Cambridge Assessment International Education

Cambridge O Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

8542376033

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.

[Turn over

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.

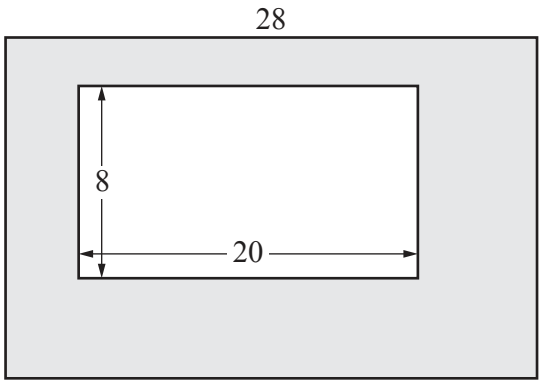
$ ..... [2]

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.

$w =$ ..... cm [3]

(b)



NOT TO SCALE

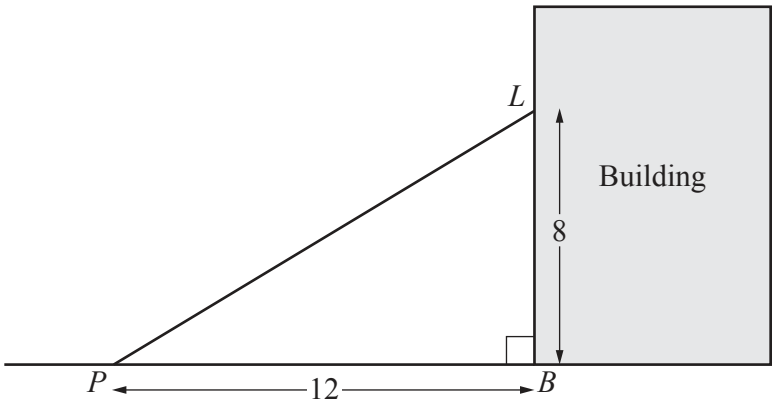
A rectangle 20 cm by 8 cm is cut from a rectangle 28 cm by 15 cm.
Each measurement is given correct to the nearest centimetre.

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

..... cm^2 [3]

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

(a)



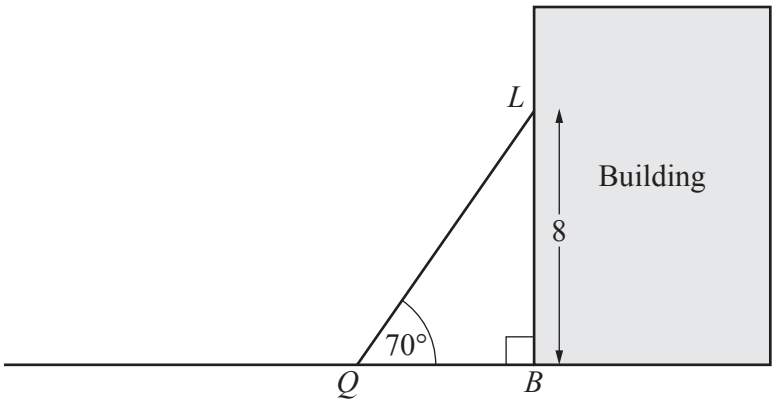
NOT TO SCALE

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

Calculate the angle of elevation of L from P.

..... [2]

(b)



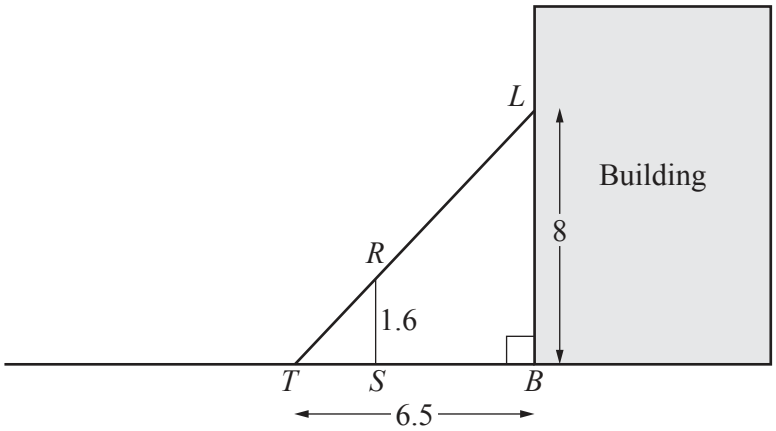
NOT TO SCALE

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.

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

(c)



NOT TO SCALE

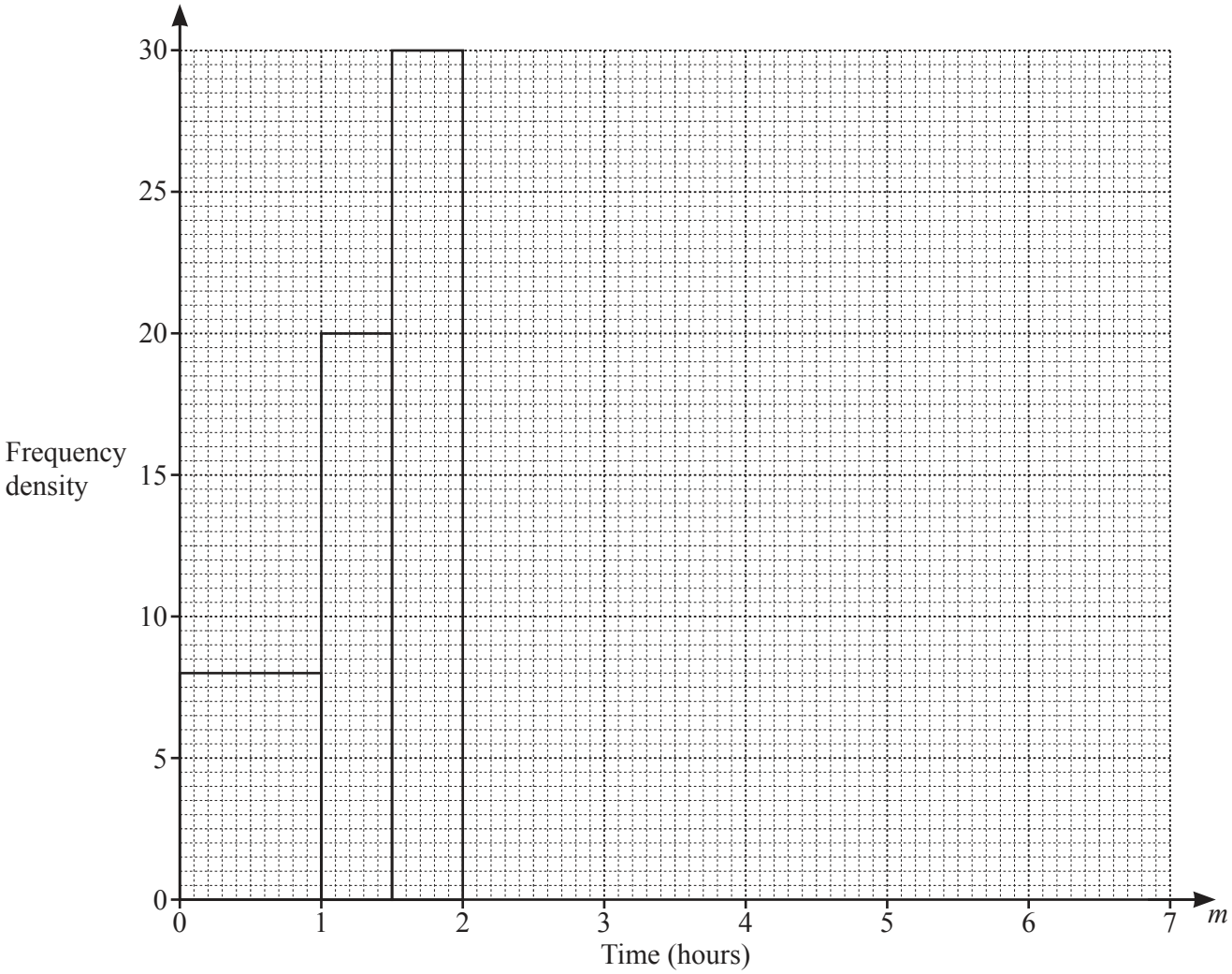
A vertical pole, *RS*, of length 1.6 m is placed touching the horizontal ground. The light produces a shadow, *TS*, of the pole on the horizontal ground. *LRT* is a straight line and $TB = 6.5$ m.

Calculate *TS*.

TS = ... 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
$0 < m \leqslant 1$	8
$1 < m \leqslant 1\frac{1}{2}$	10
$1\frac{1}{2} < m \leqslant 2$	p
$2 < m \leqslant 2\frac{1}{2}$	14
$2\frac{1}{2} < m \leqslant 3\frac{1}{2}$	23
$3\frac{1}{2} < m \leqslant 5$	18
$5 < m \leqslant 7$	12



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

$p =$ ..... [1]

(ii) Complete the histogram. [3]

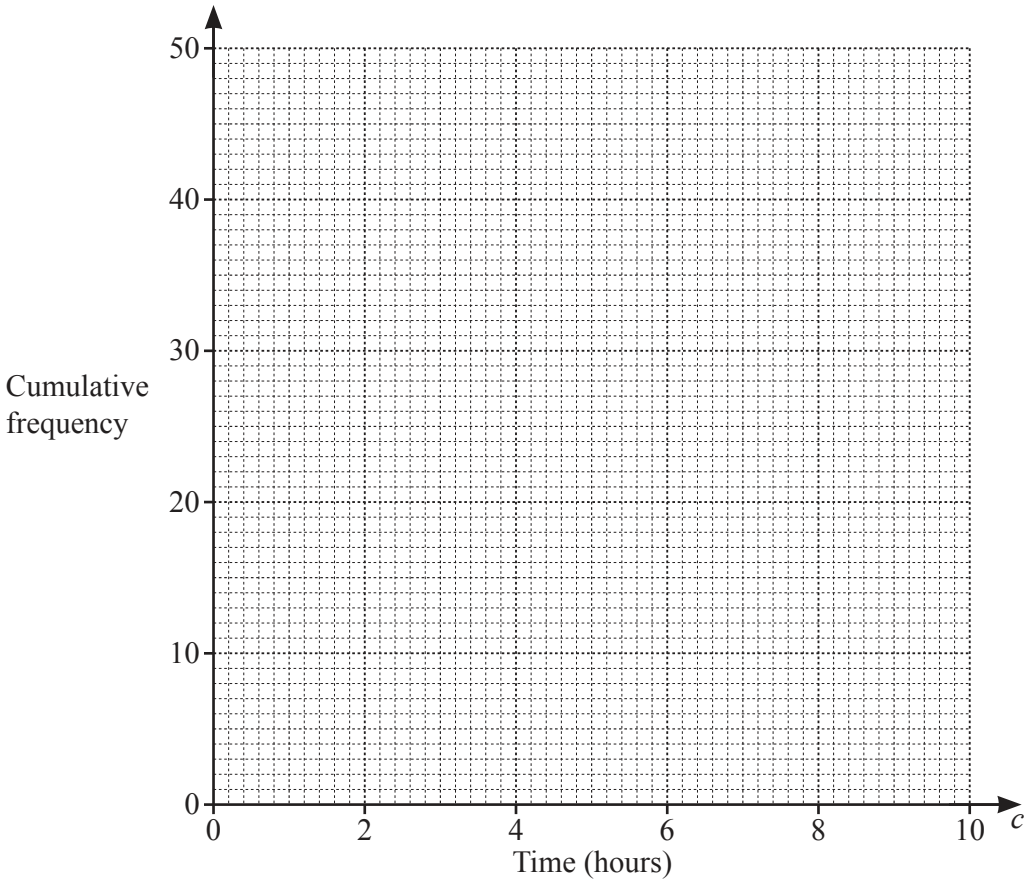
(b) This table summarises the time, c hours, that each student in a group of 50 students spent cooking in one week.

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

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

$$2x - 4y = 11$$
$$3x + 3y = -6$$

$x =$ .....

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

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

$x =$ ..... or $x =$ ..... [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.

$h =$ ..... [2]

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

$g =$ ..... [2]

6 (a)

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]

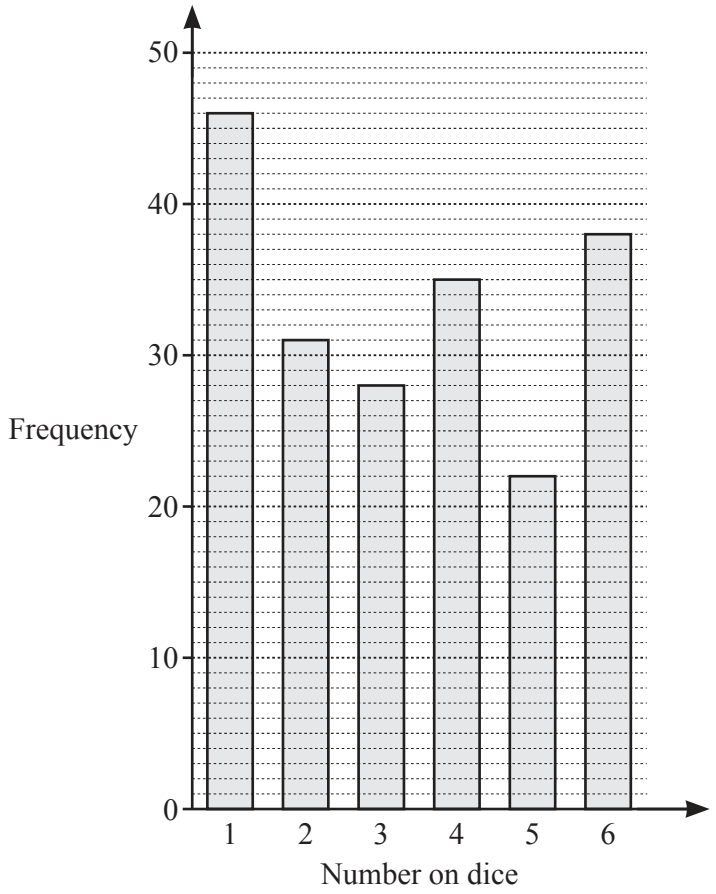
(ii) List all the possible two-digit numbers that are prime.

..... [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.

.....

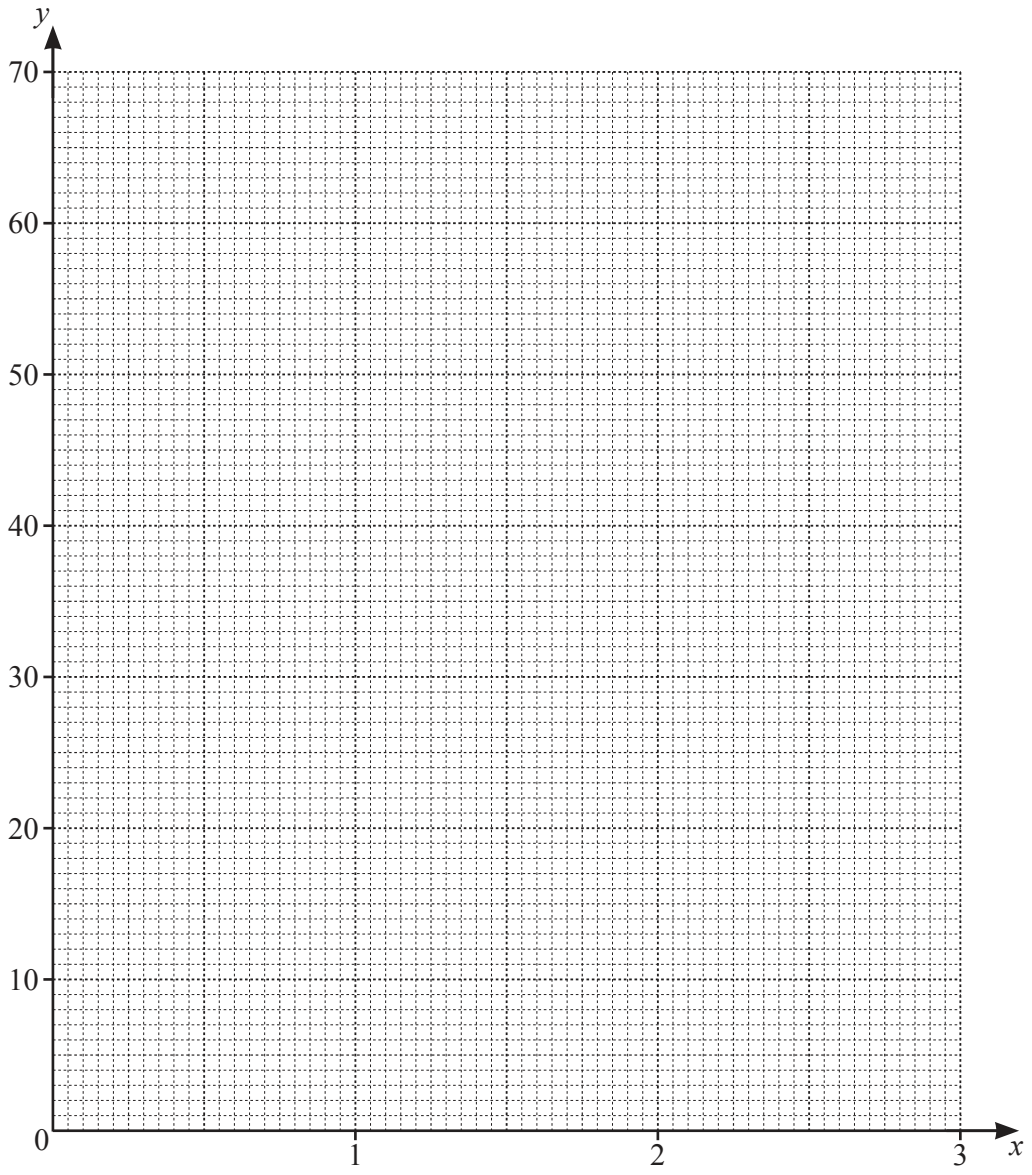
..... [2]

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 $0 \leqslant x \leqslant 3$.



[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 $y = 20x - 12$.

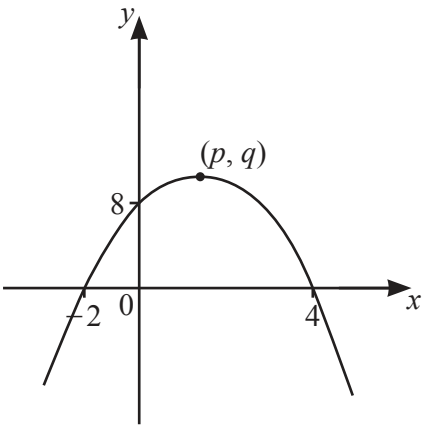
(a) Find the value of a and the value of b.

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

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

..... [3]

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



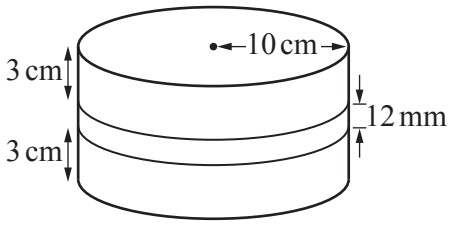
NOT TO SCALE

The curve has a maximum point (p, q).

Find the value of p and the value of q.

$p =$ ..... $q =$ ..... [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.

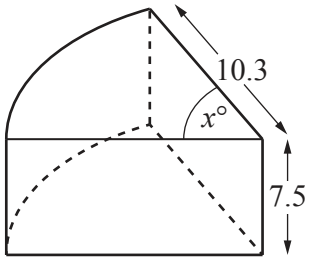
..... cm^3 [2]

(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.

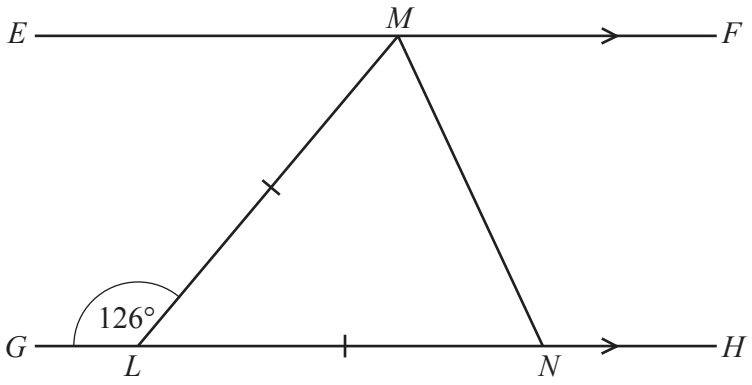


His slice is a prism of height 7.5 cm.
The top of the cake is a sector, radius 10.3 cm and angle $x°$.
The volume of his slice is 200 cm^3.

Calculate the value of x.

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

9 (a)



NOT TO SCALE

EMF and *GLNH* are parallel lines.
$LM = LN$ and $G\hat{L}M = 126°$.

Find $F\hat{M}N$.
Give a reason for each step of your working.

.....

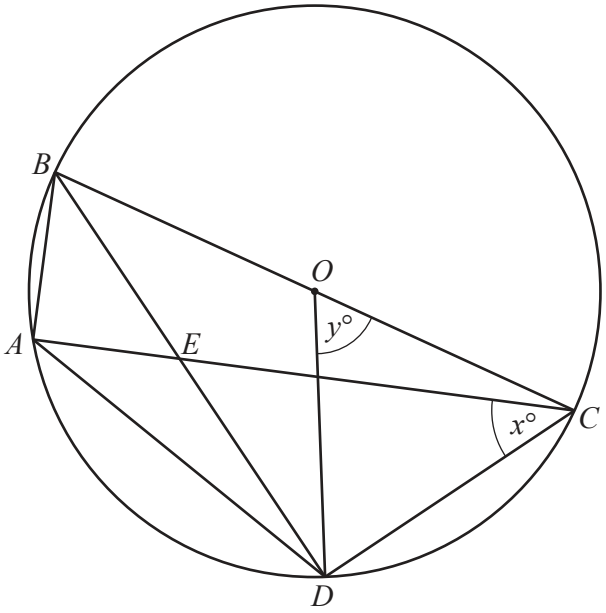
.....

.....

.....

$F\hat{M}N =$ ..... [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.
$A\hat{C}D = x°$ and $D\hat{O}C = y°$.

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

(i) $D\hat{B}C$,

$D\hat{B}C =$ ..... [1]

(ii) $A\hat{B}D$,

$A\hat{B}D =$ ..... [1]

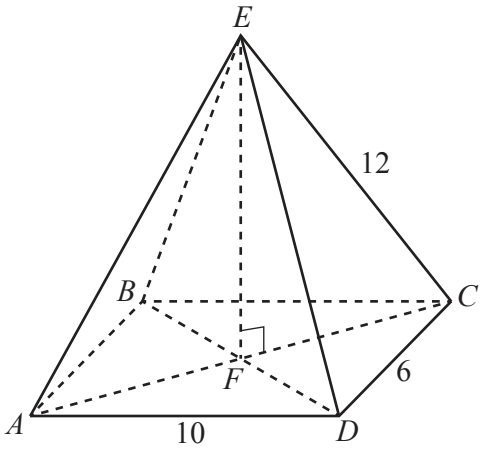
(iii) $A\hat{E}D$,

$A\hat{E}D =$ ..... [2]

(iv) $B\hat{D}A$.

$B\hat{D}A =$ ..... [1]

10 [Volume of pyramid = $\frac{1}{3}$ × base area × 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.

..... cm^3 [2]

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

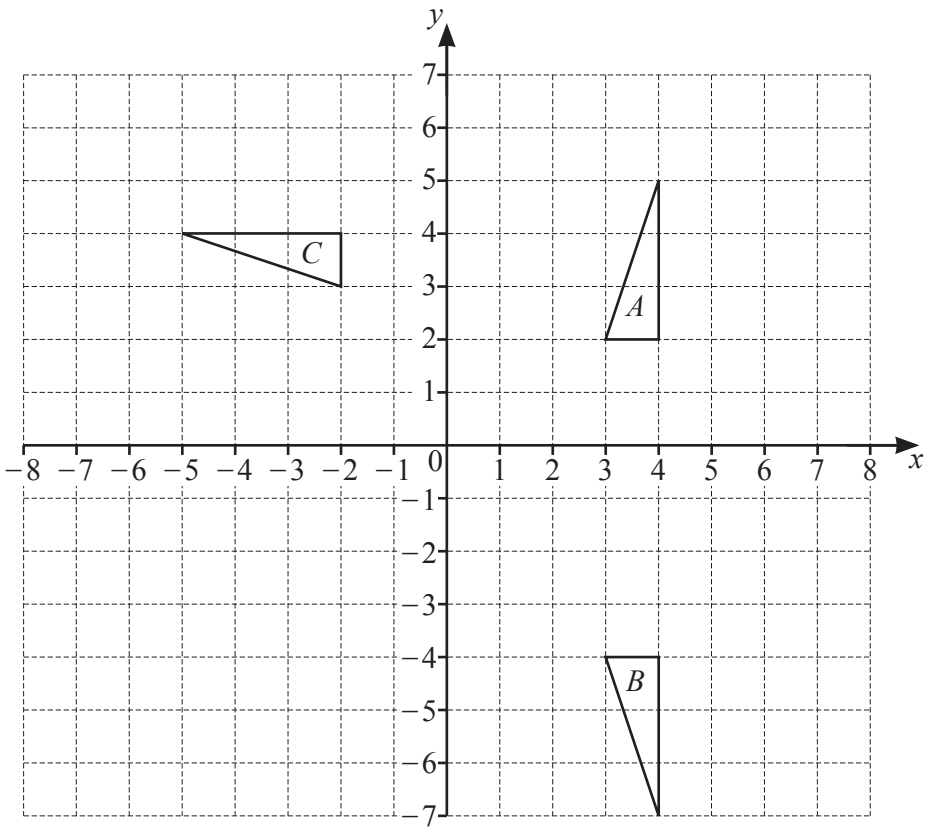
$D\hat{E}C =$ ..... [3]

(d) Calculate the area of triangle DEC.

..... cm^2 [2]

Question 11 is printed on the next page.

11



(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.

( ) [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]