

Student Name

Mathematics Stage 4

VOLUME

Book 2 Develop and apply the formula to
find the volume of a prism to solve problems

Version: 260207

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<https://MrDingMaths.com>

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OVERVIEW

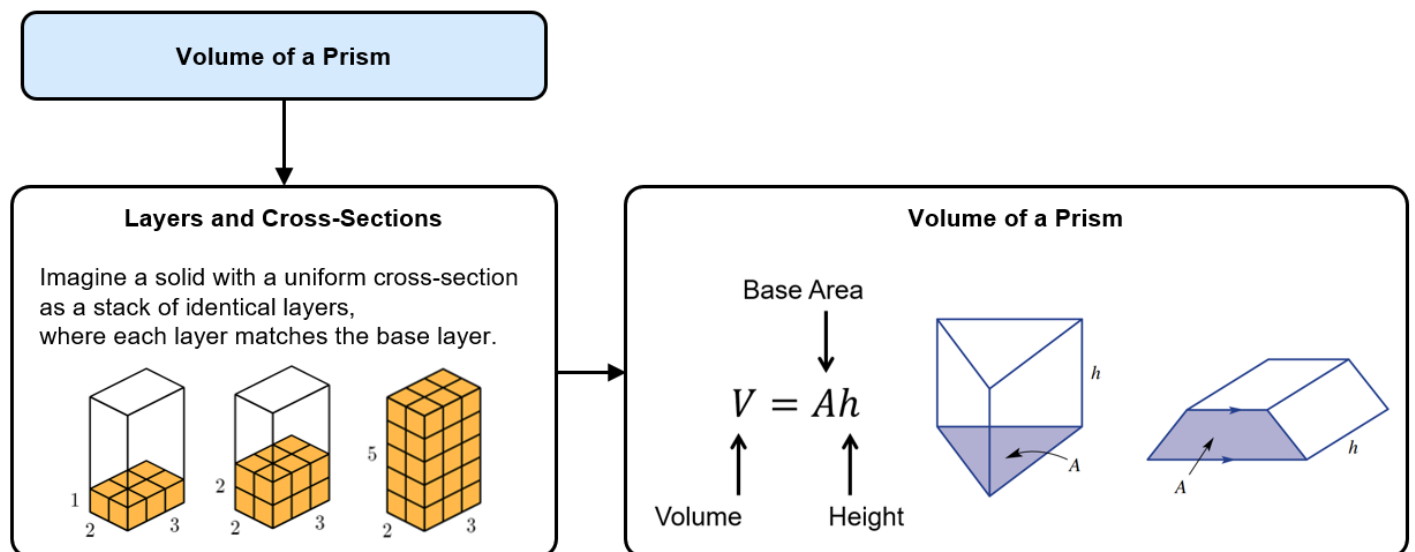
SYLLABUS CONTENT

MA4-VOL-C-01 applies knowledge of volume and capacity to solve problems involving right prisms and cylinders

Develop and apply the formula to find the volume of a prism to solve problems

- Develop the formula for the volume of a prism: $V = \text{base area} \times \text{height}$, leading to $V = Ah$
- Apply the formula for the volume of a prism to prisms with uniform cross-sections to solve problems

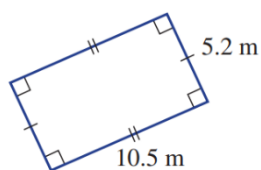
SUMMARY



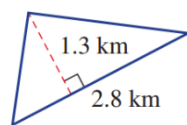
REVIEW OF PRIOR KNOWLEDGE

1 Calculate the area of these shapes.

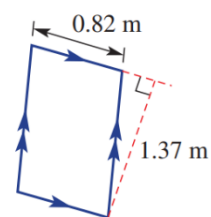
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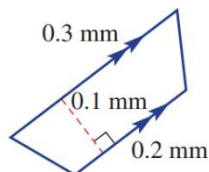
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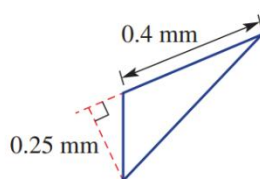
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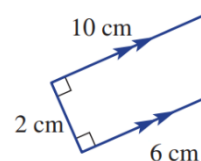
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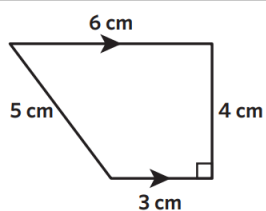
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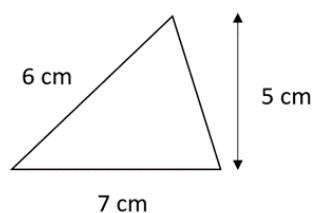
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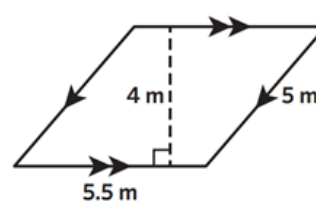
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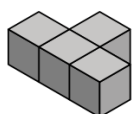


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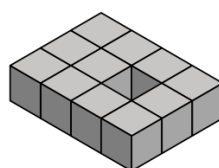


2 Determine the volume of these solids by counting the cubes. Each cube is 1 cm^3

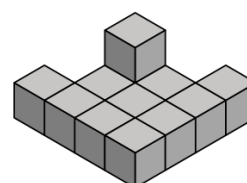
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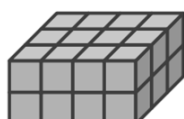
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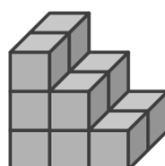
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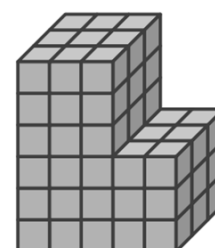
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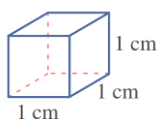
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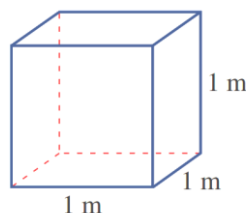
VOLUME OF A PRISM PART 1

- **Volume** is the amount of space taken up by a 3-dimensional object.
- Volume is measured in **cubic units**.

Cubic centimetre (cm^3)



Cubic metre (m^3)

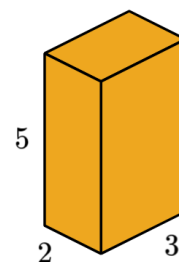


(Not to scale)

Investigation Volume of a prism.

Suppose we want to find how many unit cubes can fit in this box.

The box is a special type of 3D solid called a , because it has -

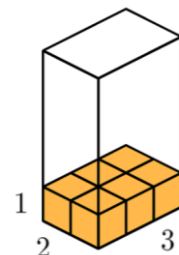


The number of unit cubes that can fit in the box is called the

We will begin by considering the bottom layer, or base, of the shape.

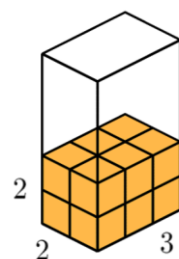
The number of cubes that can fit in the bottom layer is

..... $\times$ =



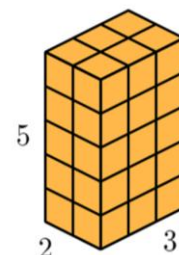
If there are two layers, then the number of cubes is:

..... $\times$ $\times$ =



So, if there are 5 layers, then the number of cubes is:

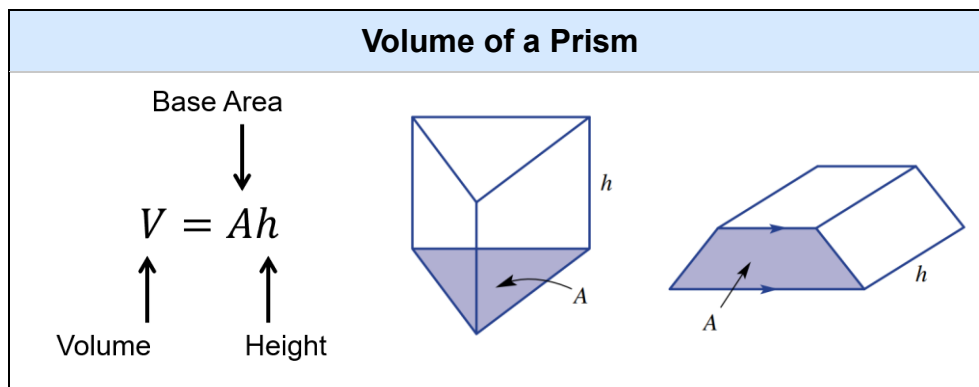
..... $\times$ $\times$ =



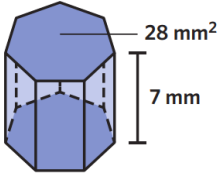
The volume of any prism can be found using the formula:

Volume = Area of the b..... $\times$ number of l.....

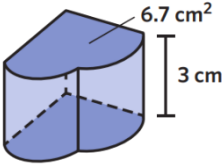
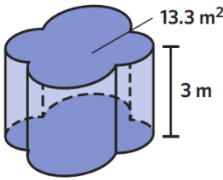
 <https://www.geogebra.org/m/rqnd3khf>



Example Calculate volume of a prism (base area given).

Calculate the volume of these prisms.  $V = Ah$ $= 28 \times 7$ $= 196 \text{ mm}^3$	Where do volume units m^3 come from? <i>If we multiply mm^2 and mm, we get due to the law of multiplication.</i>
--	--

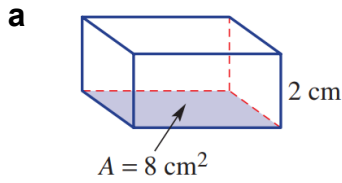
Calculate the volume of these prisms.

a  $V = Ah$ $= \dots\dots\dots$ $= \dots\dots\dots$ 20.1 cm^3	b  $V = Ah$ $= \dots\dots\dots$ $= \dots\dots\dots$ 39.9 m^3
--	--

Key ideas

- | |
|---|
| <ol style="list-style-type: none"> 1. Volume is how much a 3D solid takes up. 2. Volume is measured using units. 3. Calculate the volume of a prism by multiplying the base by the |
|---|

1 The area of the base is given. Calculate the volume of these prisms.

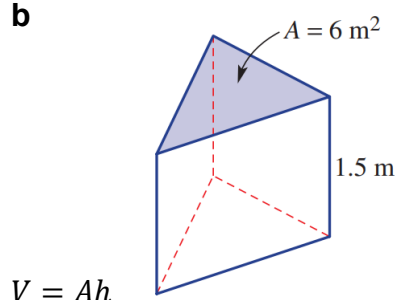


$$V = Ah$$

$$= \dots\dots\dots$$

$$= \dots\dots\dots$$

16 cm³

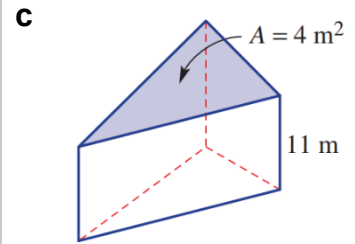


$$V = Ah$$

$$= \dots\dots\dots$$

$$= \dots\dots\dots$$

9 m³

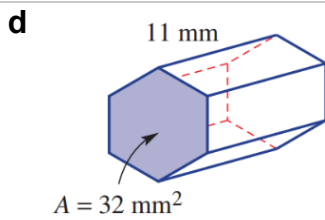


$$V = Ah$$

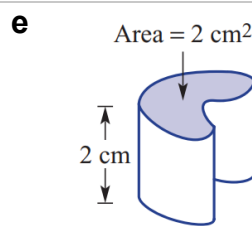
$$= \dots\dots\dots$$

$$= \dots\dots\dots$$

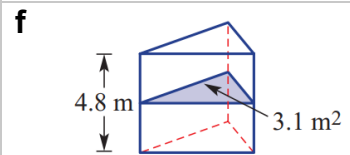
44 m³



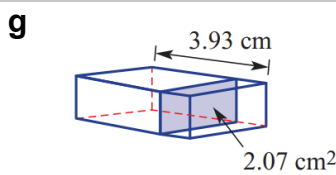
352 mm³



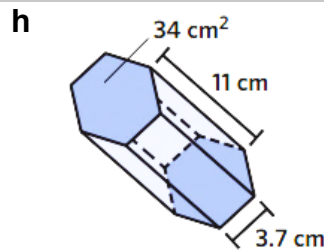
4 cm³



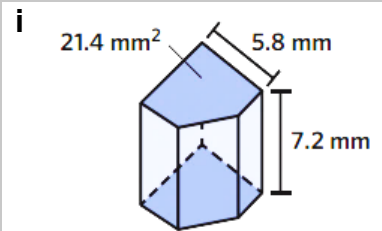
14.88 m³



8.1351 cm³

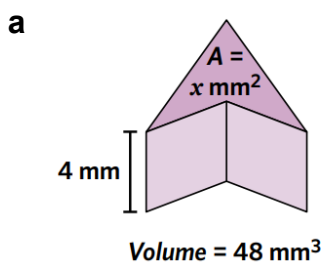


374 cm³



154.08 mm³

2 Find the missing value for each pronumeral.

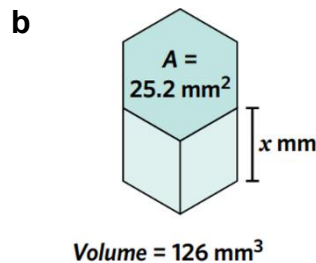


$$V = Ah$$

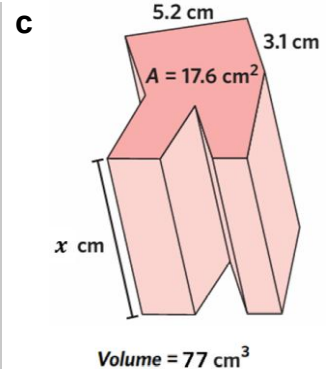
$$48 = 4x$$

$$\dots\dots = x$$

12 mm



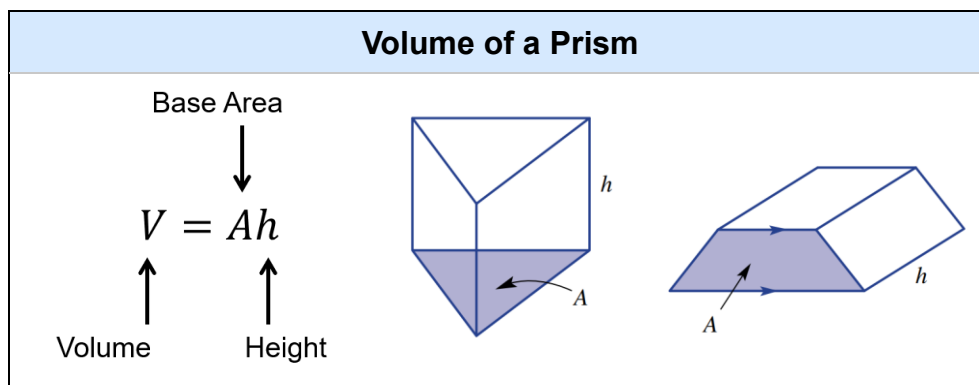
5 mm



0.4375 cm³

VOLUME OF A PRISM PART 2

Volume of Prisms: <https://www.geogebra.org/m/wprybjqc>



Area Formulas			
Rectangle	Parallelogram	Triangle	Trapezium
$A = lw$	$A = bh$	$A = \frac{bh}{2}$	$A = \frac{h(a+b)}{2}$

Example Calculate volume of a prism.

$$V = Ah$$

$$= \left(\frac{45 \times 32}{2} \right) \times 50$$

$$= 36\,000 \text{ mm}^3$$

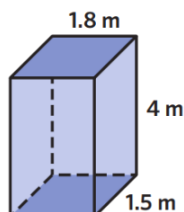
Why is the “base” a triangle, not a rectangle?

The base of a prism is the shape of the uniform

Why is the base area $\frac{45 \times 32}{2}$?

The area of a is $A = \frac{bh}{2}$

a



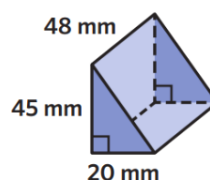
$$V = Ah$$

$$= (\dots \times \dots) \times \dots$$

$$= \dots$$

10.8 m³

b



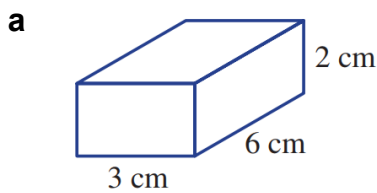
$$V = Ah$$

$$= \left(\frac{\times}{2} \right) \times \dots$$

$$= \dots$$

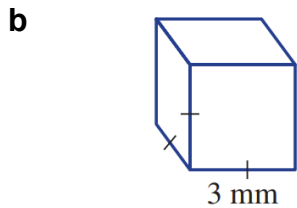
21600 m³

1 Calculate the volumes of these solids.



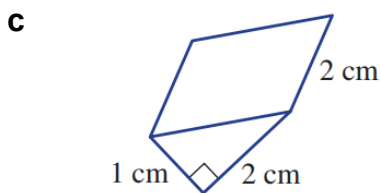
$V = Ah$
=
=

36 cm³



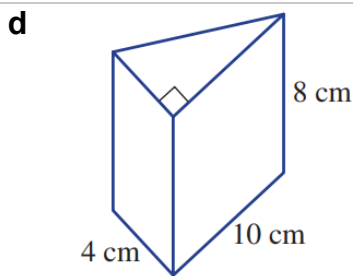
$V = Ah$
=
=

27 cm³

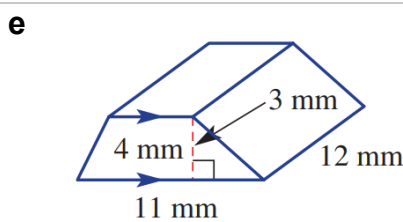


$V = Ah$
=
=

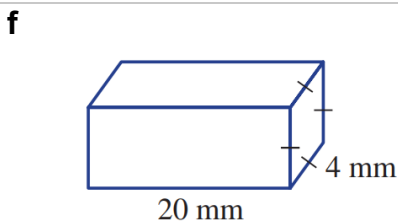
2 cm³



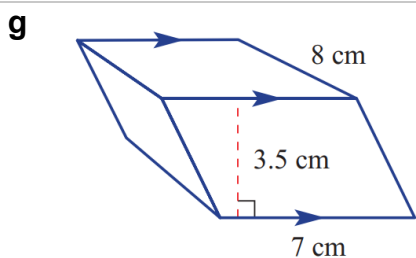
160 cm³



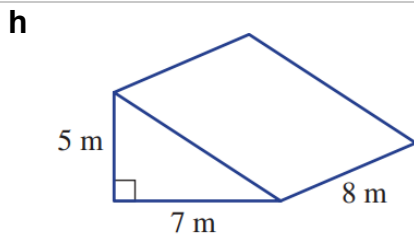
270 mm³



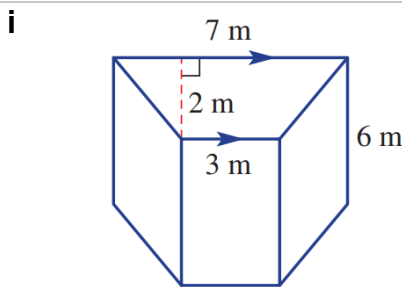
320 mm³



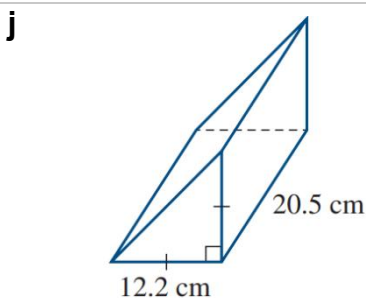
196 cm³



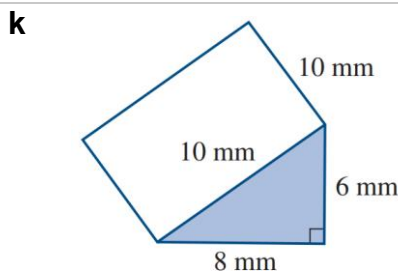
140 m³



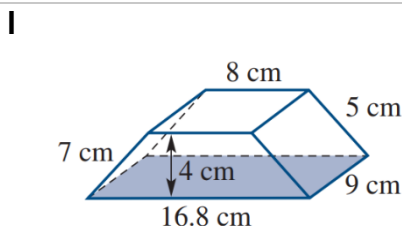
60 m³



1525.61 cm³

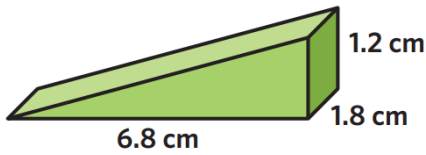


240 mm³



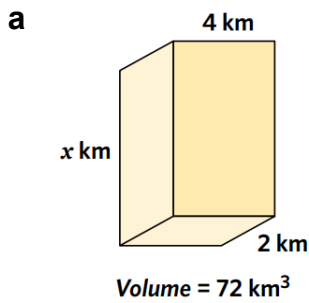
446.4 cm³

- 2 Charya is going to make 100 doorstops for his school with recycled plastic. The doorstops will be in the shape of a triangular prism with these dimensions. What volume of plastic will he need to make all 100 door stops?

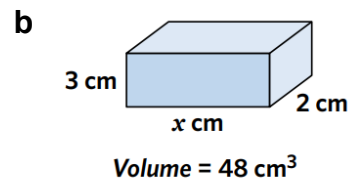


734.4 cm³

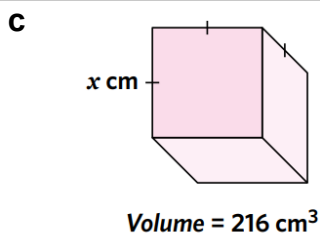
- 3 Find the missing value for each pronumeral.



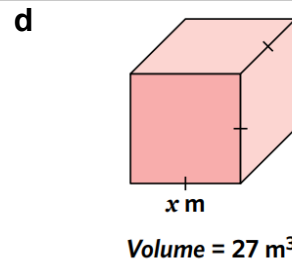
9 km



8 cm

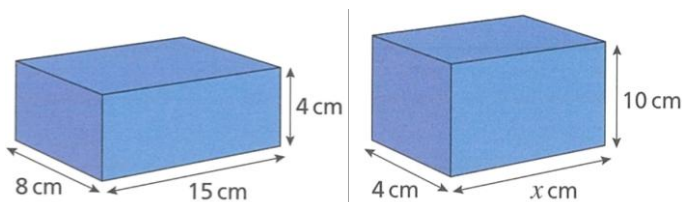


6 cm



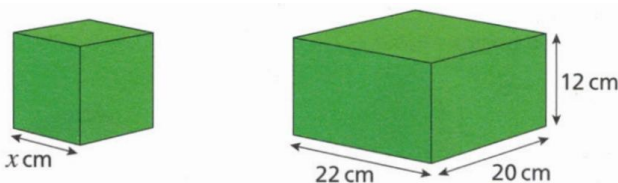
3 m

- 4 Both rectangular prisms have the same volume. Work out the value of x .



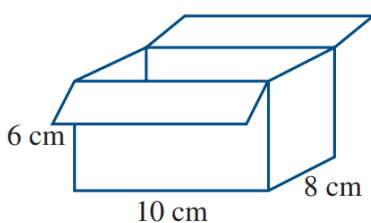
12 cm

- 5 The volume of the rectangular prism is double the volume of the cube. Work out the value of x to 2 d.p.



13.82 cm

- 6 A vase with a volume of 200 cm³ is packed into the cardboard box shown below. The space around the vase is filled with packing foam. What is the volume of the foam?



280 cm³

7

A cube measures 5 cm by 5 cm by 5 cm.

a Work out the volume of the cube.

125 cm³

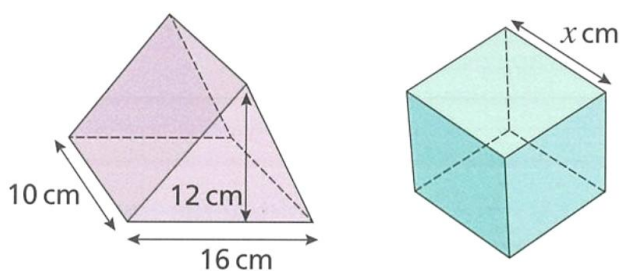
b The length of all the sides is increased by 10%.

Calculate the percentage increase in the volume of the cube.

$$1.1^3 = 1.331$$

33.1%

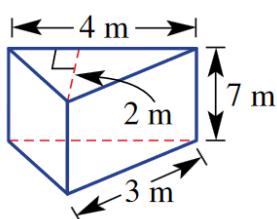
8 The cube and triangular prism have the same volume. Work out the value of x to 2 d.p.



9.86 cm

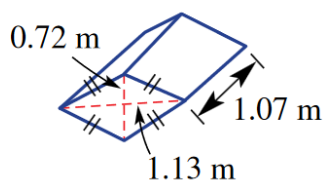
9 Find the volume of each of the following solids.

a



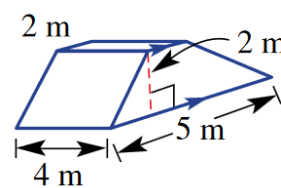
28 m³

b



0.435276 m³

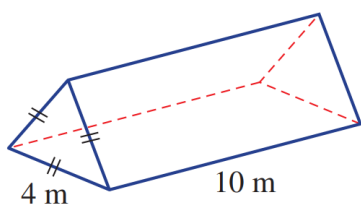
c



28 m³

10 Determine the volume of this equilateral triangular prism. Answer to 1 d.p.

(hint: you need to use Pythagoras' theorem)

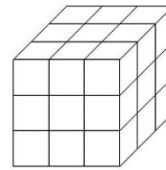


69.3 m³

CHECK YOUR UNDERSTANDING

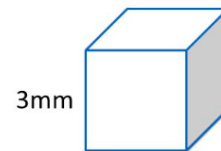
Volume of a prism

1 What is the volume of this cube?



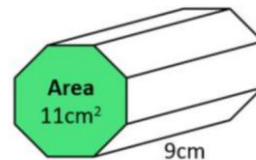
- a 36 small cubes b 27 small cubes c 19 small cubes d 9 small cubes

2 What is the volume of this cube?



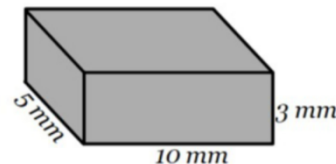
- a 27 mm^3 b 3 mm^3 c 9 mm^3 d Not enough information

3 What is the volume of this prism?



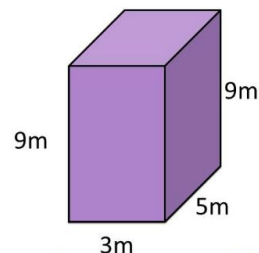
- a 99 cm^3 b 20 cm^3 c 2 cm^3 d Not enough information

4 What is the volume of this rectangular prism?



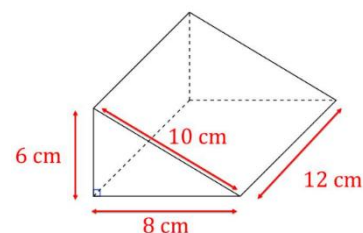
- a 18 mm^3 b 75 mm^3 c 150 mm^3 d 190 mm^3

5 What is the volume of this rectangular prism?



- a 27 m^3 b 243 m^3 c 1215 m^3 d 135 m^3

6 What is the volume of this triangular prism?



- a 576 cm^3 b 288 cm^3 c 5760 cm^3 d 240 cm^3