

LEARNING GUIDE 6: CALCULATING VOLUME

Watch the following instructional video. In your handout:

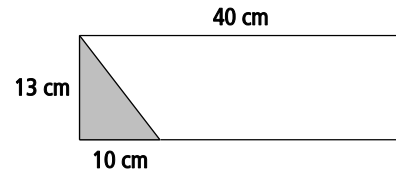
i) Copy down the given notes and examples

ii) Complete the assigned questions

https://youtu.be/F_RKSkMCbjg

Calculating Area

Area is the number of square units inside a shape.
This rectangle has a shaded triangle.



Find the area of the *unshaded* part of the rectangle.

$$\text{Area of rectangle} = l \times w$$

$$A = 40 \times 13$$

$$A = 520 \text{ cm}^2$$

$$\text{Area of triangle} = (b \times h) \div 2$$

$$A = (10 \times 13) \div 2$$

$$A = 130 \div 2$$

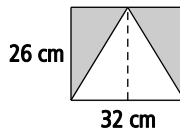
$$A = 65 \text{ cm}^2$$

Area of unshaded part = area of rectangle – area of triangle

$$A = 520 - 65$$

$$A = 455 \text{ cm}^2$$

1. Find the area of the *shaded* part.



$$\text{Area of rectangle} = l \times w$$

$$A = 32 \times \underline{\hspace{2cm}}$$

$$A = \underline{\hspace{2cm}} \text{ cm}^2$$

$$\text{Area of triangle} = (b \times h) \div 2$$

$$A = (32 \times \underline{\hspace{2cm}}) \div 2$$

$$A = \underline{\hspace{2cm}} \div 2$$

$$A = \underline{\hspace{2cm}} \text{ cm}^2$$

Area of shaded part = area of rectangle – area of triangle

$$A = \underline{\hspace{2cm}} - \underline{\hspace{2cm}}$$

$$A = \underline{\hspace{2cm}}$$

Repeated Multiplication

2^3 can be written as $2 \times 2 \times 2$.

$$2^3 = 2 \times 2 \times 2 = 8$$

2. Write as repeated multiplication. Then, find the answer.

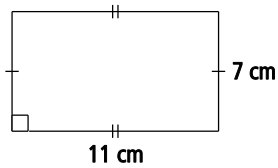
a) $7^2 = \underline{\hspace{2cm}} \times \underline{\hspace{2cm}}$
 $= \underline{\hspace{2cm}}$

b) $5^2 = \underline{\hspace{2cm}} \times \underline{\hspace{2cm}}$
 $= \underline{\hspace{2cm}}$

Warm Up

1. Find the area of each shape using the formula.

a) Rectangle

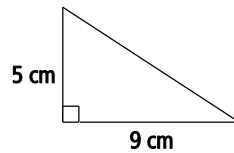


$A = l \times w$

$A = \underline{\hspace{2cm}} \times \underline{\hspace{2cm}}$

$A = \underline{\hspace{2cm}} \text{ cm}^2$

b) Triangle

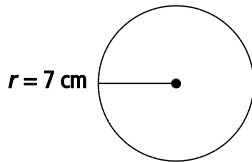


$A = b \times h \div 2$

$A = \underline{\hspace{2cm}} \times \underline{\hspace{2cm}} \div 2$

$A = \underline{\hspace{2cm}}$

c) Circle

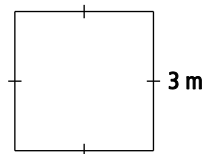


$A = \pi \times r^2$

$A = \underline{\hspace{2cm}} \times \underline{\hspace{2cm}} \times \underline{\hspace{2cm}}$

$A = \underline{\hspace{2cm}}$

d) Square



$A = s^2$

$A = \underline{\hspace{2cm}} \times \underline{\hspace{2cm}}$

$A = \underline{\hspace{2cm}}$

Understanding Volume

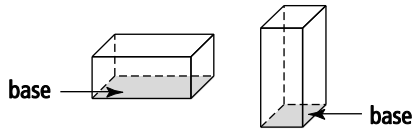
Example: Determine the Volume Using the Base and the Height

volume (V)

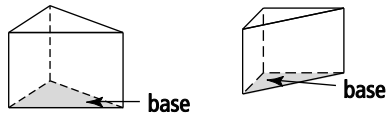
- the amount of space an object occupies
- measured in cubic units (cm^3)
- $\text{Volume} = \text{area of base} \times \text{height}$

base

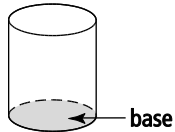
- the face that helps name the object



- the base of a triangular prism is a triangular face

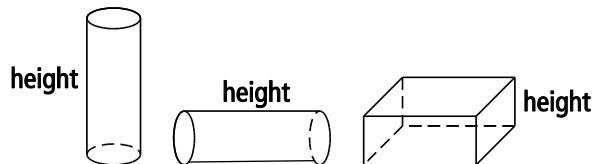


- the base of a cylinder is a circular face



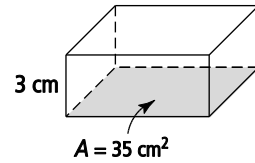
height

- the distance between the 2 faces that name the shape
- if the shape is on its side, the height is still the distance between the 2 faces



Example 1

- a) Find the volume of the right rectangular prism using the area of the base and the height.



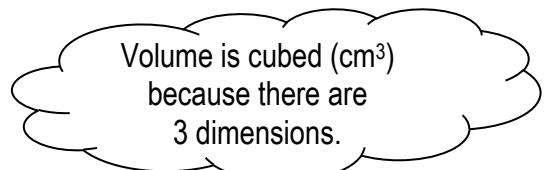
Solution

The area of the base is 35 cm².
The height is 3 cm.

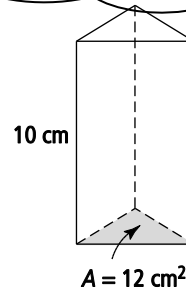
Volume = area of base × height

$$V = 35 \times \underline{\hspace{2cm}}$$

$$V = \underline{\hspace{2cm}} \text{ cm}^3$$



- b) Find the volume of the right triangular prism using the area of the base and the height.



Solution

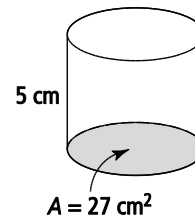
The area of the base is 12 cm².
The height is 10 cm.

Volume = area of base × height

$$V = \underline{\hspace{2cm}} \times 10$$

$$V = \underline{\hspace{2cm}} \text{ cm}^3$$

- c) Find the volume of the cylinder using the area of the base and the height.



Solution

The area of the base is _____ cm².

The height is _____ cm.

Volume = area of base × height

$$V = \underline{\hspace{2cm}} \times \underline{\hspace{2cm}}$$

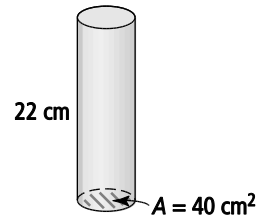
$$V = \underline{\hspace{2cm}} \text{ cm}^3$$

1. What is the volume of the right cylinder?

Volume = area of base \times _____

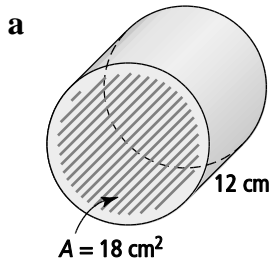
$V =$ _____ \times _____

$V =$ _____



Practise

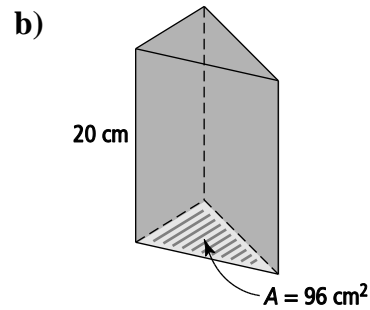
1. Find the volume of the right cylinder and right prism.



Volume = area of base \times _____

$V =$ _____ \times _____

$V =$ _____

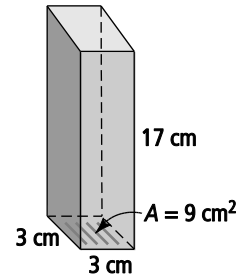
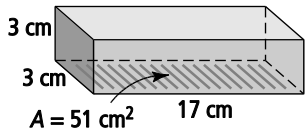


Volume = _____ \times _____

$V =$ _____ \times _____

$V =$ _____

2. Find the volume of each right rectangular prism.



Volume = _____ × height

Volume = _____

$V = \underline{\hspace{2cm}} \times \underline{\hspace{2cm}}$

$V = \underline{\hspace{4cm}}$

$V = \underline{\hspace{4cm}}$

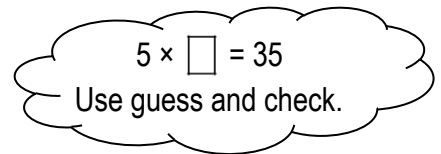
How does the orientation of the prism affect the volume of the prism?

3. Find the height of the right rectangular prism.

area of base = 5 cm^2 , volume = 35 cm^3

Formula → Volume = area of base × _____

Substitute → $35 = 5 \times \underline{\hspace{2cm}}$



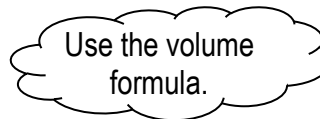
The height of the right rectangular prism is _____.

4. Jose opens a can of soup and sees the soup only reaches 9 cm up the can. If the area of the base is 10.4 cm^2 , how much soup is in the can?

Formula →

Substitute →

Solve →

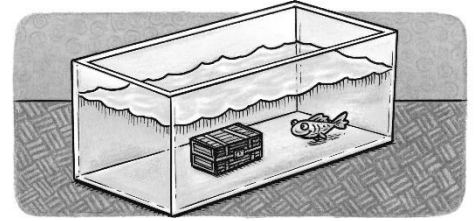


Sentence:

5. Ocean City Aquarium is building a new rectangular tank for its coral reef fish. The area of the base is $18\,750\text{ cm}^2$ and the height is 90 cm .



- a) What is the volume of the tank?



Sentence: The volume of the tank is _____.

- b) Millilitres and litres are measures of capacity. What is the capacity of the tank in litres?

$$1\text{ L} = 1000\text{ cm}^3$$

Volume of fish tank $\div 1000$

$$= \text{_____} \div 1000$$

$$= \text{_____ L}$$

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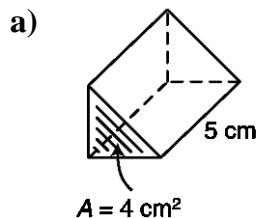
i) Copy down the given notes and examples

ii) Complete the assigned questions

<https://youtu.be/bXF0Rg6Yry8>

Warm Up

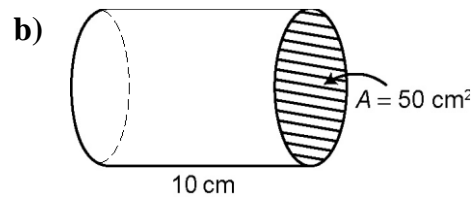
1. Find the volume of each prism.



Volume = area of base \times _____

$$V = \text{_____} \times \text{_____}$$

$$V = \text{_____}$$



Volume = _____ \times height

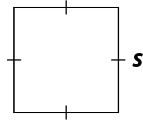
$$V = \text{_____} \times \text{_____}$$

$$V = \text{_____}$$

2. What is the area formula for each shape?

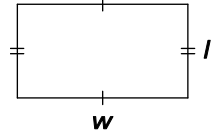
a) Square

$A = \underline{\hspace{2cm}}$



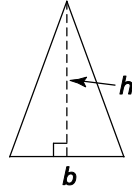
b) Rectangle

$A = \underline{\hspace{2cm}} \times \underline{\hspace{2cm}}$



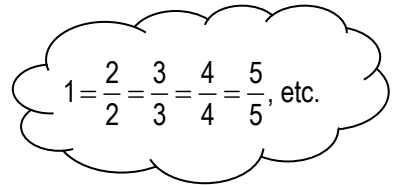
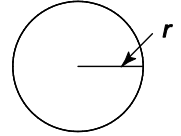
c) Triangle

$A = \underline{\hspace{2cm}} \times \underline{\hspace{2cm}} \div 2$



d) Circle

$A = \underline{\hspace{2cm}} \times \underline{\hspace{2cm}}^2$



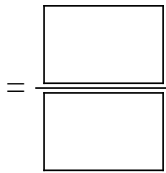
3. Solve

a) $\frac{1}{4}$ of 40

$\frac{1}{4} \times 40$

$= \frac{1}{4} \times \frac{40}{1}$

$= \frac{1 \times 40}{4 \times 1}$

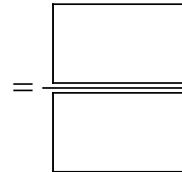
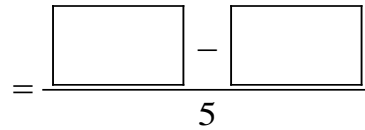


$= \underline{\hspace{2cm}}$

b)

$1 - \frac{4}{5}$

$= \frac{5}{5} - \frac{4}{5}$



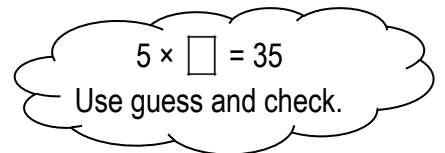
4. Find the height of the right rectangular prism.

area of base = 5 cm^2 , volume = 35 cm^3

Formula \rightarrow Volume = area of base \times _____

Substitute \rightarrow $35 = 5 \times$ _____

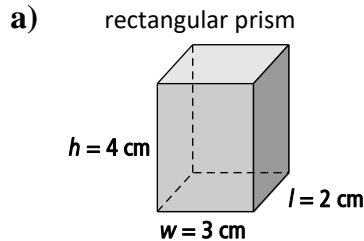
The height of the right rectangular prism is _____.



Volume of a Prism

Example: Use a Formula to Determine the Volume of a Rectangular Prism

Find the volume.



Solution

$V = \text{area of base} \times \text{height of prism}$

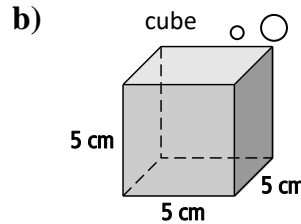
$V = (\text{length} \times \text{width}) \times \text{height}$

$V = l \times w \times h$

$V = 2 \times \underline{\hspace{2cm}} \times \underline{\hspace{2cm}}$

$V = \underline{\hspace{2cm}} \text{ cm}^3$

The volume is $\underline{\hspace{2cm}}$.



A rectangular prism with 6 square faces that are all the same size.

Solution

Volume = area of base \times height of prism

$V = (\text{length} \times \text{width}) \times \text{height}$

$V = s \times s \times s$

$s^3 = s \times s \times s$

$V = 5 \times \underline{\hspace{2cm}} \times \underline{\hspace{2cm}}$

$V = \underline{\hspace{2cm}} \text{ cm}^3$

The volume is $\underline{\hspace{2cm}}$.

Example: Use a Formula to Determine the Volume of a Triangular Prism

What is the volume of the right triangular prism?

Solution

Volume of triangular prism = area of triangular base \times height of prism

$V = (b \times h \div 2) \times h$

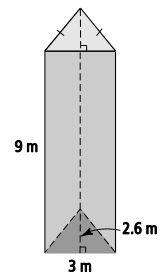
$V = (3 \times 2.6 \div 2) \times 9$

$V = (\underline{\hspace{2cm}} \div 2) \times 9$

$V = \underline{\hspace{2cm}} \times 9$

$V = \underline{\hspace{2cm}} \text{ m}^3$

The volume of the right triangular prism is $\underline{\hspace{2cm}}$.

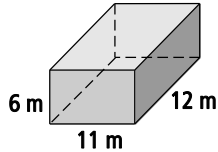


The first h is for the height of the triangle.
The second h is for the height of the prism.

Practise

1. What is the volume of each right rectangular prism?

a)



b) $l = 8 \text{ cm}, w = 7 \text{ cm}, h = 9 \text{ cm}$

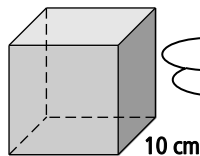
$V = \underline{\hspace{2cm}} \times \underline{\hspace{2cm}} \times \underline{\hspace{2cm}}$ ← Formula →

$V = \underline{\hspace{2cm}} \times \underline{\hspace{2cm}} \times \underline{\hspace{2cm}}$ ← Substitute →

$V = \underline{\hspace{2cm}} \text{ m}^3$

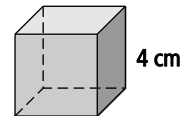
2. Find the volume of each cube.

a)



All sides of a cube have the same measurement.

b)



$V = s^3$ ← Formula →

$V = \underline{\hspace{2cm}} \times \underline{\hspace{2cm}} \times \underline{\hspace{2cm}}$ ← Substitute →

$V = \underline{\hspace{2cm}} \text{ cm}^3$

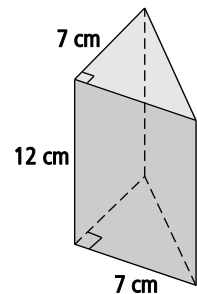
3. What is the volume of the triangular prism?

a)

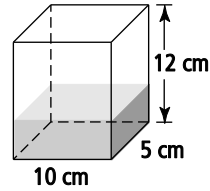
$V = \text{area of base} \times \underline{\hspace{2cm}}$

$V = (b \times h \div 2) \times h$

$V = (\underline{\hspace{2cm}} \times \underline{\hspace{2cm}} \div 2) \times \underline{\hspace{2cm}}$



4. The container is $\frac{1}{3}$ full. How much liquid is in it?



Find the volume.

Volume of the container:

Volume of liquid:

Formula \rightarrow

$$V = \frac{1}{3} \times \text{volume of container}$$

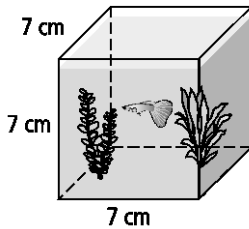
Substitute \rightarrow

$$= \frac{1}{3} \times \underline{\hspace{2cm}}$$

Solve \rightarrow

$$= \underline{\hspace{2cm}} \text{ cm}^3$$

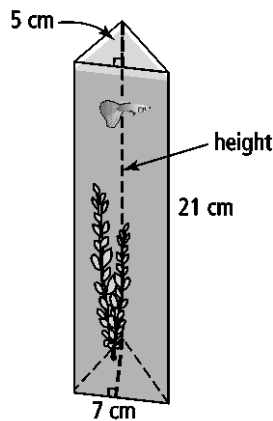
5. Melissa wants to buy 1 of these fish tanks for her guppy fish. Which tank holds the most water?



Formula $\rightarrow V = s^3$

Substitute \rightarrow

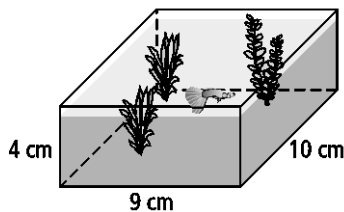
Solve \rightarrow



Formula $\rightarrow V = (b \times h \div 2) \times h$

Substitute \rightarrow

Solve \rightarrow



Formula $\rightarrow V = l \times w \times h$

Substitute \rightarrow

Solve \rightarrow

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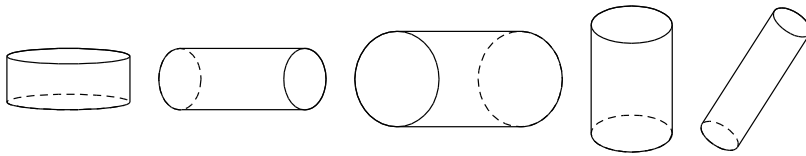
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ii) Complete the assigned questions

<https://youtu.be/ieRDS91AYIY>

Warm Up

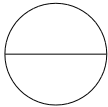
1. a) Shade the base of each cylinder.



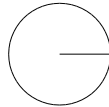
b) What shape is the base of each cylinder? _____

2. Circle the correct name for the part of the circle that is shown in the diagram.

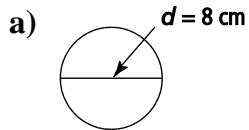
radius or diameter



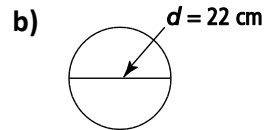
radius or diameter



3. Find the radius of each circle.



$r = d \div 2$



The radius of the circle is _____.

The radius of the circle is _____.

Volume of a Cylinder

Example: Determine the Volume of a Cylinder Given the Radius

a) Calculate the volume of the cylinder.

Solution

Volume of cylinder = area of circular base \times height of cylinder

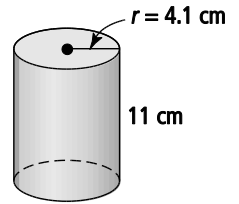
$$V = (\pi \times r^2) \times h$$

$$V = \pi \times r \times r \times h$$

$$V = 3.14 \times \underline{\hspace{2cm}} \times \underline{\hspace{2cm}} \times 11$$

$$V = \underline{\hspace{2cm}} \times \underline{\hspace{2cm}} \times 11$$

$$V = \underline{\hspace{2cm}} \text{ cm}^3$$



Example: Determine the Volume of a Cylinder Given the Diameter

How much rubber is needed to make a hockey puck?

Round your answer to the nearest cubic centimetre.

The height of the puck is 5 cm.



Solution

The hockey puck is in the shape of a _____.

Find the volume of the puck.

The diameter is 7.6 cm.

$$r = d \div 2$$

$$= \underline{\hspace{2cm}} \div 2$$

$$= \underline{\hspace{2cm}}$$

The radius is 3.8 cm.

Volume of cylinder = area of circular base \times height of cylinder

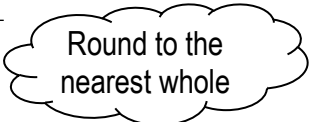
$$V = (\pi \times r^2) \times h$$

$$V = \pi \times r \times r \times h$$

$$V = \underline{\hspace{2cm}} \times \underline{\hspace{2cm}} \times \underline{\hspace{2cm}} \times \underline{\hspace{2cm}}$$

$$V = \underline{\hspace{2cm}} \times \underline{\hspace{2cm}} \times \underline{\hspace{2cm}}$$

$$V = \underline{\hspace{2cm}} \text{ cm}^3$$



The amount of rubber needed to make a hockey puck is _____ cm^3 .

Practise

1. Find the volume of the cylinder. Round your answer to the nearest tenth (1 decimal place).

$$V = (\pi \times r^2) \times h$$

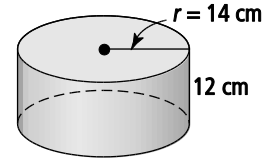
$$V = \pi \times r \times r \times h$$

$$V = \underline{\hspace{2cm}} \times \underline{\hspace{2cm}} \times \underline{\hspace{2cm}} \times \underline{\hspace{2cm}}$$

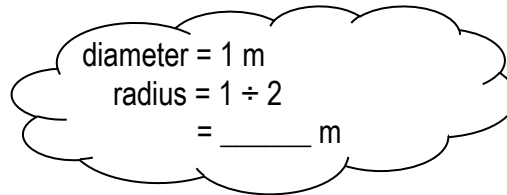
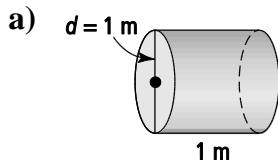
$$V = \underline{\hspace{2cm}} \times \underline{\hspace{2cm}} \times \underline{\hspace{2cm}}$$

$$V = \underline{\hspace{2cm}} \times \underline{\hspace{2cm}}$$

$$V = \underline{\hspace{3cm}} \text{ cm}^3$$



2. Find the volume of each cylinder.



Volume of cylinder = area of circular base × height of cylinder

Formula →

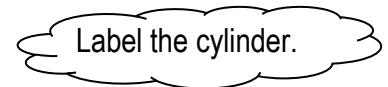
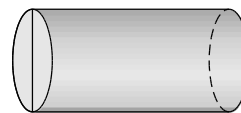
Substitute → $V = \underline{\hspace{2cm}} \times \underline{\hspace{2cm}} \times \underline{\hspace{2cm}} \times \underline{\hspace{2cm}}$

Solve →

- b) diameter = 12 cm, height = 37.5 cm

diameter = 12 cm

radius = _____



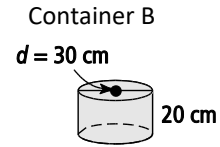
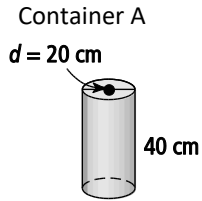
Volume of cylinder = area of circular base × height of cylinder

Formula →

Substitute → $V = \underline{\hspace{2cm}} \times \underline{\hspace{2cm}} \times \underline{\hspace{2cm}} \times \underline{\hspace{2cm}}$

Solve →

3. Martha is choosing between 2 containers of popcorn at the movie theatre. Which container holds more popcorn?



$$d = \underline{\hspace{2cm}} \quad \leftarrow \text{Formula} \rightarrow$$

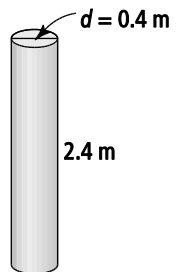
$$r = \underline{\hspace{2cm}} \div \underline{\hspace{2cm}} \quad \leftarrow \text{Substitute} \rightarrow$$

$$= \underline{\hspace{2cm}} \quad \leftarrow \text{Solve} \rightarrow$$

$$V = \underline{\hspace{2cm}} \times \underline{\hspace{2cm}} \times \underline{\hspace{2cm}}$$

Container _____ holds the most popcorn.

4. Companies use tubes to make concrete posts. If a building needs 35 posts, how much concrete is needed?



$$r = \underline{\hspace{2cm}} \div \underline{\hspace{2cm}}$$

$$= \underline{\hspace{2cm}}$$

Formula \rightarrow $V = \underline{\hspace{2cm}} \times \underline{\hspace{2cm}} \times \underline{\hspace{2cm}}$

$$V = \pi \times r \times r \times h$$

Substitute \rightarrow $V = \underline{\hspace{2cm}} \times \underline{\hspace{2cm}} \times \underline{\hspace{2cm}} \times \underline{\hspace{2cm}}$

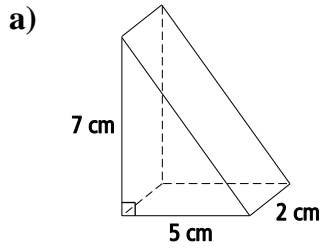
Solve \rightarrow

1 post needs _____ m^3 of concrete.

35 posts need $35 \times \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$

The amount of concrete needed to make 35 posts is _____ m^3 .

5. Calculate the volume.



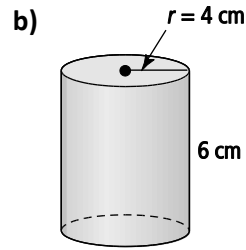
$$V = (b \times h \div 2) \times h$$

$$V = (\underline{\hspace{2cm}} \times \underline{\hspace{2cm}} \div 2) \times \underline{\hspace{2cm}}$$

$$V = (\underline{\hspace{2cm}} \div 2) \times \underline{\hspace{2cm}}$$

$$V = \underline{\hspace{2cm}} \times \underline{\hspace{2cm}}$$

$$V = \underline{\hspace{2cm}} \text{ cm}^3$$



$$V = \pi \times r \times r \times h$$

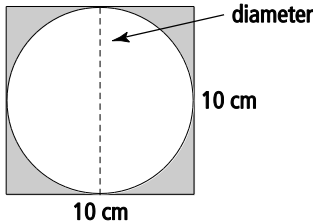
$$V = \underline{\hspace{1cm}} \times \underline{\hspace{1cm}} \times \underline{\hspace{1cm}} \times \underline{\hspace{1cm}}$$

$$V = \underline{\hspace{1cm}} \times \underline{\hspace{1cm}} \times \underline{\hspace{1cm}}$$

$$V = \underline{\hspace{1cm}} \times \underline{\hspace{1cm}}$$

$$V = \underline{\hspace{1cm}} \text{ cm}^3$$

6. Find the area of the shaded part.



Area of square:
 $A = \text{side} \times \text{side}$

$$A = \underline{\hspace{2cm}} \times \underline{\hspace{2cm}}$$

$$A = \underline{\hspace{2cm}} \text{ cm}^2$$

Area of circle:
 $A = \pi \times r^2$

$r = d \div 2$

$$A = \underline{\hspace{1cm}} \times \underline{\hspace{1cm}} \times \underline{\hspace{1cm}}$$

$$A = \underline{\hspace{1cm}} \times \underline{\hspace{1cm}}$$

$$A = \underline{\hspace{1cm}} \text{ cm}^2$$

Area of shaded part = area of square – area of circle

$$= \underline{\hspace{2cm}} - \underline{\hspace{2cm}}$$

$$= \underline{\hspace{2cm}}$$

The area of the shaded part is $\underline{\hspace{2cm}} \text{ cm}^2$.