



Higher Tier

Frustums

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- You must **show all your working.**
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- If your calculator does not have a π button, take the value of π to be 3.142 unless the question instructs otherwise.

Information

- The marks for **each** question are shown in brackets- *use this as a guide as to how much time to spend on each question.*

Advice

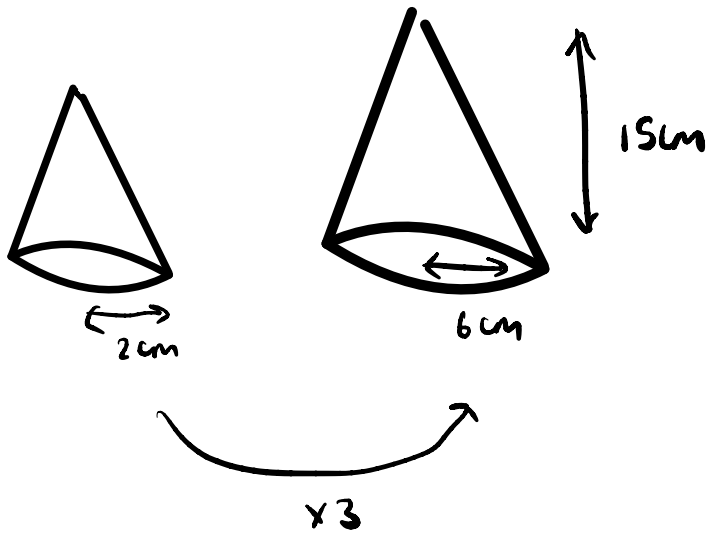
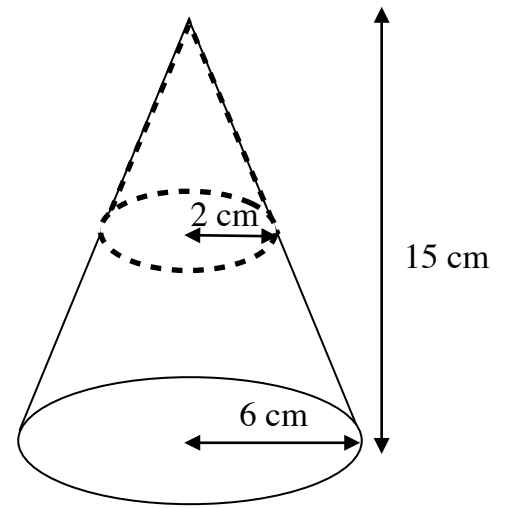
- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

1. A frustum is formed by removing a small cone from a larger cone.

The large cone has height 15 cm and radius 6 cm.

The small cone removed has radius 2 cm.

Find the height of the small cone.



$$h = 15 \div 3 = 5$$

5 cm

(Total for Question 1 is 3 marks)

2. A frustum is formed by removing a small cone from a larger cone.

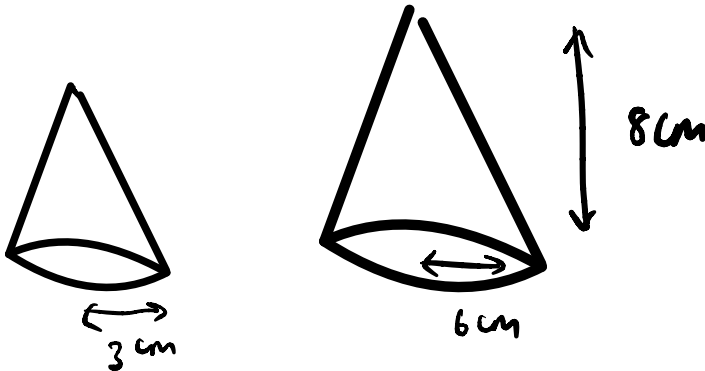
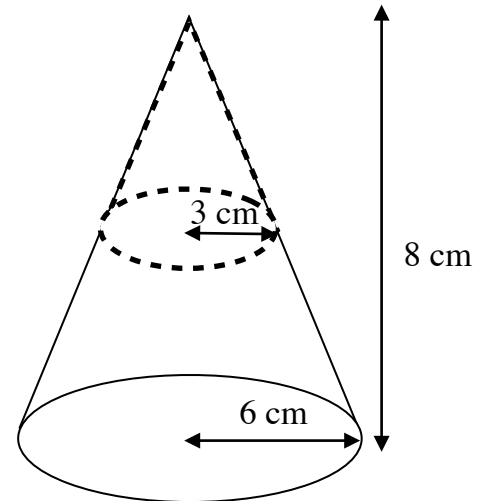
The radius of the top of the frustum is 3 cm.

The radius of the base of the cone is 6 cm.

The vertical height of the original larger cone is 8 cm.

Find the volume of the frustum.

Give your answer to 3 significant figures.



$$SF = 6 \div 3 = 2$$

$$h_{\text{small}} = 8 \div 2 = 4 \text{ cm}$$

$$\frac{1}{3} \pi (6)^2 \times 8 - \frac{1}{3} \pi (3)^2 \times 4 =$$

$$96\pi - 12\pi = 84\pi = 263.89$$

264 cm^3

(Total for Question 2 is 4 marks)

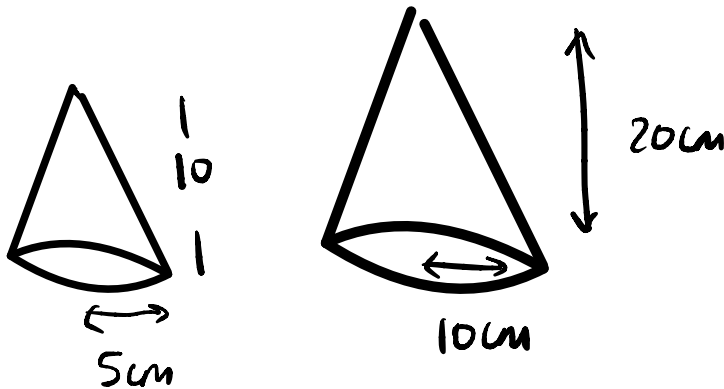
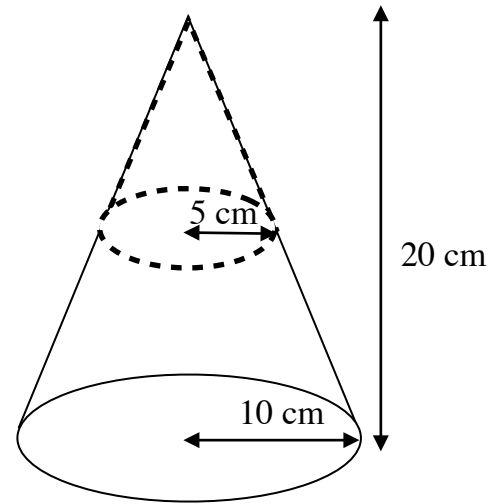
3. A frustum is formed from a cone of height 20 cm and radius 10 cm.

A smaller similar cone is removed from the top.

The radius of the smaller cone is 5 cm.

Find the volume of the frustum.

Give your answer to 3 significant figures.



$$SF=2$$

$$20 \div 2 = 10$$

$$V = \frac{1}{3} \pi \times 10^2 \times 20 - \frac{1}{3} \pi \times 5^2 \times 10$$

$$= 1832.59$$

$$= 1830 \text{ (3SF)}$$

1830 cm^3

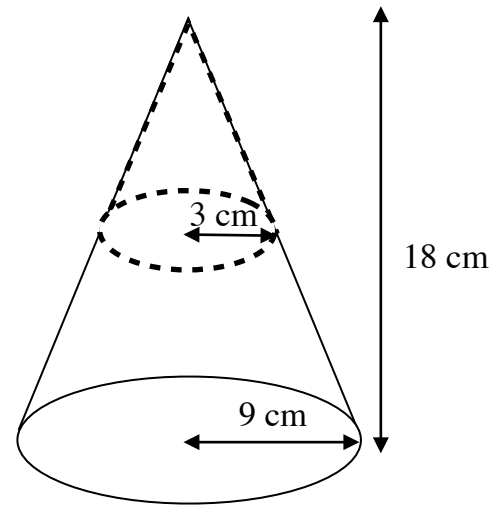
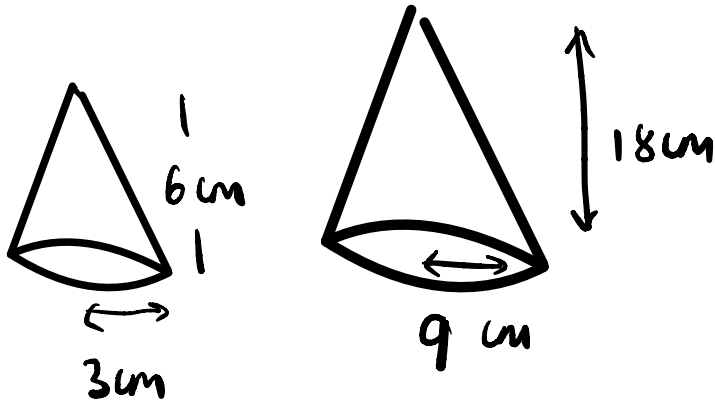
(Total for Question 3 is 3 marks)

4. A frustum is formed removing a smaller cone from a large cone of height 18 cm and radius 9 cm.

The smaller cone has radius 3 cm.

Find the volume of the frustum.

Give your answer to 3 significant figures.



$$SF = 9 \div 3 = 3$$

$$18 \div 3 = 6 \text{ cm}$$

$$\begin{aligned} \frac{1}{3} \pi \times 9^2 \times 18 - \frac{1}{3} \pi \times 3^2 \times 6 &= 1470.265 \\ &= 1470 \text{ (3SF)} \end{aligned}$$

1470 cm³

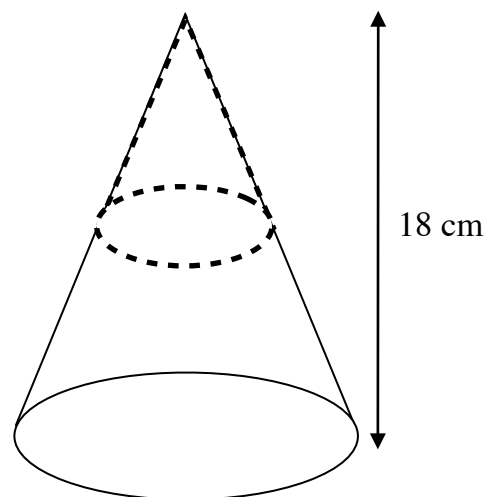
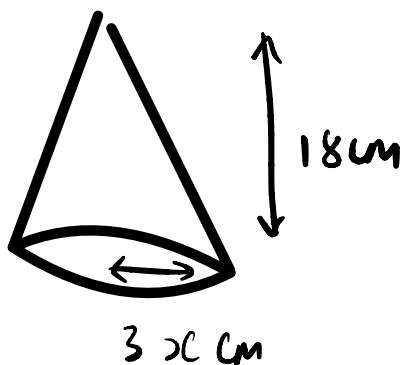
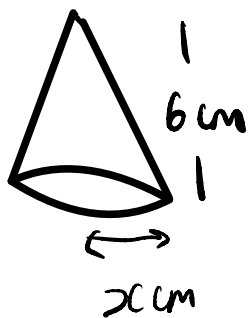
(Total for Question 4 is 4 marks)

5. A frustum is formed by removing a smaller cone from a larger cone.

The radii of the cones are in the ratio small : large = 1 : 3.

The height of the large cone is 18 cm.

Find the height of the frustum.



$$SF = 3$$

$$18 \div 3 = 6$$

6 cm

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(Total for Question 5 is 3 marks)

6. A decorative candle is shaped like a frustum of a cone.

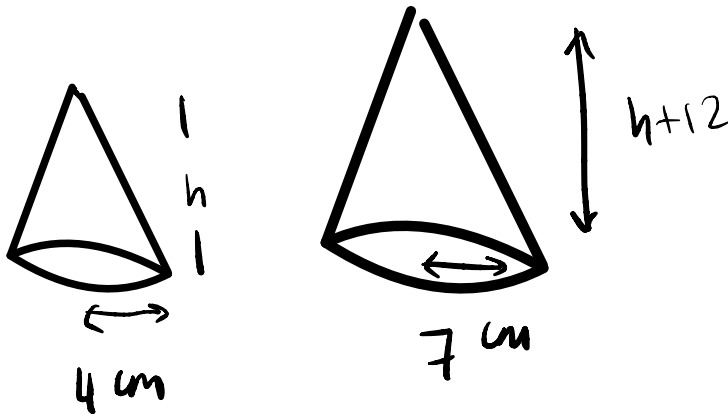
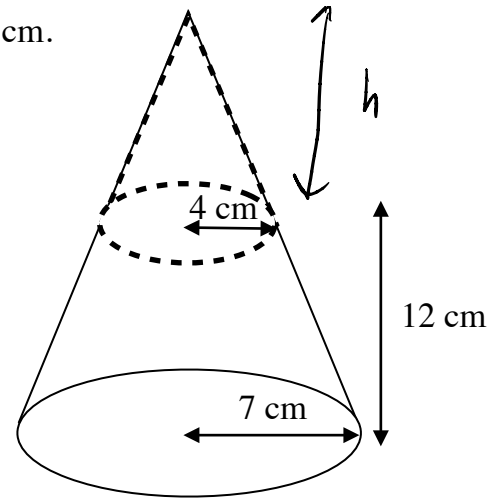
The radius of the base is 7 cm and the radius of the top is 4 cm.

The height of the candle is 12 cm.

The wax has a density of 0.92 g/cm^3 .

Find the mass of the candle.

Give your answer to 3 significant figures.



$$SF = \frac{7}{4}$$

$$\frac{7}{4}h = h + 12$$

$$\frac{3}{4}h = 12$$

$$h = \frac{48}{3} = 16$$

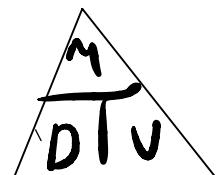
$$\frac{1}{3}\pi(7)^2 \times 28 - \frac{1}{3}\pi(4)^2 \times 16$$

$$= 1168.67 \text{ cm}^3$$

$$m = D \times V$$

$$= 0.92 \times 1168.67$$

$$= 1075.17$$



1075 g

(Total for Question 6 is 4 marks)

7. A container is shaped like a frustum.

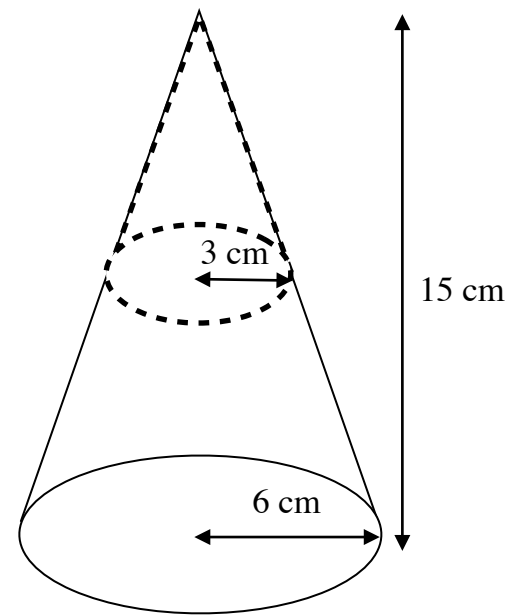
The radius at the base is 6 cm and the radius at the top is 3 cm.

The height is 15 cm.

Water flows into the container at a rate of 20 cm^3 per second.

How long does it take to fill the container?

Give your answer in minutes and seconds.



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(Total for Question 7 is 4 marks)