Cambridge O Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

MATHEMATICS (SYLLABUS D) **4024/02**

Paper 2 Calculator **For examination from 2025**

SPECIMEN PAPER **2 hours**

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 scientific 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 [ ].

[Turn over

List of formulas

|	
Area, A, of triangle, base b, height h.	$A = \frac{1}{2}bh$
Area, A, of circle of radius r.	$A = \pi r^2$
Circumference, C, of circle of radius r.	$C = 2\pi r$
Curved surface area, A, of cylinder of radius r, height h.	$A = 2\pi rh$
Curved surface area, A, of cone of radius r, sloping edge l.	$A = \pi rl$
Surface area, A, of sphere of radius r.	$A = 4\pi r^2$
Volume, V, of prism, cross-sectional area A, length l.	$V = Al$
Volume, V, of pyramid, base area A, height h.	$V = \frac{1}{3}Ah$
Volume, V, of cylinder of radius r, height h.	$V = \pi r^2 h$
Volume, V, of cone of radius r, height h.	$V = \frac{1}{3}\pi r^2 h$
Volume, V, of sphere of radius r.	$V = \frac{4}{3}\pi r^3$
For the equation $ax^2 + bx + c = 0$, where $a \neq 0$	$x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

For the triangle shown,
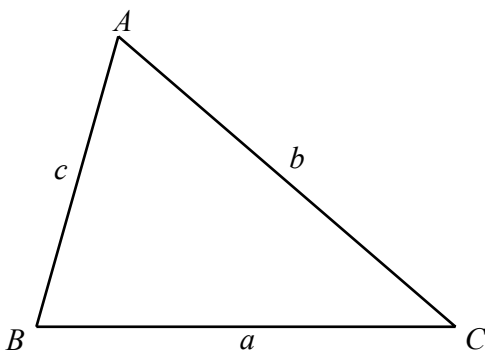
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

$$\text{Area} = \frac{1}{2}ab\sin C$$

1 Calculate.
$$\frac{4}{\sqrt{0.0025}}$$

.... [1]

2 Work out 40% of $530.

$ .... [1]

3 This is part of a bus timetable from New York to Raleigh.

New York	09 15
Baltimore	13 40
Washington	15 20
Richmond	19 00
Petersburg	19 40
Raleigh	22 15

(a) Work out the journey time from New York to Petersburg.
Give your answer in hours and minutes.

.... hours .... minutes [1]

(b) Arjan arrives at the bus station in Washington at 1.36 pm.

Work out how long he waits for the 09 15 bus from New York to arrive.
Give your answer in minutes.

.... minutes [1]

4   Pens cost 53 cents each.

(a) Work out the maximum number of pens Maryam can buy with $15.

.... pens [2]

(b) Work out the change she receives in cents.

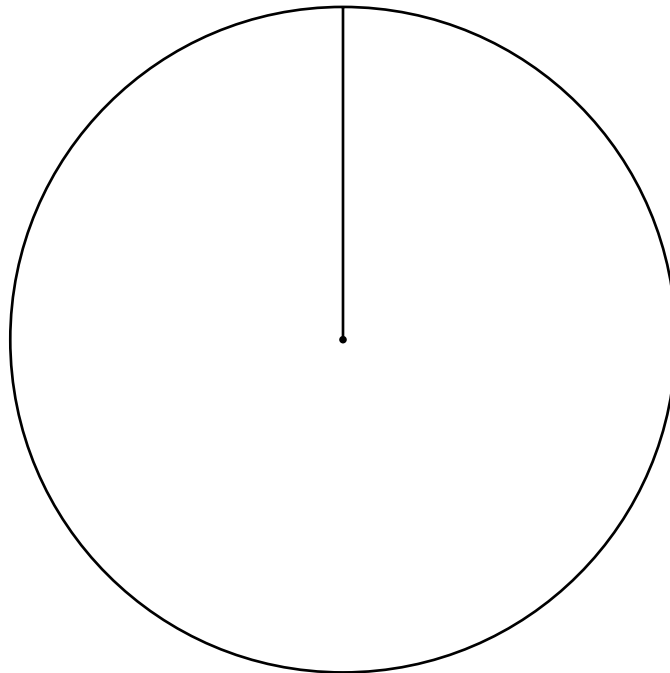.......................... cents change [1]

5   The table shows how a class of 30 children travel to school.
The information will be shown in a pie chart.

Travel to school	Number of children	Pie chart angle
Walk	18	
Car	3	
Bus	9	

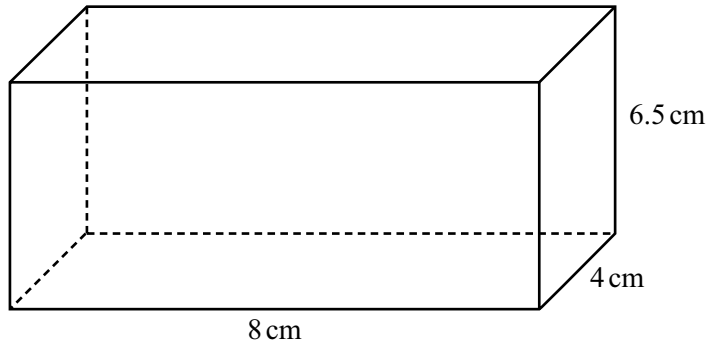(a) Complete the table. [2]

(b) Draw a pie chart to show this information.

[2]

6

6.5 cm

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4 cm

8 cm

The diagram shows a cuboid.

Calculate the volume of the cuboid.

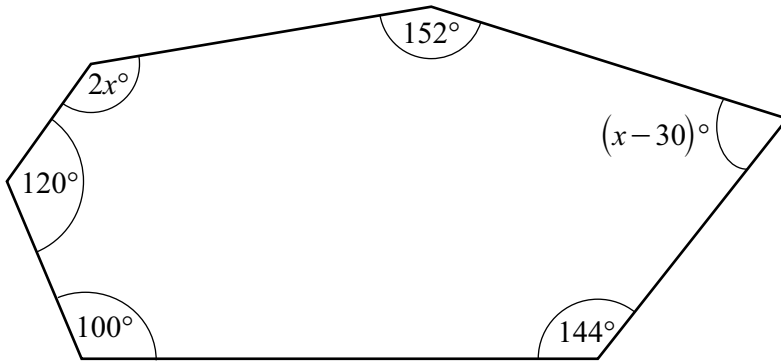...cm^3 [1]

7 Alex buys a shirt at a price of £14.75 .
Pedro buys a shirt at a price of $21.99 .
The exchange rate is $1 = £0.73 .

Calculate how much more Pedro pays than Alex.
Give your answer in dollars and cents correct to the nearest cent.

$ .... [2]

8

The diagram shows a hexagon.

Write an equation and solve it to find the value of x.

$x =$ .... [4]

9   3.56   5 $\sqrt{196}$ 8 $\sqrt{7}$ 12

From the list, write down a number that is

(a) a multiple of 3

.... [1]

(b) a cube number

.... [1]

(c) a prime number

.... [1]

(d) an irrational number.

.... [1]

10 Anna has a bag containing 10 beads.
There are 4 red beads and the rest are blue.

(a) Anna takes two beads from the bag at random without replacement.

Complete the tree diagram.

First bead   Second bead

$\frac{4}{10}$
Red
$\frac{3}{9}$ Red
.... Blue

.... Blue
.... Red
.... Blue
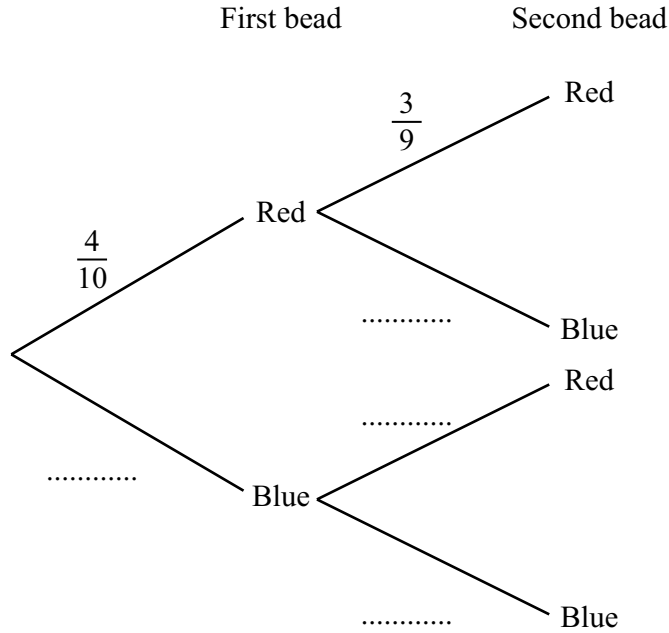
[2]

(b) Calculate the probability that Anna takes two red beads.

.... [1]

11 Maya builds a patio in her garden in the shape of a cylinder, with radius 2 m and a height of 0.08 m.
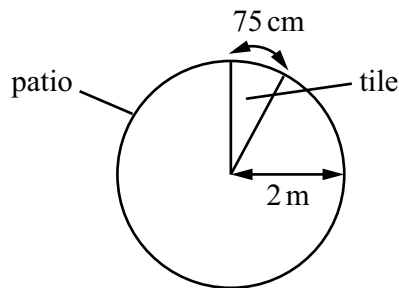
(a) The patio is made from concrete.
The density of the concrete is $2500 \, \text{kg/m}^3$.

Calculate the mass of the concrete used to build the patio.
[Density = mass ÷ volume]

.... kg [4]

(b) Maya wants to put tiles on the surface of her patio, as shown on the diagram.
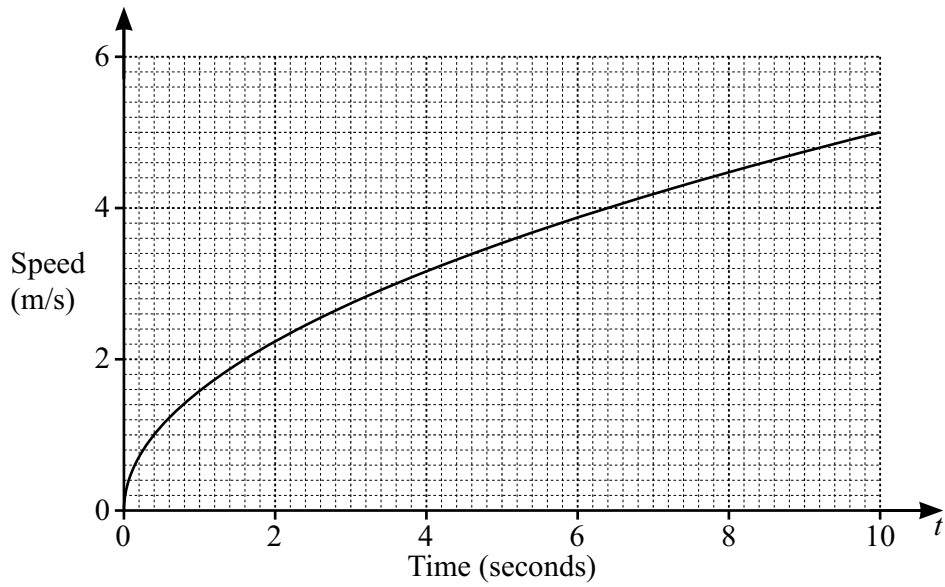Each tile is a sector with arc length 75 cm.

Explain why the tiles do **not** fit exactly on the surface of the patio.

.... [3]

12 Find all the integer values of x that satisfy the inequality $-6 \leqslant 3x < 6$.

.... [2]

13 The speed–time graph shows the first 10 seconds of the journey of a car.

(a) By drawing a tangent, estimate the gradient of the curve at $t = 2$.

.... [2]

(b) Write down what the gradient of the curve represents in terms of the car's motion for the first 10 seconds of its journey.
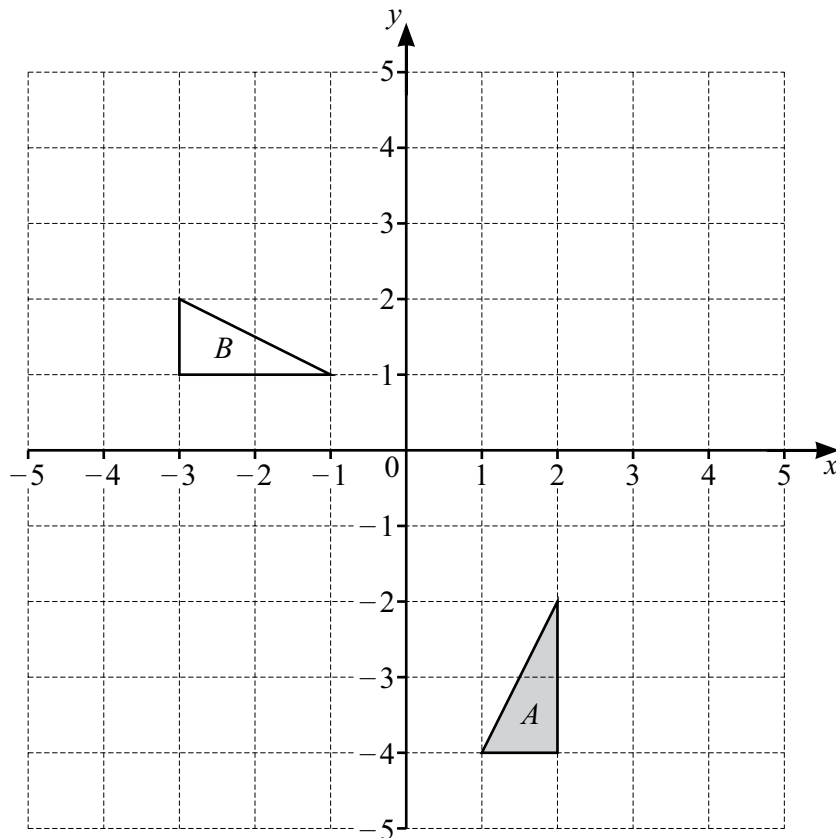
.... [1]

14 The table shows the distances travelled by 80 people to a shopping mall.

Distance (d km)	$0 < d \leqslant 5$	$5 < d \leqslant 10$	$10 < d \leqslant 20$	$20 < d \leqslant 50$
Frequency	35	20	14	11

Calculate an estimate of the mean distance travelled.

.... km [4]

15 The diagram shows triangle A and triangle B.

Describe fully the **single** transformation that maps triangle A onto triangle B.
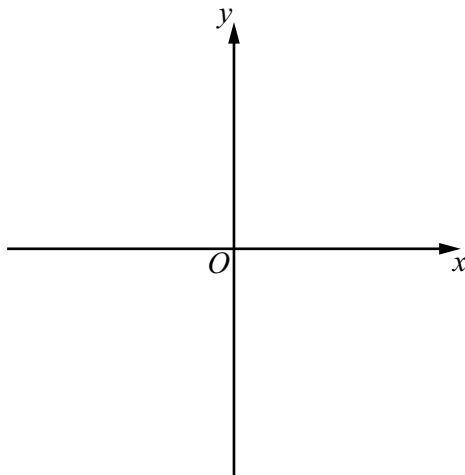
....

.... [3]

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16 Sketch the graph of each function.

(a) $y = x - 3$
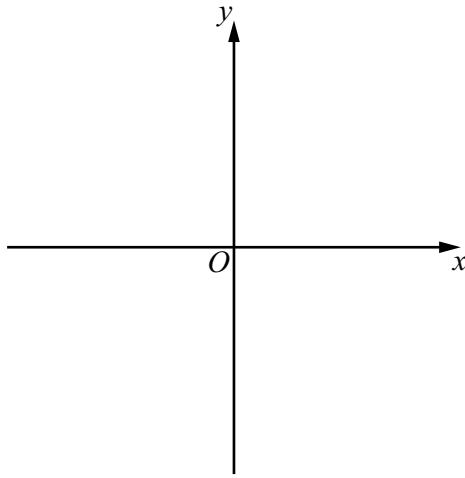
[1]

(b) $y = \dfrac{1}{x}$

[2]

17 An insect population decreases at a rate of 12% per year.
The insect population on 1st January 2022 is 3.7 million.

Calculate the number of complete years it will take for the insect population to first fall below 1 million insects.
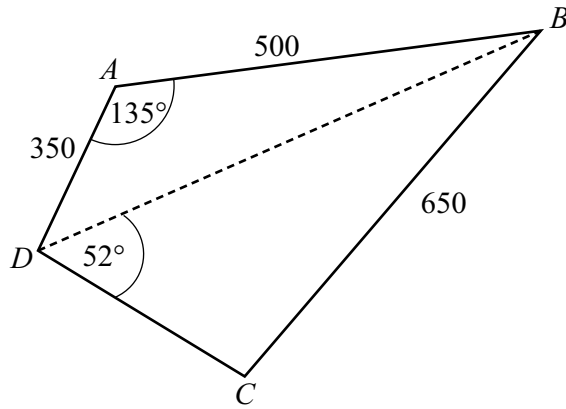
.... years [3]

18 y is inversely proportional to the cube root of x.

Given that $y = 2.5$ when $x = 8$, find y when $x = 64$.

$y = $ .... [3]

19

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ABCD is a quadrilateral with *AB* = 500 m, *BC* = 650 m and *DA* = 350 m.
Angle *DAB* = 135° and angle *BDC* = 52°.

(a) Calculate *DB*.

DB = ... m [3]

(b) Calculate the obtuse angle *BCD*.

Angle *BCD* = ... [4]

20 Shanti travels 12 km from home to school.
She travels at an average speed of x km/h.

(a) Write down an expression, in terms of x, for the time taken in minutes for Shanti to travel from home to school.

.... minutes [1]

(b) Felix travels 12 km from home to school.
He travels at an average speed that is 20 km/h slower than Shanti's average speed.

Write down an expression, in terms of x, for the time taken in minutes for Felix to travel from home to school.

.... minutes [1]

(c) Felix takes 15 minutes longer to travel from home to school than Shanti.

Use your answers from **part (a)** and **part (b)** to form an equation in x and show that it simplifies to $x^2 - 20x - 960 = 0$.

[4]

(d) Solve the equation $x^2 - 20x - 960 = 0$.
Show your working and give your answers correct to 2 decimal places.

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

(e) Calculate the time Felix takes to travel from home to school.
Give your answer in minutes and seconds.

.... minutes .... seconds [3]

21 The table shows some values for $y = \dfrac{x^3}{3} - 2x + 5$ correct to 1 decimal place.

x	-3	-2.5	-2	-1	0	1	2	2.5	3
y		4.8	6.3	6.7	5.0	3.3	3.7	5.2	

(a) Complete the table. [2]

(b) Draw the graph of $y = \dfrac{x^3}{3} - 2x + 5$ for $-3 \leqslant x \leqslant 3$.
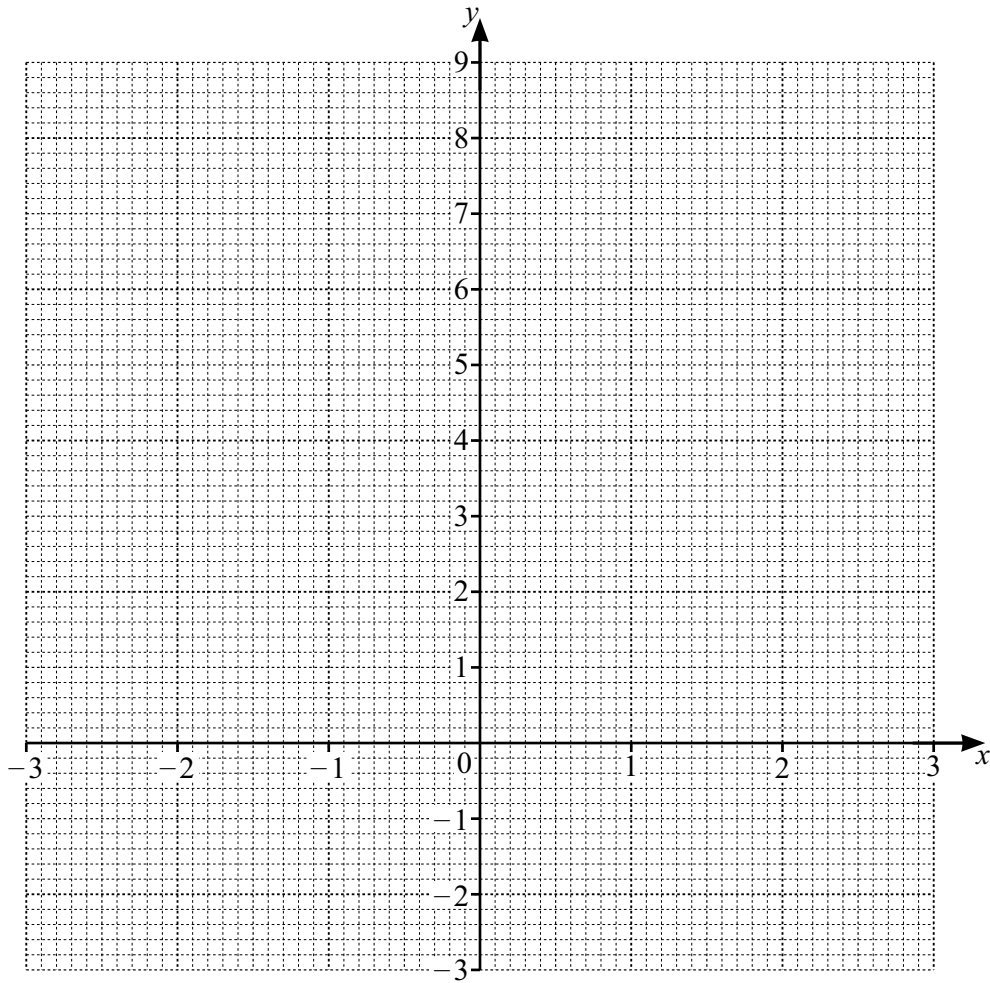
[4]

(c) By drawing a suitable line on the grid, find the roots of the equation $\frac{x^3}{3} - 1.5x + 1 = 0$.

$x = $ .... or $x = $ .... or $x = $ .... [4]

22 The length of a pencil is given as 16 cm, correct to the nearest cm.
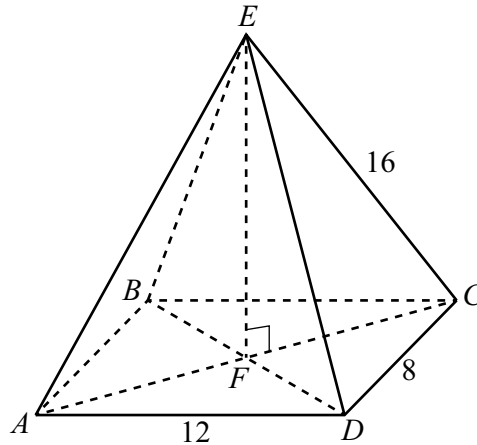The length of a pen is given as 14.7 cm, correct to the nearest mm.

Calculate the upper bound for the difference between the length of the pencil and the length of the pen.

.... cm [3]

23 Expand and simplify.

$$(x-2)(4x+1)(x-5)$$

.... [3]

24

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

AD = 12 cm, *DC* = 8 cm and *EC* = 16 cm.

(a) Write down the number of planes of symmetry of the pyramid.

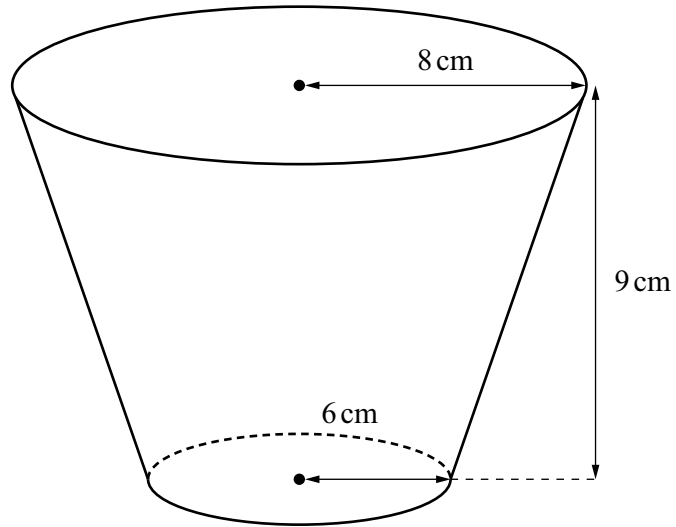.. [1]

(b) Show that *EF* = 14.3 cm correct to 1 decimal place.

[4]

(c) Calculate the angle between the line *EC* and the base *ABCD*.

.... [2]

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25

The diagram shows a bowl in the shape of a frustum.

Calculate the volume of the bowl.

.... cm³ [5]

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