



Cambridge O Level

CANDIDATE
NAME

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MATHEMATICS (SYLLABUS D)

4024/22

Paper 2

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 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.

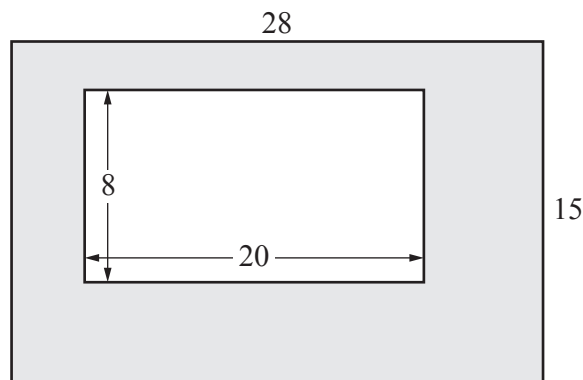
\$ [2]

- 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

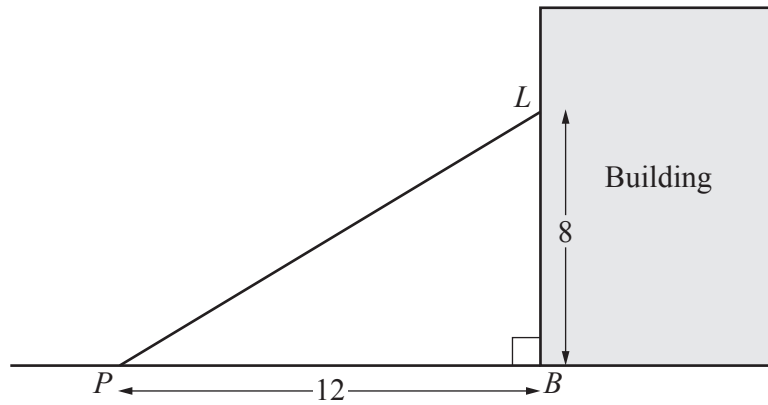
A rectangle 20 cm by 8 cm is cut from a rectangle 28 cm by 15 cm.
Each measurement is given correct to the nearest centimetre.

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

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

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

(a)



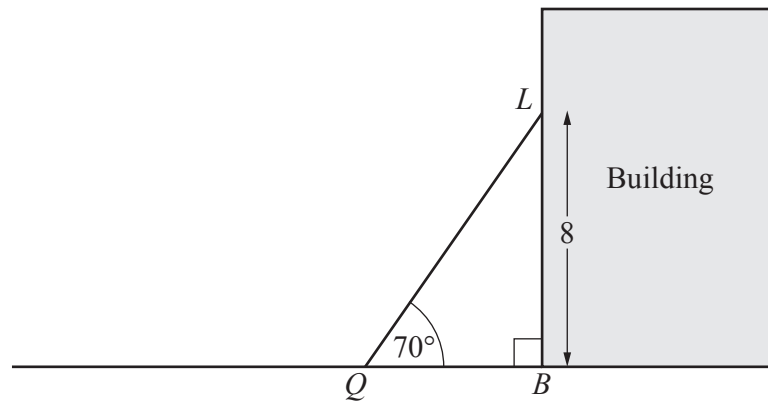
NOT TO SCALE

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

Calculate the angle of elevation of L from P .

..... [2]

(b)



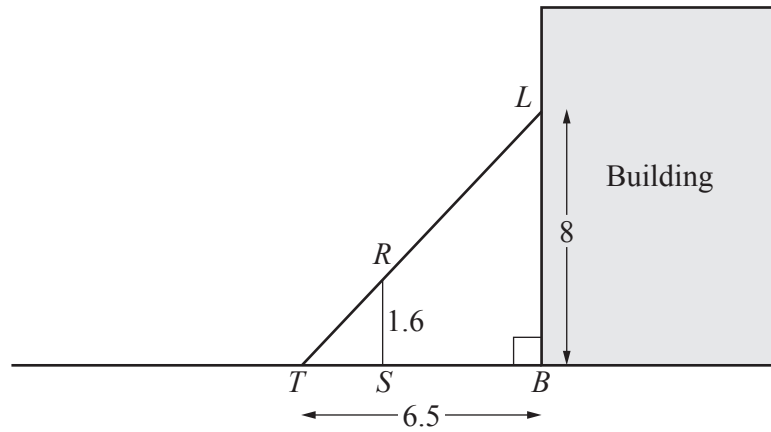
NOT TO SCALE

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

Calculate QL .

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

(c)

NOT TO
SCALE

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.

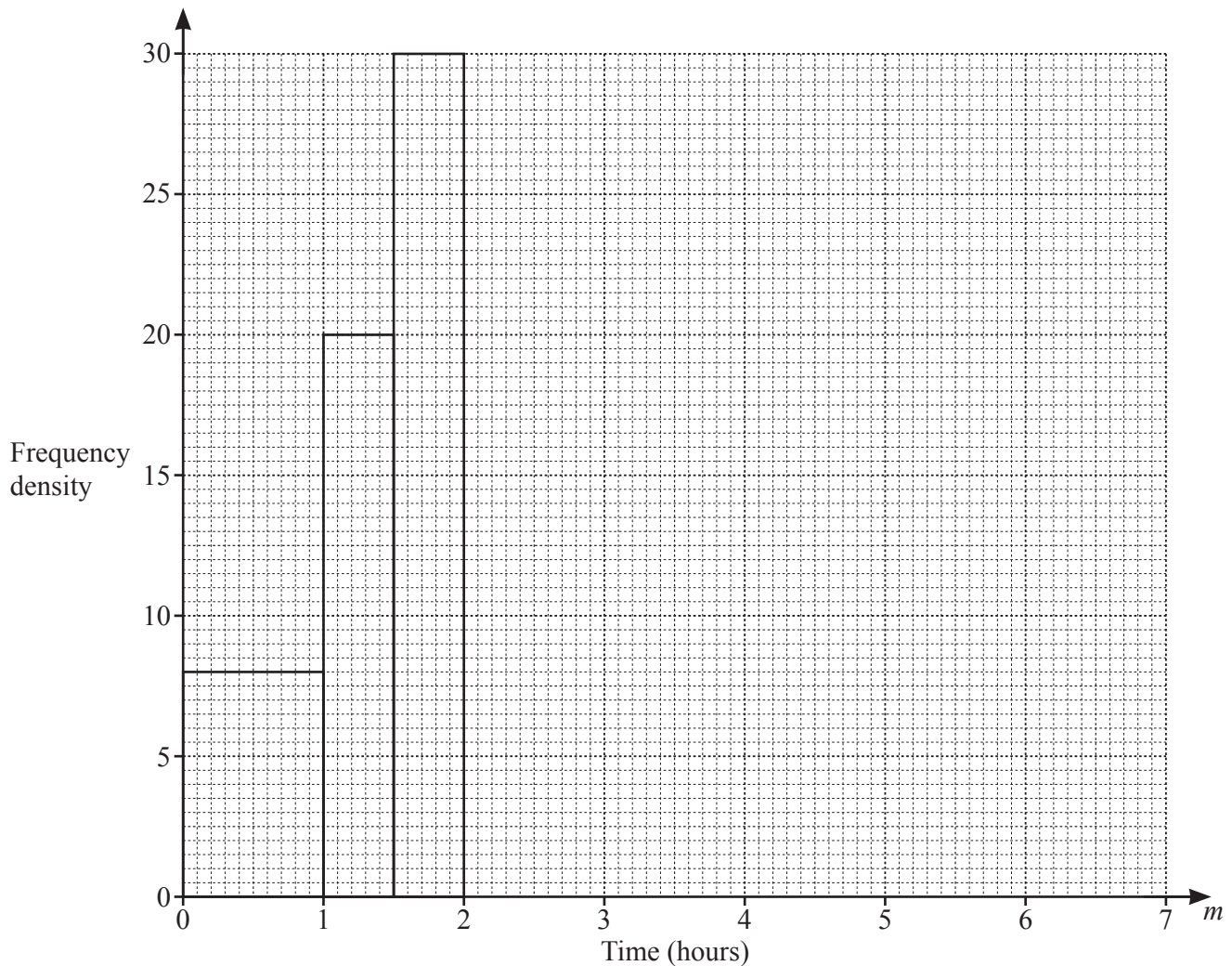
Calculate TS .

$TS = \dots\dots\dots$ 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]

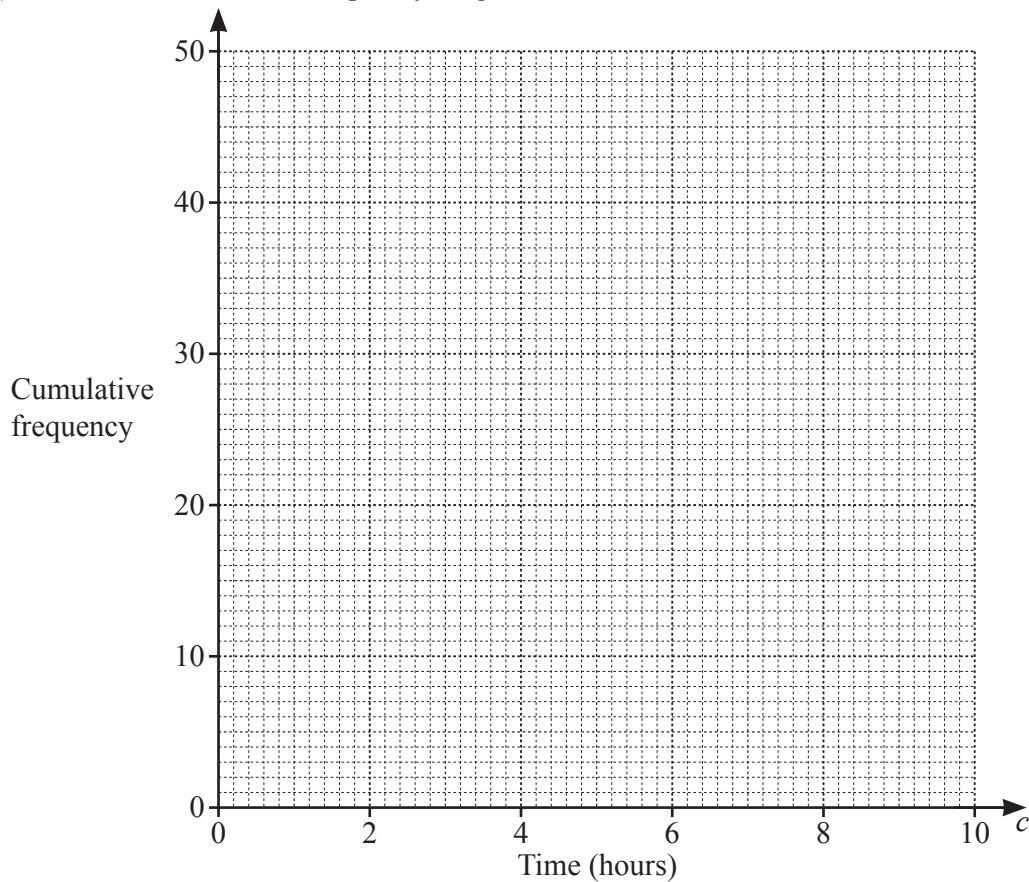
- (b) This table summarises the time, c hours, that each student in a group of 50 students spent cooking in one week.

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]

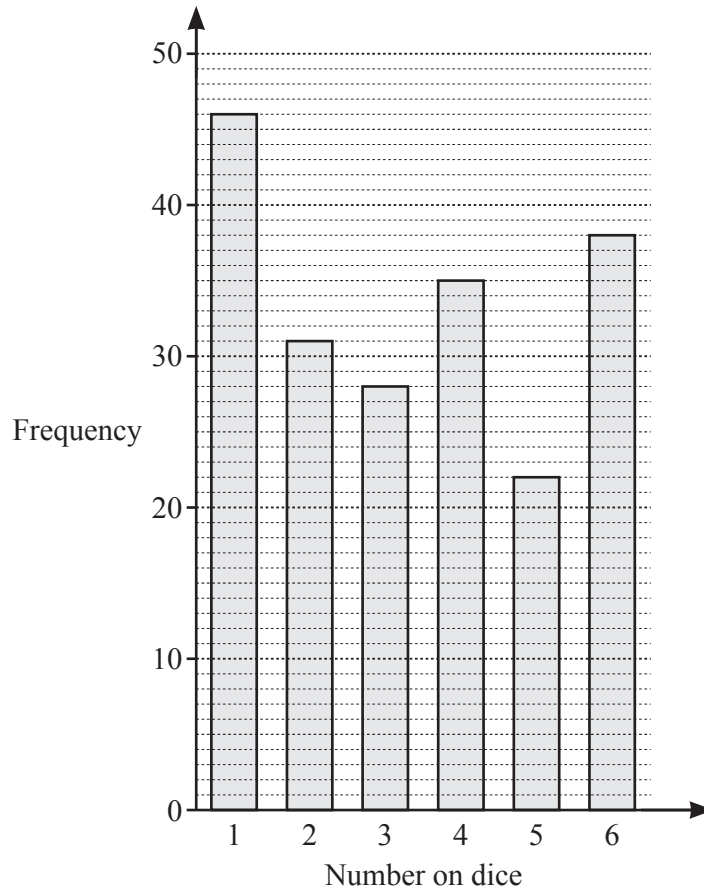
(ii) List all the possible two-digit numbers that are prime.

..... [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]

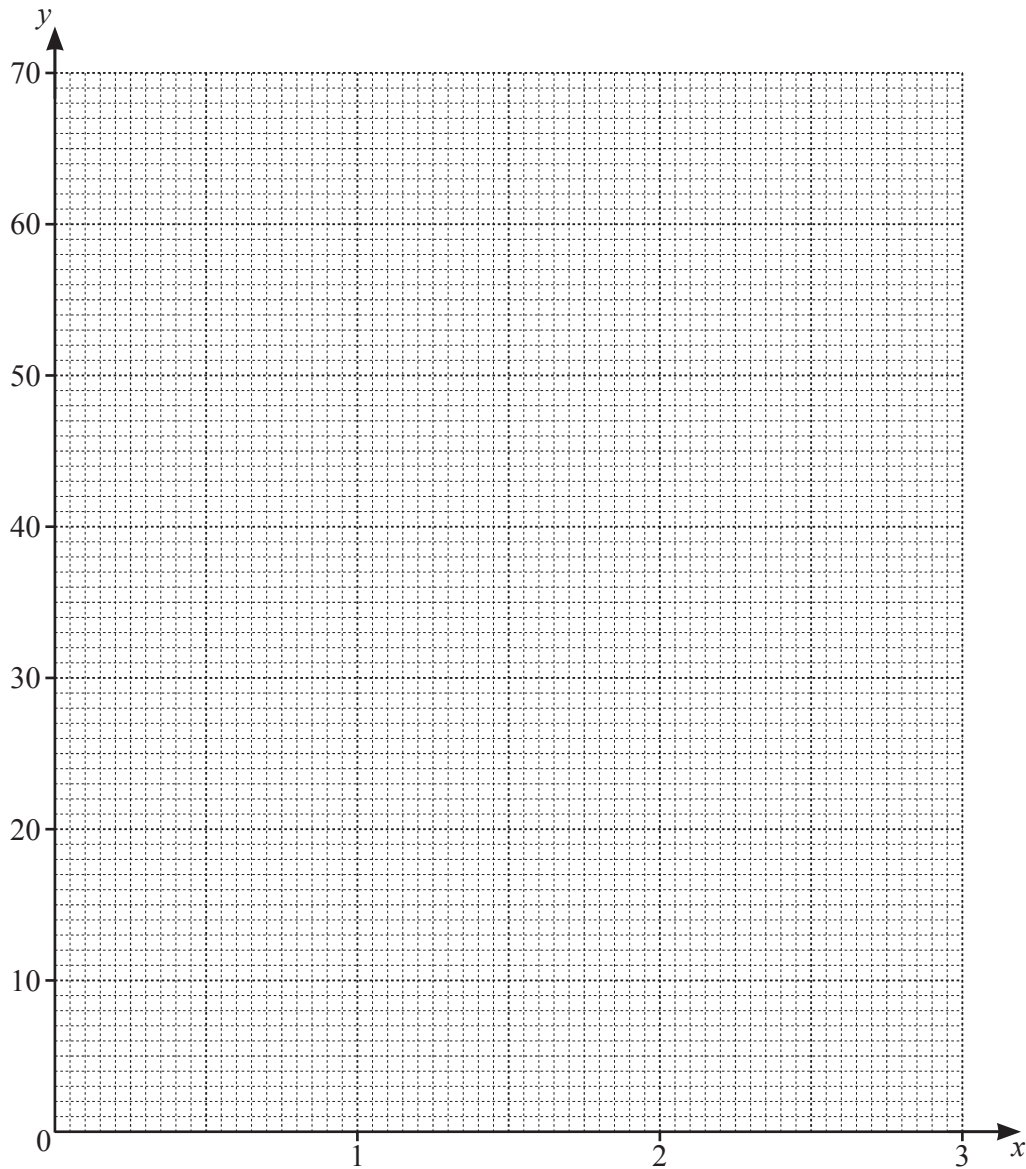
7 (a) The table shows some values for $y = 4^x$.

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 $y = 20x - 12$.

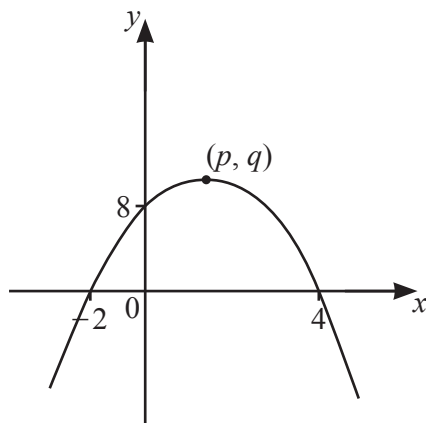
(a) Find the value of a and the value of b .

$a = \dots\dots\dots b = \dots\dots\dots$ [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.



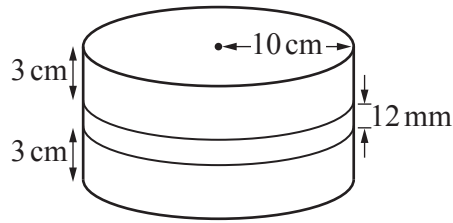
NOT TO SCALE

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 cm^3 .

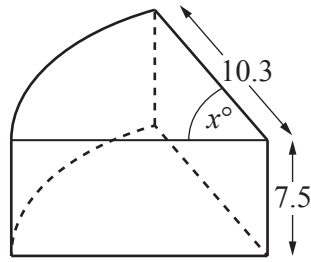
..... cm^3 [2]

- (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.

..... cm^2 [3]

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



His slice is a prism of height 7.5 cm.

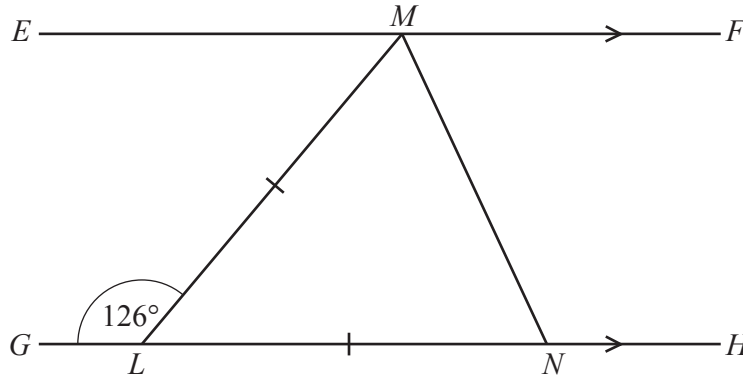
The top of the cake is a sector, radius 10.3 cm and angle x° .

The volume of his slice is 200 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.

.....

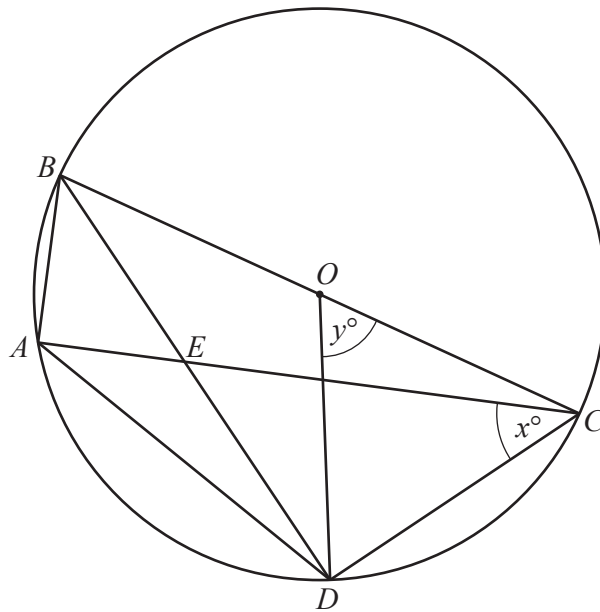
.....

.....

.....

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

(b)



NOT TO SCALE

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.
 $\widehat{ACD} = x^\circ$ and $\widehat{DOC} = y^\circ$.

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

(i) \widehat{DBC} ,

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

(ii) \widehat{ABD} ,

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

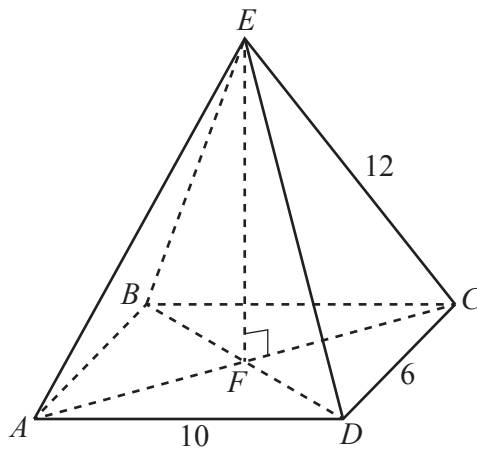
(iii) \widehat{AED} ,

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

(iv) \widehat{BDA} .

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

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



ABCDE is a rectangular-based pyramid.
AC and *BD* intersect at *F*.
EF is perpendicular to *FC*.

AD = 10 cm, *DC* = 6 cm and *EC* = 12 cm.

(a) Show that *EF* = 10.5 cm, correct to 1 decimal place.

[4]

(b) Find the volume of the pyramid.

..... cm³ [2]

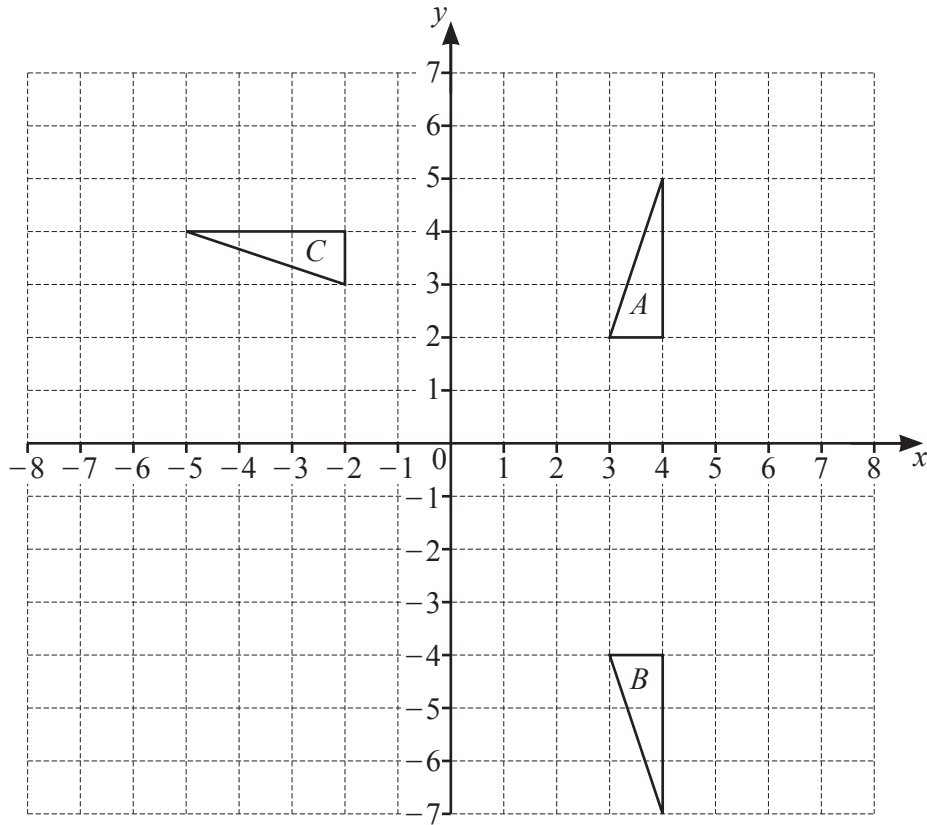
(c) Calculate $\hat{D\hat{E}C}$.

$\hat{D\hat{E}C} = \dots\dots\dots$ [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° 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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