AQA, OCR, Edexcel

GCSE

GCSE Maths

Volumes of 3D Shapes
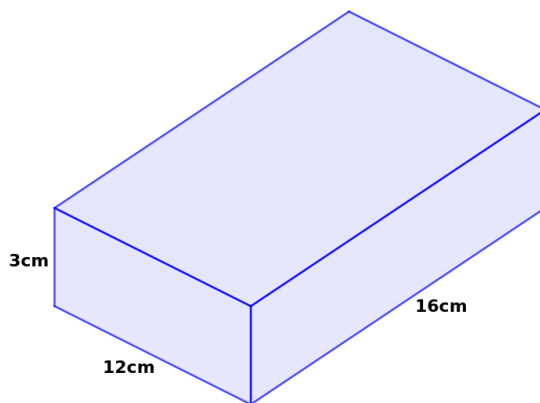
Name:

MME
Mathsmadeeasy.co.uk
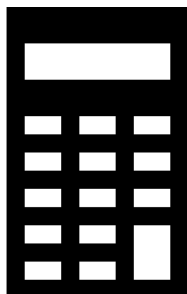
Guidance

1. Read each question carefully.
2. Don't spend too long on each question.
3. Attempt every question.
4. Always show your workings.

Revise GCSE Maths:
www.MathsMadeEasy.co.uk/gcse-maths-revision/
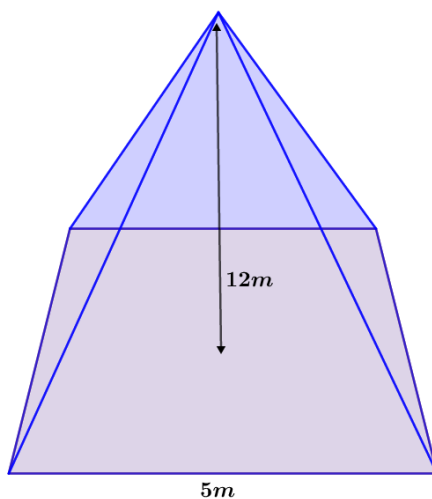
1. Calculate the volume of the cuboid below.

3cm

16cm

12cm

$$3 \times 12 \times 16 = 576$$

………………………………………………………….. Volume = …576…cm^3

(1 mark)

2. Calculate the volume of the square based pyramid below.

12m

5m

$$Volume = \frac{a^2 h}{3}$$

$$Volume = \frac{5^2 \times 12}{3} = 100$$

…………………………………………………………. Volume = …100…..m^3

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(1 mark)

3. Which prism has the greater volume?

The shape below, or a cylinder with diameter 9cm and height 2cm.
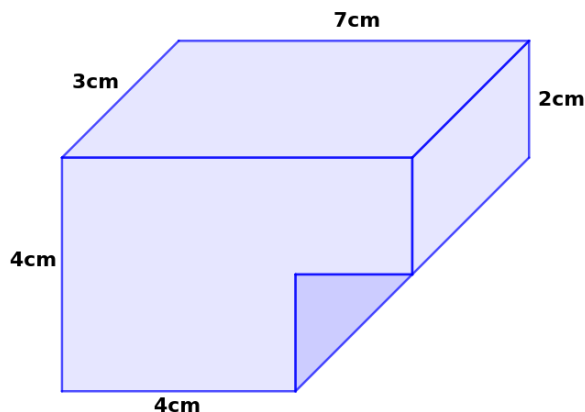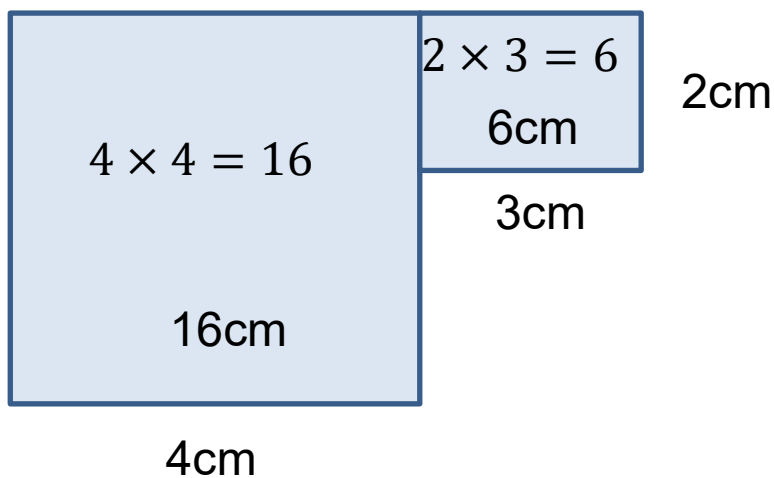

Cylinder

$$Volume = \pi r^2 h$$

$$radius = \frac{diameter}{2} = \frac{9}{2} = 4.5$$

$$Volume = \pi \times 4.5^2 \times 2 = 127.23cm^3$$

Shape

$2 \times 3 = 6$

6cm

2cm

$4 \times 4 = 16$

3cm

16cm

4cm

$$Area\ of\ Cross-section\ =\ 16+6=22cm$$

$$Volume\ =\ area\ of\ corss\ section \times length = 22 \times 3 = 66cm^3$$

The cylinder has a bigger volume.

(4 marks)

4. Calculate the volume of a sphere with radius 4m.

$$Volume\ of\ sphere = \frac{4}{3}\pi r^3$$

$$Volume = \frac{4}{3} \times \pi \times 4^3 = \frac{256\pi}{3}$$

……………………………………………………………………….. Volume = …$\frac{256\pi}{3}$…m³

(2 marks)

5. 1500ml of water is poured into an open-topped cylinder with diameter 16cm and height 12cm.

How high does the water reach from the base of the cylinder?
Give your answer to 2d.p.

$$Volume = \pi r^2 h$$

$$Volume \ (amount \ of \ water) = 1500$$

$$Radius = 16 \div 2 = 8$$

Substituting these values into the formula to find h:

$$1500 = 8^2 \pi h$$
$$1500 = 64 \pi h$$

Rearranging to find h:

$$h = \frac{1500}{64\pi} = 7.46 \ (2dp)$$

The water reaches 7.46cm from the base of the cylinder.

(3 marks)

6. Typically, when buying an ice cream cone, a sphere of ice cream is pressed into the cone, so a hemi-sphere of ice cream protrudes from the top. The rest of the ice cream is contained within the cone.

In this case the cone is 10cm tall, and the radius of the sphere and cone are both 4cm.

What proportion of the volume of the cone is filled with ice cream? Give your answer as a percentage.

Volume of Cone

$$Volume = \pi r^3 \frac{h}{3}$$

$$h = 10$$
$$r = 4$$

$$Volume = \pi \times 4^3 \times \frac{10}{3} = \frac{640\pi}{3}$$

Volume of Sphere

$$\frac{4}{3}\pi r^3$$

$$Volume = \frac{4}{3} \times \pi \times 4^3 = \frac{256\pi}{3}$$

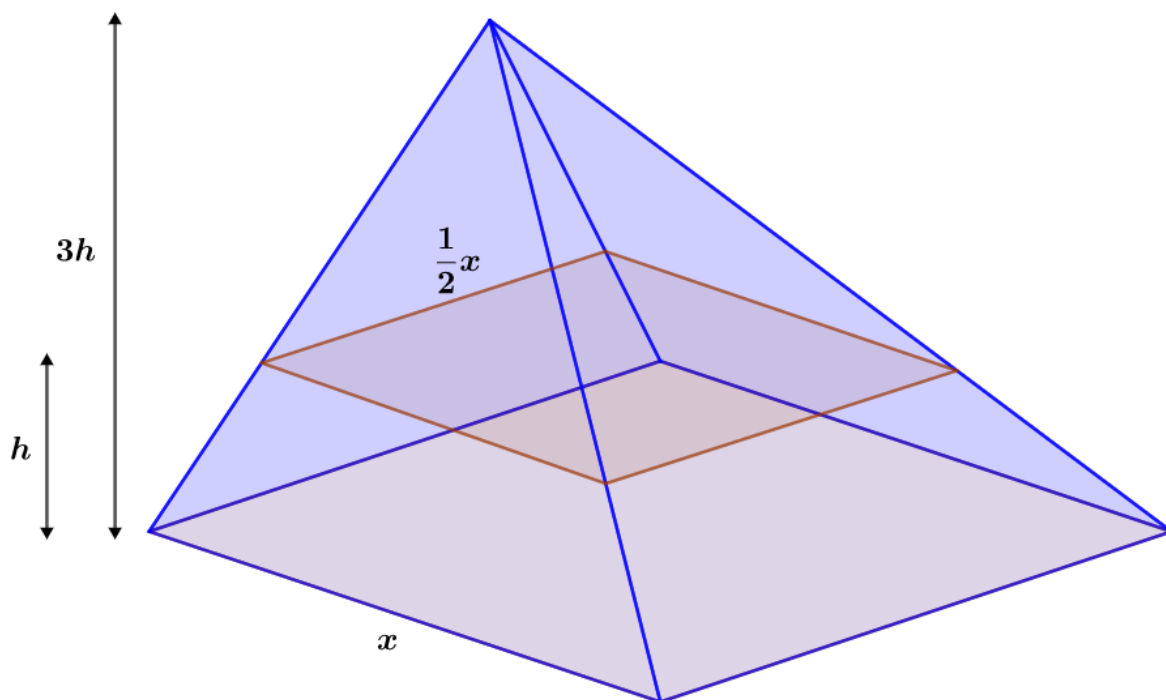Volume of ice cream inside of cone will be half of the volume of the sphere.

$$\frac{256\pi}{3} \div 2 = \frac{128\pi}{3}$$

To find the proportion of ice cream in the cone to the volume of the cone, divide the ice cream by the cone.

$$\frac{640\pi}{3} \div \frac{128\pi}{3} = \frac{1}{5}$$

(3 marks)

7. Water fills a square based pyramid below to a height of h.
   Calculate the proportion of the pyramid that is filled with water.

Give your answer as a percentage.

$$Volume\ of\ square\ based\ pyramid = a^2 \frac{height}{3}$$

Volume of Larger Pyramid

$$Volume = x^2 \frac{3h}{3}$$
$$Volume = x^2 h$$

Volume of Smaller Pyramid

$$Volume = \left(\frac{x}{2}\right)^2 \frac{2h}{3}$$
$$Volume = \frac{x^2}{4} \times \frac{2h}{3} = \frac{x^2 h}{6}$$

Volume of water = Larger Pyramid – Smaller Pyramid

$$Water\ volume = x^2h - \frac{x^2h}{6} = \frac{5x^2h}{6}$$

$$Proportion\ filled\ =\ Water\ volume \div Larger\ pyramid$$

$$\frac{5x^2h}{6} \div x^2h = \frac{5}{6}$$

$$\frac{5}{6} = 83.3\%$$

(3 marks)