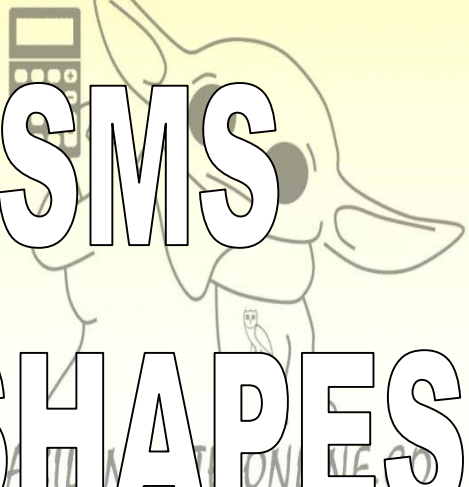
ST. JEAN DE BREBEUF
MATHEMATICS

CHAPTER 1.2

VOLUME OF PRISMS AND COMPOSITE SHAPES



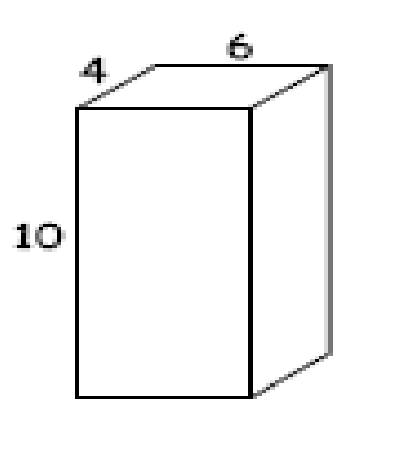
CHAPTER 1.2 VOLUME OF PRISMS AND COMPOSITE SHAPES

Prisms are three-dimensional objects that have equal and parallel ends.

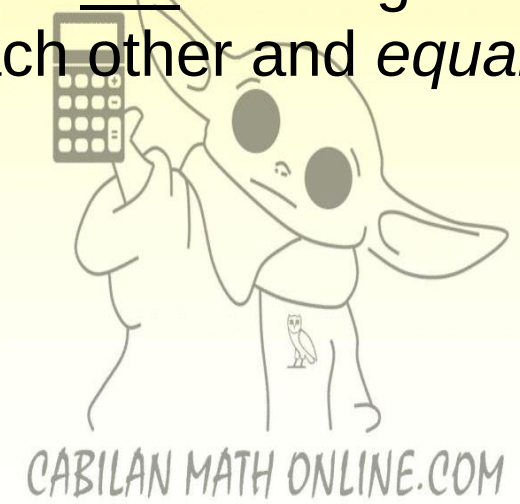
Did You Know?

Prisms are named according to the shape of their *equal* and *parallel* ends?

For example



This is a **rectangular prism** because it is a *three-dimensional* figure with <u>two</u> rectangular ends that are *parallel* to each other and *equal* in size.



CHAPTER 1.2 VOLUME OF PRISMS AND COMPOSITE SHAPES

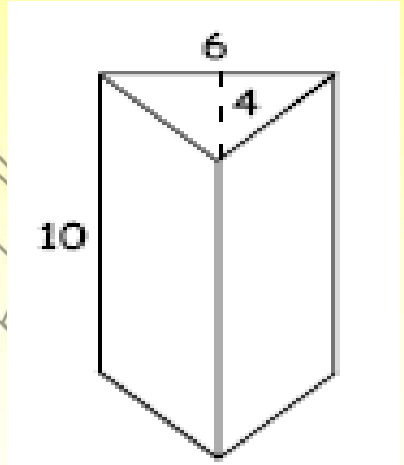
Prisms are three-dimensional objects that have equal and parallel ends.

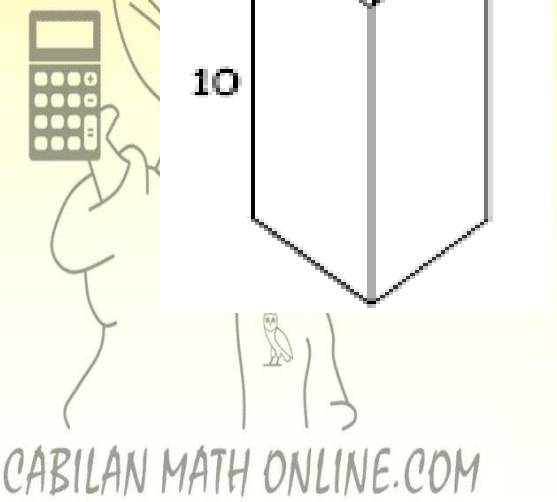
Did You Know?

Prisms are named according to the shape of their *equal* and *parallel* ends?

For example

This is a **triangular prism** because it is a *three-dimensional* figure with <u>two</u> triangular ends that are *parallel* to each other and *equal* in size.





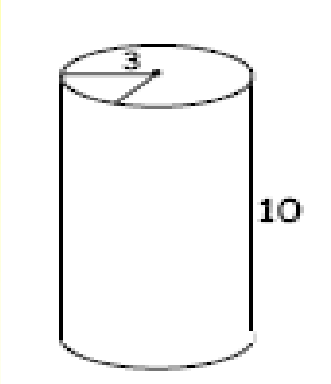
CHAPTER 1.2 VOLUME OF PRISMS AND COMPOSITE SHAPES

Prisms are three-dimensional objects that have equal and parallel ends.

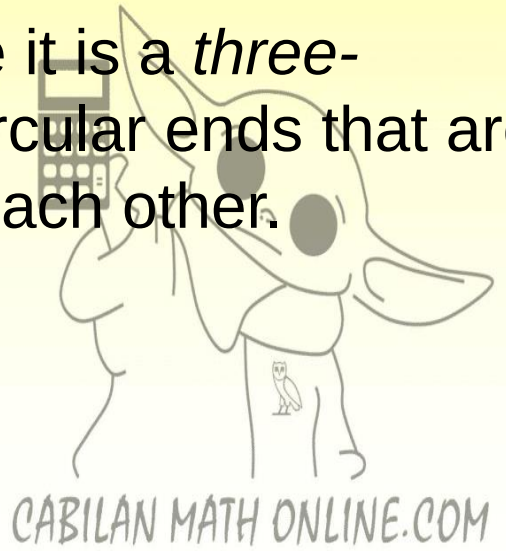
Did You Know?

Prisms are named according to the shape of their *equal* and *parallel* ends?

For example



A **cylinder** is a prism because it is a *three-dimensional* figure with <u>two</u> circular ends that are *equal* in size, and *parallel* to each other.



CHAPTER 1.2 VOLUME OF PRISMS AND COMPOSITE SHAPES

Volume can be thought of as how much space a three-dimensional object occupies.

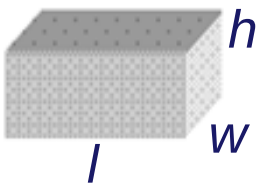
Volume is always measured in **cubic** units

i.e. cm^3, ft^3.

"cubic" units always have the exponent **3**

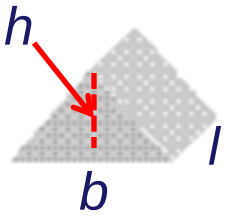
The general equation for solving **volume of a prism** is

= **Area** of the base x **Height** of the object



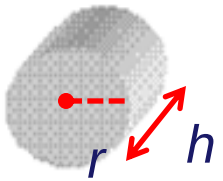
V = **Area** of the base x **Height**

$$V = lwh$$



V = **Area** of the base x **Height**

$$V = \left(\frac{bh}{2}\right)l \quad or \quad V = \frac{bhl}{2}$$



V = **Area** of the base x **Height**

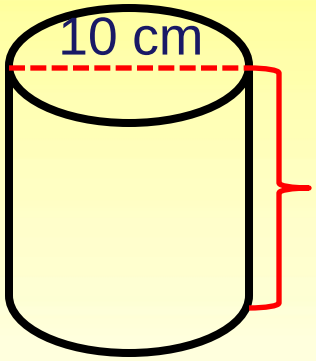
$$V = \pi r^2 h$$

CHAPTER 1.2 VOLUME OF PRISMS AND COMPOSITE SHAPES

Example

Determine the **volume** of a cylinder with a **diameter of 10cm** and a **height of 20cm**.

*** Note the volume formula requires the **radius** of the circular ends, <u>not</u> the diameter.



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

$$V = \pi (5)^2 (20)$$

$$V = 1570.8\,cm^3$$

For **radius**
= diameter / 2
= 10 / 2
= **5**
r

Therefore, the volume of the cylinder is **1570.8 cubic centimetres**.

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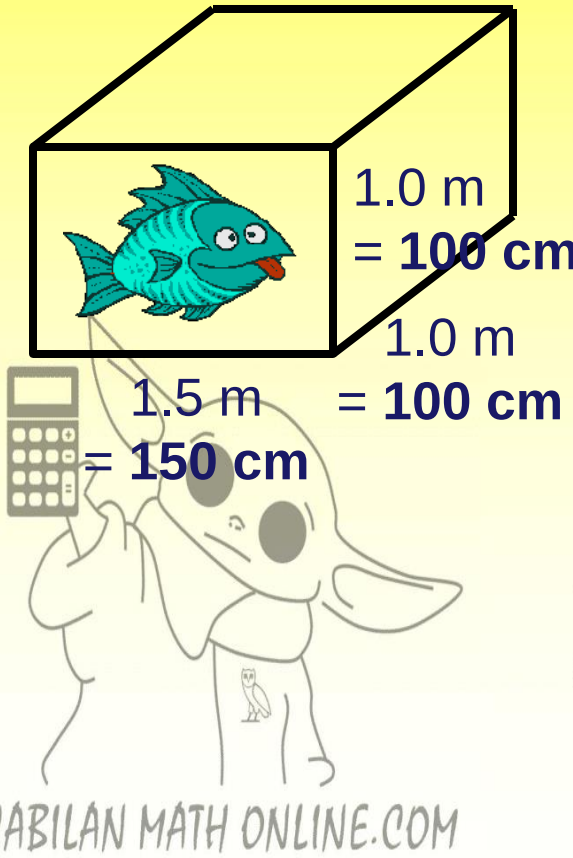
CHAPTER 1.2 VOLUME OF PRISMS AND COMPOSITE SHAPES

Example

A large *rectangular* aquarium has dimensions **1.5m by 1.0m by 1.0m**. Assuming the aquarium is filled right to the top, how many **litres** of water are required to fill the aquarium?

*** Conversion factor: **1 Litre = 1000 cm^3**



Solution

Step 1

To easily convert into *Litres*, convert all measurements from **metres** to **centimetres**

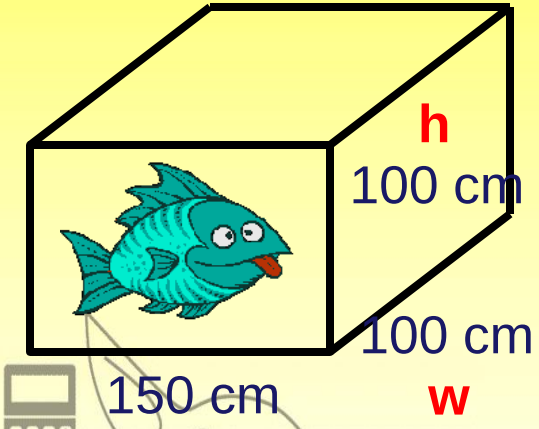
→ Multiply by **100**

CHAPTER 1.2 VOLUME OF PRISMS AND COMPOSITE SHAPES

Example

A large *rectangular* aquarium has dimensions **1.5m by 1.0m by 1.0m**. Assuming the aquarium is filled right to the top, how many **litres** of water are required to fill the aquarium?

*** Conversion factor: **1 Litre = 1000 cm³**



Solution

Step 2
Find the **Volume**

$$V = lwh$$

$$V = (150)(100)(100)$$

$$V = 1500000\,cm^3$$

Step 3
Convert Volume from **cm³** to **Litres**
→ Divide by **1000**

$$V = \frac{1500000\,cm^3}{1000\,cm^3}$$

$$V = 1500\,L$$

*Therefore it will require **1500 Litres** to fill the aquarium.*

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CHAPTER 1.2 VOLUME OF PRISMS AND COMPOSITE SHAPES

Example

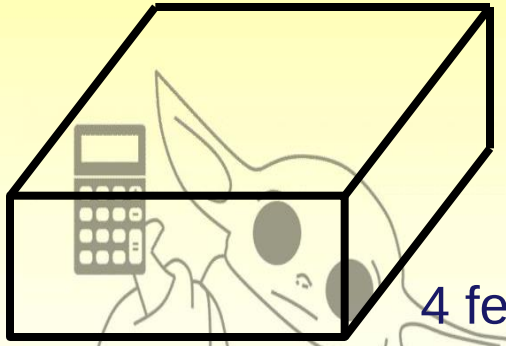
The bed of a standard pickup truck measures **8 feet long by 4 feet wide by 2 feet deep**. How many **cubic yards** of gravel will the truck hold?

Solution

Step 1

Convert all dimensions from **feet** to **yards** (use conversion from Intro)

→ Divide by **3**



2 feet
= 2 / 3
= **0.67 yd.**

8 feet
= 8 / 3
= **2.67 yd.**

4 feet
= 4 / 3
= **1.33 yd.**

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CHAPTER 1.2 VOLUME OF PRISMS AND COMPOSITE SHAPES

Example

The bed of a standard pickup truck measures **8 feet long by 4 feet wide by 2 feet deep**. How many **cubic yards** of gravel will the truck hold?

Solution

Step 2

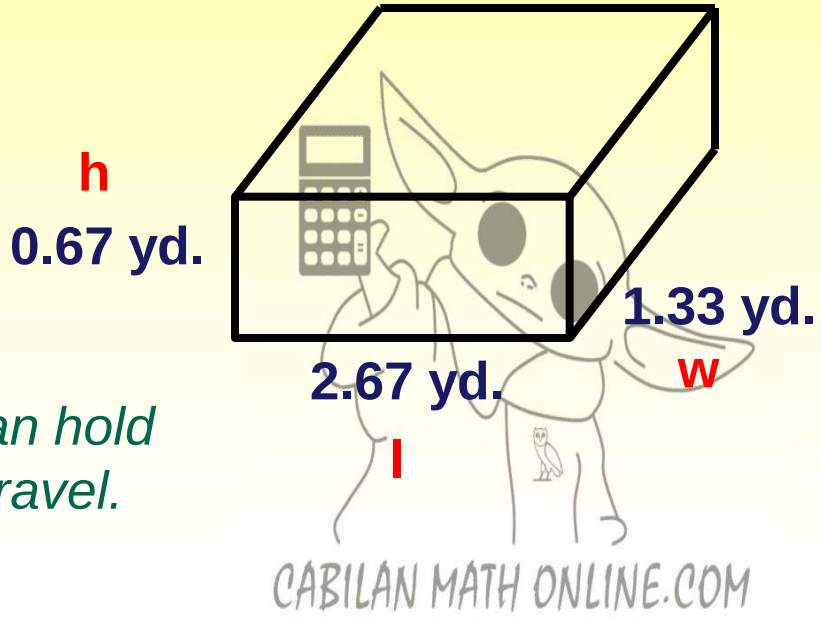
Calculate **Volume**

$$V = lwh$$

$$V = (2.67)(1.33)(0.67)$$

$$V = 2.38\ yd^3$$

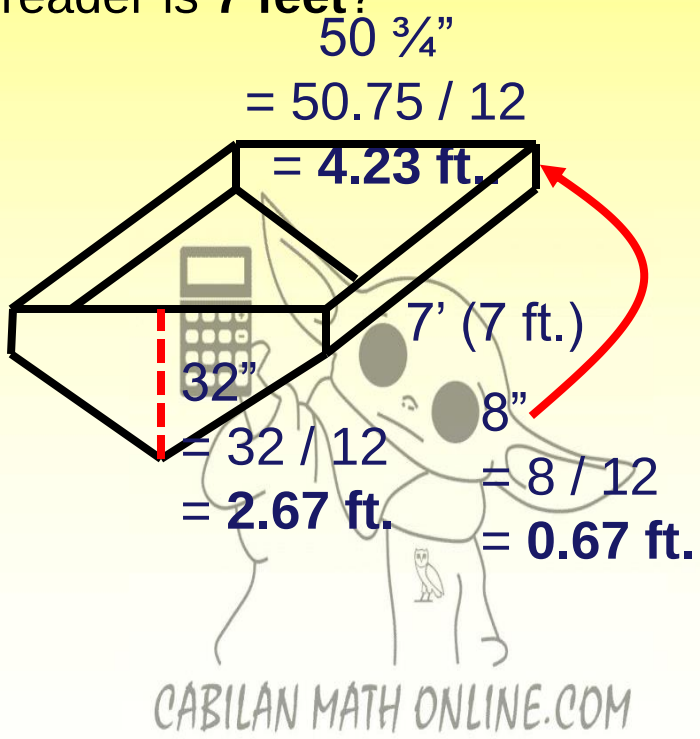
Therefore, the truck can hold ***2.38 cubic yards*** *of gravel.*



CHAPTER 1.2 VOLUME OF PRISMS AND COMPOSITE SHAPES

Example

A local snow removal company has just purchased a salt and sand spreader for applying salt and sand to the parking lots after the snow has been removed. The spreader is a composite figure made up of a rectangular prism on top of a triangular prism as shown in the diagram below. How many **cubic yards** of sand will fit in the spreader if the overall length of the spreader is **7 feet**?



Solution

Step 1

Convert all measurements to a common unit

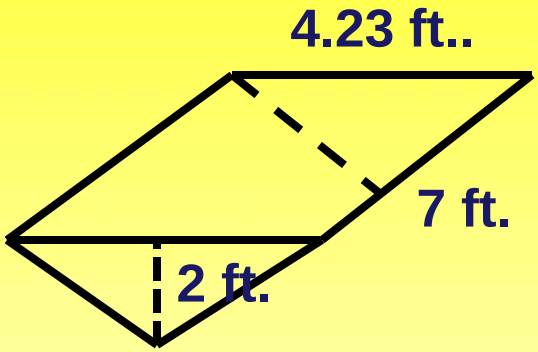
→To easily solve for *cubic yards*, we need to convert all measurements to **feet**

→Divide by **12**

CHAPTER 1.2

VOLUME OF PRISMS AND COMPOSITE SHAPES

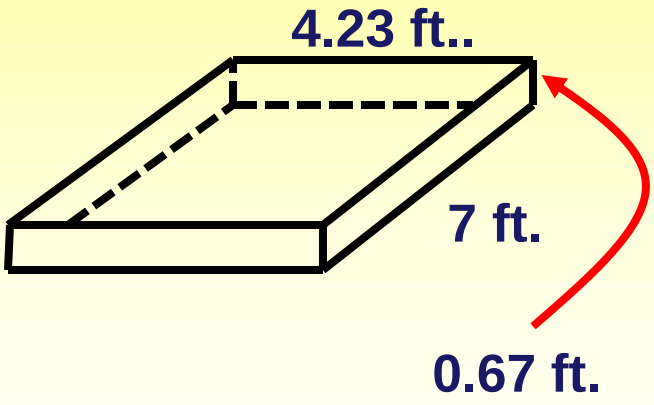
Example

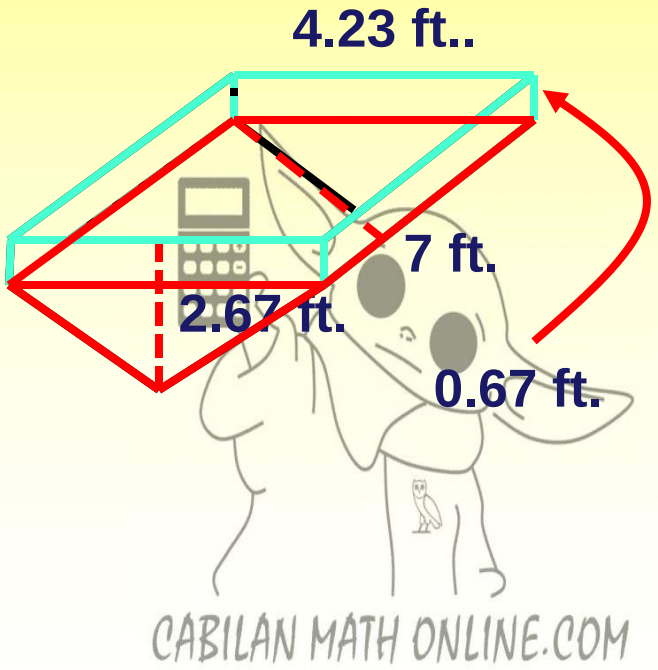


Solution

Step 2

Divide this composite shape into two prisms that you know, a **rectangular** prism and a **triangular** prism.





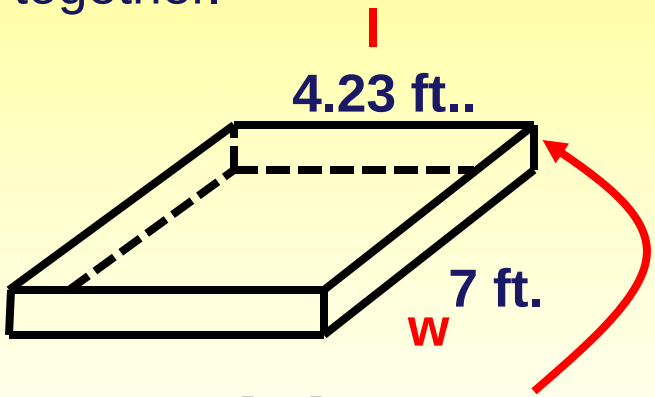
CHAPTER 1.2 VOLUME OF PRISMS AND COMPOSITE SHAPES

Example

Solution

Step 3

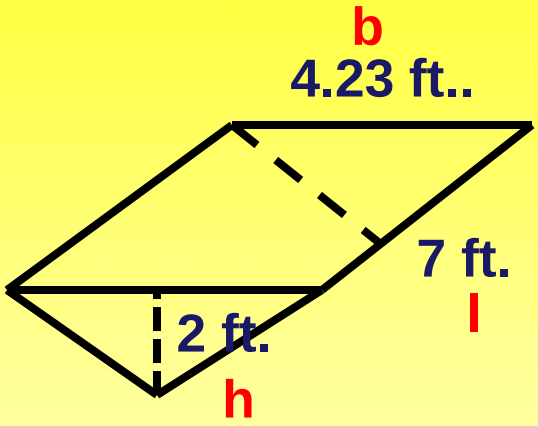
Determine the **Volume** of both prisms (in **cubic feet**) and add your totals together.



$$V = lwh$$

$$V = (4.23)(7)(0.67)$$

$$V = 19.84\ ft^3$$



$$V = \frac{bhl}{2}$$

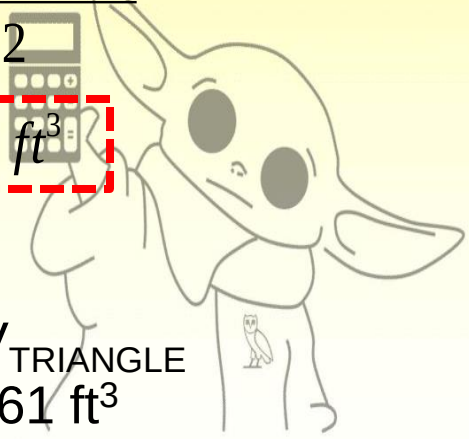
$$V = \frac{(4.23)(2)(7)}{2}$$

$$V = 29.61\ ft^3$$

$V_{TOTAL} = V_{RECTANGLE} + V_{TRIANGLE}$

$= 19.84\ ft^3 + 29.61\ ft^3$

$= 49.45\ ft^3$



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CHAPTER 1.2 VOLUME OF PRISMS AND COMPOSITE SHAPES

Example

Solution

Step 3

Determine the **Volume** of both prisms (in **cubic feet**) and add your totals together.

$V_{TOTAL} = V_{RECTANGLE} + V_{TRIANGLE}$

$= 19.84\ ft^3 + 29.61\ ft^3$

$= 49.45\ ft^3$

Therefore, for the Volume in **cubic yards**

$= 49.45\ ft^3 / 27\ ft^3$

$=$ **1.8 yd³** (or **cubic yards**)

Step 4

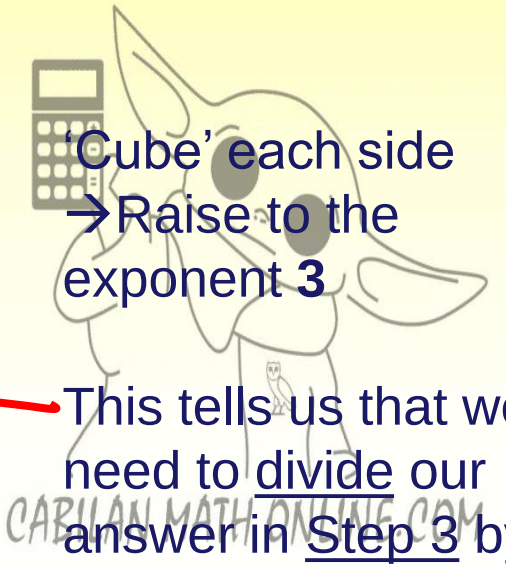
Convert **cubic feet** to **cubic yards** (this is the hard part!)

From the Intro, we know that **1 yard = 3 feet**

$$1\,yd = 3\,ft$$

$$(1\,yd)^3 = (3\,ft)^3$$

$$1\,yd^3 = 27\,ft^3$$



'Cube' each side → Raise to the exponent **3**

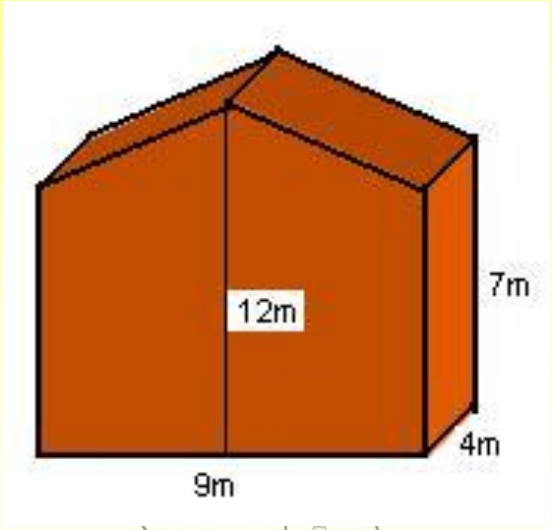
This tells us that we need to divide our answer in Step 3 by **27** to finish!

CHAPTER 1.2 VOLUME OF PRISMS AND COMPOSITE SHAPES

Assignment

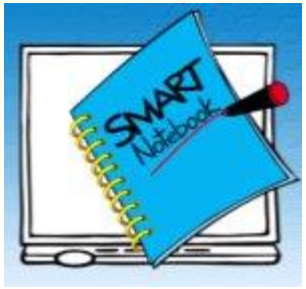
1. A swimming pool is **164 feet long**, **82 feet wide**, and **6 ½ feet deep**. How many **litres** of water are required to fill the swimming pool? (1 ft^3 = 28.32 L)

2. Below is a diagram of a storage shed located on a local farm.



(i) What is the total volume of the shed?

(ii) If rectangular bales of hay are **300cm** by **200cm** by **100cm**, approximately how many bales of hay can be stored in the shed?



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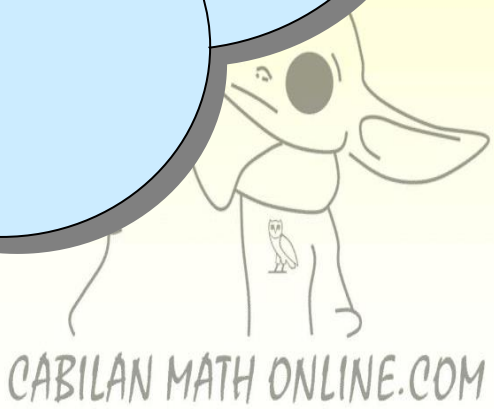
CHAPTER 1.2

VOLUME OF PRISMS AND COMPOSITE SHAPES

Homework

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