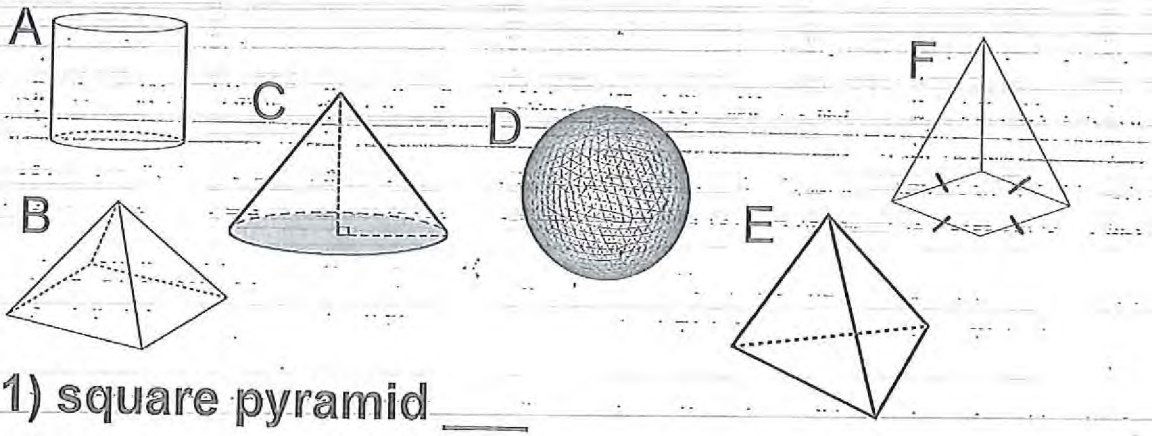
Volume of Solid Figures

#28

Matching solid figures...



1) square pyramid ___

2) sphere ___

3) triangular pyramid ___

4) cone ___

5) cylinder ___

6) rectangular pyramid ___

The **volume** of a three-dimensional figure is the number of nonoverlapping unit cubes of a given size that will exactly fill the interior.

A cube built out of 27 unit cubes has a volume of 27 cubic units.

We will learn how to find the volume of a pyramid, sphere, cone, and cylinder.

The basic formula for finding the volume of a figure is...

$B \cdot h$ where "B" is the _____

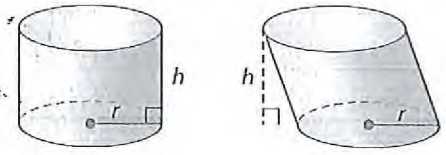
and "h" is the _____

Know it! Note

Volume of a Cylinder

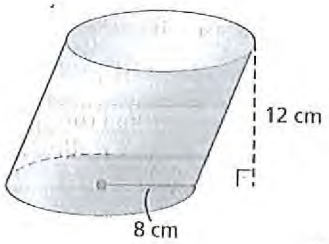
The volume of a cylinder with base area B, radius r, and height h is

$V =$ _____ OR $V =$ _____



The base of a cylinder is a _____. so the area of the base is _____.

Example: Find the volume of the cylinder.



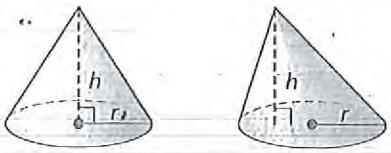
Know it! Note

Volume of Cones

The volume of a cone with base area B, radius r, and height h is

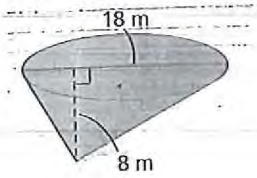
$V =$ _____

$V =$ _____



The base of a cone is a _____. so the area of the base is _____.

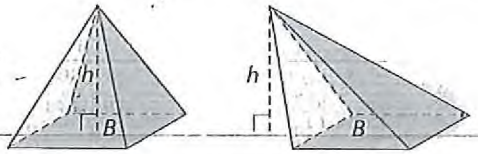
Example: Find the volume of the cone.

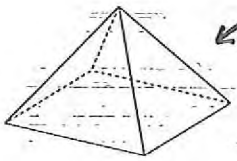


Know it! Note

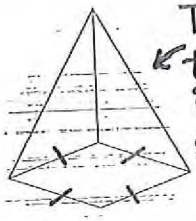
Volume of a Pyramid

The volume of a pyramid with base area B and height h is $V =$ _____

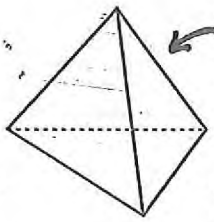




The base of this pyramid is a _____ so the area of the base is a _____.



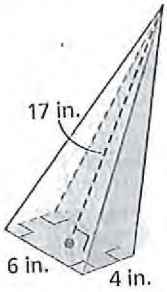
The base of this pyramid is a _____ so the area of the base is _____.



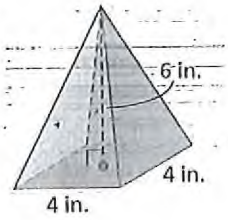
The base of this pyramid is a _____ so the area of the base is _____.

Example: Find the volume of each pyramid.

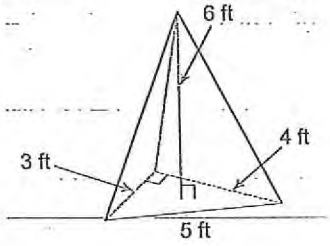
a)



b)



c)

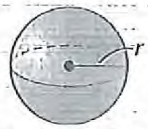


Know it! Note

Volume of a Sphere

The volume of a sphere with radius r is

$V =$ _____



Example: Find the volume of the sphere.

How does changing the dimensions of a figure effect volume?

* Example: The radius of a sphere is 5 m. How does the volume of the sphere change when the radius is doubled?

ORIGINAL	NEW
$r =$ _____, $V =$ _____	$r =$ _____, $V =$ _____

The radius changed by ____ and the volume changed by ____.

* Example: In a cylinder the diameter is 5 in and the height is 7 in. How does the volume change when the dimensions of the sphere are tripled?

ORIGINAL	NEW
$r =$ _____ $h =$ _____, $V =$ _____	$r =$ _____ $h =$ _____, $V =$ _____

The dimensions changed by ____. The volume changed by ____.

[If the dimensions of a figure change by a factor "K", then the volume of the figure will change by a factor _____.]

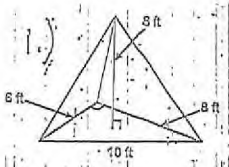
Example:

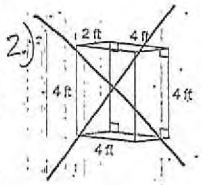
a) The dimensions of a pyramid changed by a factor of 5, so the volume will change by a factor of ____.

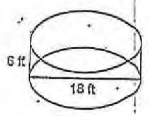
b) The dimensions of a cone changed by a factor of $\frac{1}{2}$, so the volume will change by a factor of _____.

Volume Practice

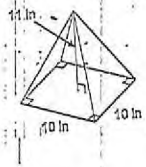
For each figure:
1) Name the figure
2) Find the volume. Round to the nearest tenth.
3) Show all work!

1.) 

2.) 

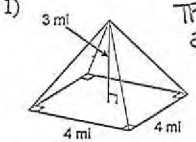
3.) 

4.) 

5.) 

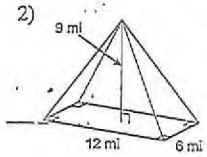
6.) 

For each, tell how the volume of the figure is affected by the change in dimension.

1) 

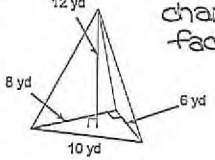
The dimensions are doubled.

The volume will change by a factor of ____.

2) 

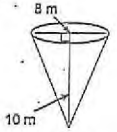
The dimensions are tripled.

The volume will change by a factor of ____.

3) 

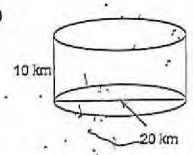
The dimensions change by a factor of $\frac{1}{2}$.

The volume will change by a factor of ____.

4) 

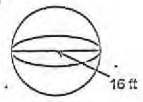
The dimensions change by a factor of 4.

The volume will change by a factor of ____.

5) 

The dimensions change by a factor of 6.

The volume will change by a factor of ____.

6) 

The dimensions change by a factor of $\frac{1}{4}$.

The volume will change by a factor of ____.

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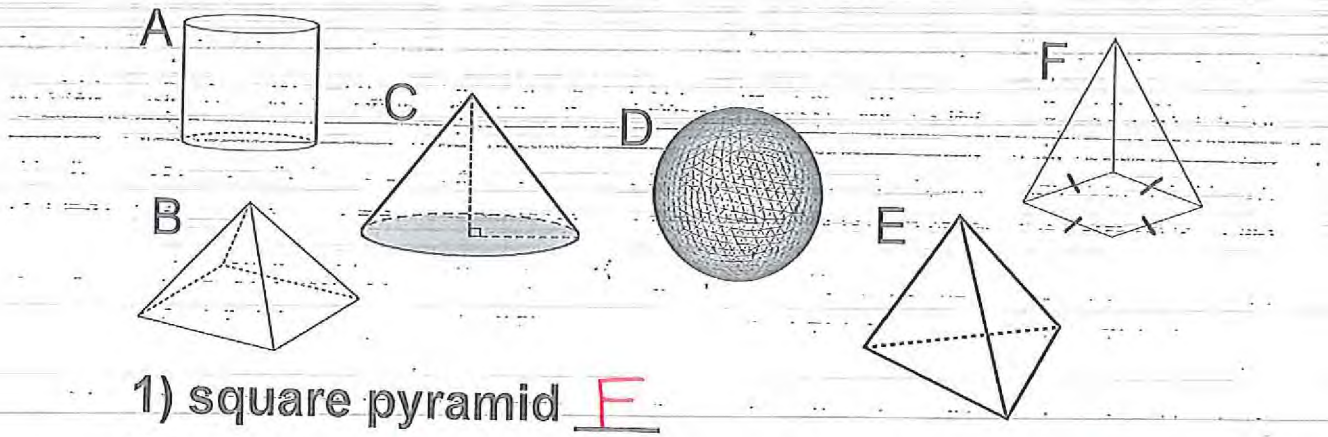
#28

Matching solid figures...



1) square pyramid F
2) sphere D
3) triangular pyramid E
4) cone C
5) cylinder A
6) rectangular pyramid B

The **volume** of a three-dimensional figure is the number of nonoverlapping unit cubes of a given size that will exactly fill the interior.

A cube built out of 27 unit cubes has a volume of 27 cubic units.

We will learn how to find the volume of a pyramid, sphere, cone, and cylinder.

The basic formula for finding the volume of a figure is...

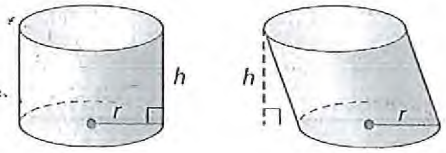
$B \cdot h$ where "B" is the area of the base and "h" is the height of the figure.

Know it! Note

Volume of a Cylinder

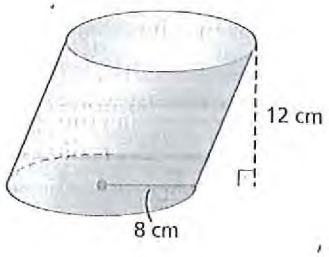
The volume of a cylinder with base area B, radius r, and height h is

$V = B \cdot h$ OR $V = (\pi r^2) \cdot h$



The base of a cylinder is a circle. So the area of the base is πr^2.

Example: Find the volume of the cylinder.



$V = B \cdot h$

$= (\pi r^2) \cdot h$

$= (\pi \cdot 8^2) \cdot 12$

$= 2412.74 \text{ cm}^3$

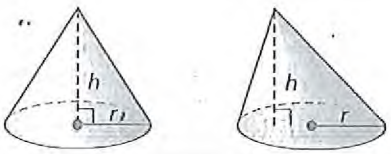
Know it! Note

Volume of Cones

The volume of a cone with base area B, radius r, and height h is

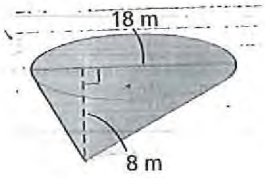
$V = \frac{1}{3}Bh$

$V = \frac{1}{3}(\pi r^2) \cdot h$



The base of a cone is a circle, so the area of the base is πr^2.

Example: Find the volume of the cone.



$V = \frac{1}{3}Bh$

$= \frac{1}{3}(\pi r^2) \cdot h$

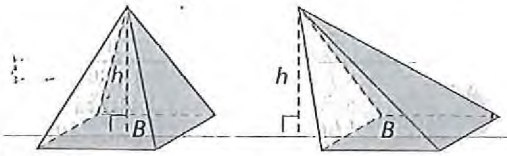
$= \frac{1}{3}(\pi \cdot 9^2) \cdot 8$

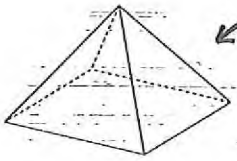
$= 678.58 \text{ m}^3$

Know it! Note

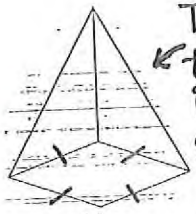
Volume of a Pyramid

The volume of a pyramid with base area B and height h is $V = \frac{1}{3}Bh$

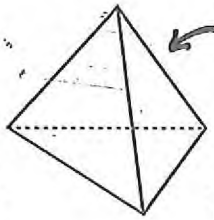




The base of this pyramid is a rectangle, so the area of the base is a $l \cdot w$ or $b \cdot h$.



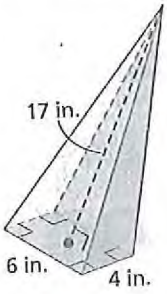
The base of this pyramid is a square, so the area of the base is $l \cdot w$ or $b \cdot h$.



The base of this pyramid is a triangle, so the area of the base is $\frac{1}{2}bh$.

Example: Find the volume of each pyramid.

a)



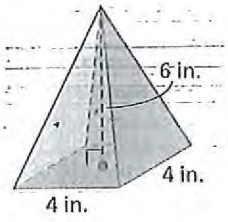
$V = \frac{1}{3}Bh$

$= \frac{1}{3}(l \cdot w) \cdot h$

$= \frac{1}{3}(4 \cdot 6) \cdot 17$

$= 136 \text{ in}^3$

b)



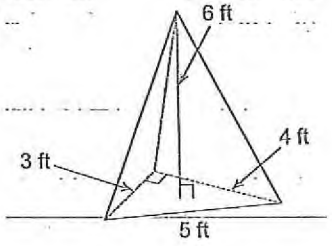
$V = \frac{1}{3}Bh$

$= \frac{1}{3}(l \cdot w) \cdot h$

$= \frac{1}{3}(4 \cdot 4) \cdot 6$

$= 32 \text{ in}^3$

c)



$V = \frac{1}{3}Bh$

$= \frac{1}{3}(\frac{1}{2}bh) \cdot h$

$= \frac{1}{3}(\frac{1}{2} \cdot 3 \cdot 4) \cdot 6$

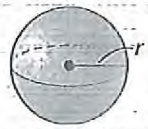
$= 12 \text{ ft}^3$

Know it! Note

Volume of a Sphere

The volume of a sphere with radius r is

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



Example: Find the volume of the sphere.

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

$= \frac{4}{3}\pi \cdot 9^3$

$= 3053.63\ cm^3$

How does changing the dimensions of a figure effect volume?

* Example: The radius of a sphere is 5 m. How does the volume of the sphere change when the radius is doubled?

ORIGINAL	NEW
$r =$ 5 , $V =$ 523.6	$r =$ 10 , $V =$ 4188.8
$\frac{4}{3}\pi r^3 = \frac{4}{3}\pi \cdot 5^3$	$\frac{4}{3}\pi r^3 = \frac{4}{3}\pi \cdot 10^3$

The radius changed by 2 and the volume changed by 8.

* Example: In a cylinder the diameter is 5 in and the height is 7 in. How does the volume change when the dimensions of the sphere are tripled?

ORIGINAL	NEW
$r =$ 2.5 $h =$ 7 , $V =$ 137.4	$r =$ 7.5 $h =$ 21 , $V =$ 3711.0
$B \cdot h = (\pi r^2) \cdot h$ $= (\pi \cdot 2.5^2) \cdot 7$	$B \cdot h = (\pi r^2) \cdot h$ $= (\pi \cdot 7.5)^2 \cdot 21$

The dimensions changed by 3. The volume changed by 27.

[If the dimensions of a figure change by a factor "K", then the volume of the figure will change by a factor K^3.]

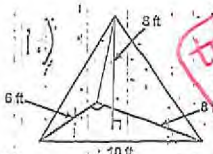
Example:

a) The dimensions of a pyramid changed by a factor of 5, so the volume will change by a factor of 125. ← 5^3

b) The dimensions of a cone changed by a factor of $\frac{1}{2}$, so the volume will change by a factor of 1/8. ← $(\frac{1}{2})^3$

Volume Practice

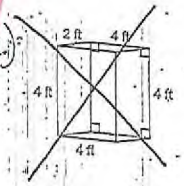
For each figure:
1) Name the figure
2) Find the volume. Round to the nearest tenth.
3) Show all work!

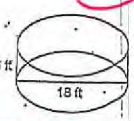
1.) 

triangular pyramid

$\frac{1}{3}(\frac{1}{2}6 \cdot 8) \cdot 8$

64

2.) 

3.) 

cylinder

$(\pi 9^2) \cdot 6$

1526.8

4.) 

cone

$\frac{1}{3}(\pi \cdot 10^2) \cdot 20$

2094.4

5.) 

square pyramid

$\frac{1}{3}(10 \cdot 10) \cdot 11$

366.7

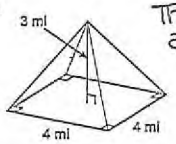
6.) 

sphere

$\frac{4}{3}\pi \cdot 7^3$

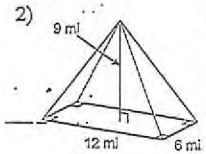
1436.8

For each, tell how the volume of the figure is affected by the change in dimension.

1) 

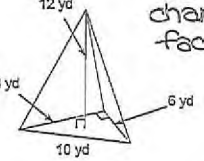
The dimensions are doubled.

The volume will change by a factor of 8.

2) 

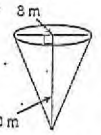
The dimensions are tripled.

The volume will change by a factor of 27.

3) 

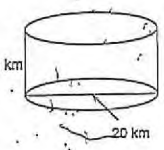
The dimensions change by a factor of $\frac{1}{2}$.

The volume will change by a factor of $\frac{1}{8}$.

4) 

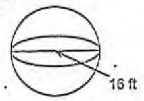
The dimensions change by a factor of 4.

The volume will change by a factor of 64.

5) 

The dimensions change by a factor of 6.

The volume will change by a factor of 216.

6) 

The dimensions change by a factor of $\frac{1}{4}$.

The volume will change by a factor of $\frac{1}{64}$.