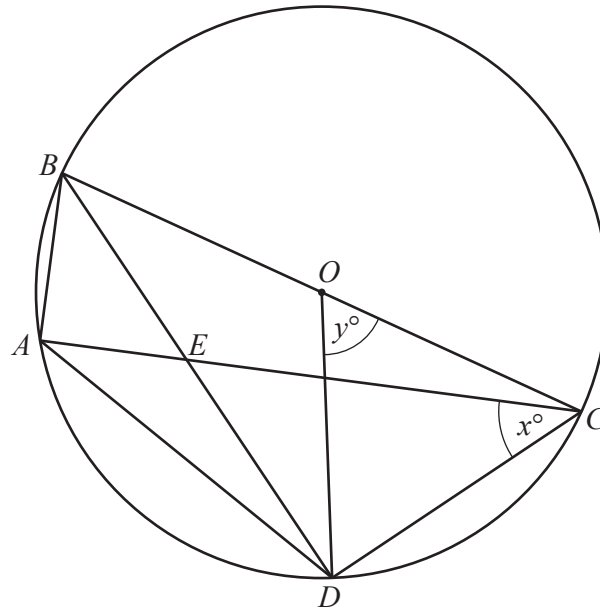
.....

.....

$\hat{FMN} = \dots\dots\dots$  [4]



(b)

NOT TO  
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$A, B, C$  and  $D$  are points on the circumference of a circle, centre  $O$ .  
 $BD$  and  $AC$  intersect at  $E$  and  $BC$  is a diameter of the circle.  
 $\hat{ACD} = x^\circ$  and  $\hat{DOC} = y^\circ$ .

Find an expression, in terms of  $x$  and/or  $y$ , for

(i)  $\hat{DBC}$ ,

$$\hat{DBC} = \dots\dots\dots [1]$$

(ii)  $\hat{ABD}$ ,

$$\hat{ABD} = \dots\dots\dots [1]$$

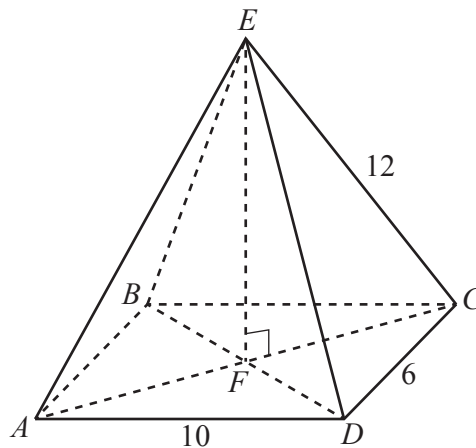
(iii)  $\hat{AED}$ ,

$$\hat{AED} = \dots\dots\dots [2]$$

(iv)  $\hat{BDA}$ .

$$\hat{BDA} = \dots\dots\dots [1]$$

10 [Volume of pyramid =  $\frac{1}{3} \times \text{base area} \times \text{height}$ ]



$ABCDE$  is a rectangular-based pyramid.

$AC$  and  $BD$  intersect at  $F$ .

$EF$  is perpendicular to  $FC$ .

$AD = 10 \text{ cm}$ ,  $DC = 6 \text{ cm}$  and  $EC = 12 \text{ cm}$ .

(a) Show that  $EF = 10.5 \text{ cm}$ , correct to 1 decimal place.

[4]

(b) Find the volume of the pyramid.

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

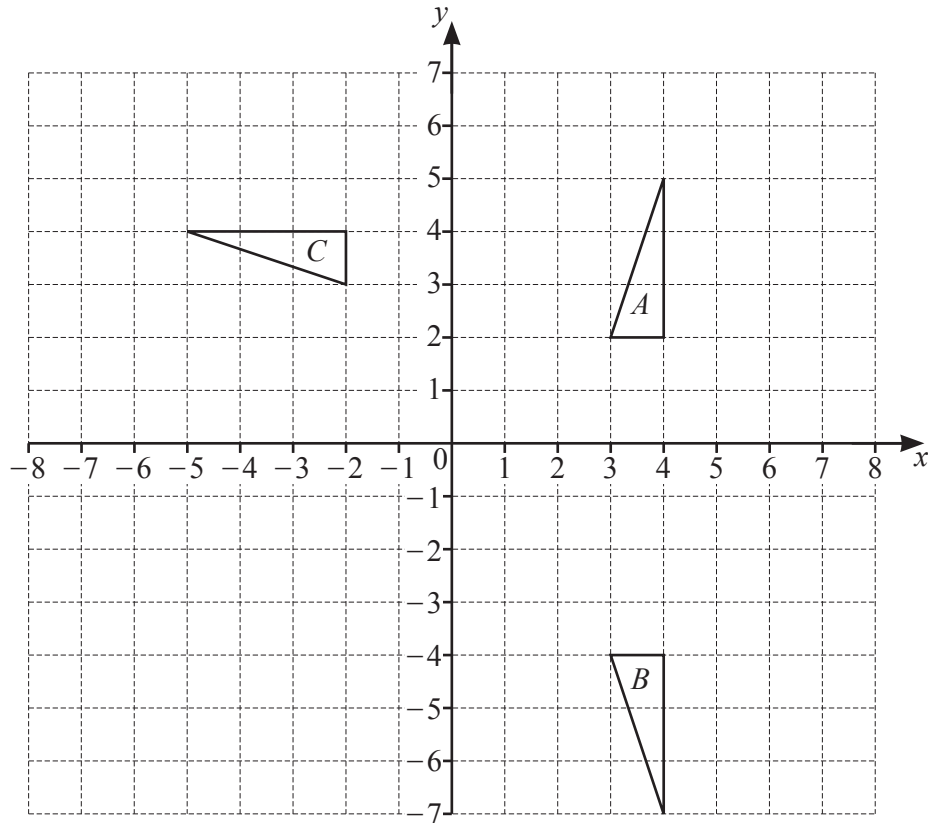
(c) Calculate  $\hat{DEC}$ .

$\hat{DEC} = \dots\dots\dots$  [3]

(d) Calculate the area of triangle  $DEC$ .

$\dots\dots\dots \text{cm}^2$  [2]

**Question 11 is printed on the next page.**



- (a) Describe fully the **single** transformation that maps triangle  $A$  onto triangle  $B$ .

..... [2]

- (b) Triangle  $A$  is mapped onto triangle  $C$  by the **single** transformation  $H$ .

Find the matrix representing  $H$ .

$\left( \begin{array}{cc} & \\ & \end{array} \right)$  [2]

- (c) Transformation  $M$  is a reflection in the line  $x = 2$ .  
Transformation  $R$  is a rotation  $180^\circ$  about  $(0, 0)$ .

Triangle  $A$  is mapped onto triangle  $D$  such that  $RM(A) = D$ .

Draw and label triangle  $D$ .

[3]

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