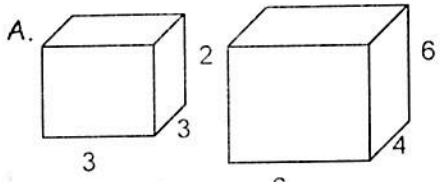
4.7 Perimeter/Area of Similar Solids
4.7 Explore Similar Solids
Pre-AP Geometry

Name Key
Period _____ Date _____

EXPLORE/EXPLAIN

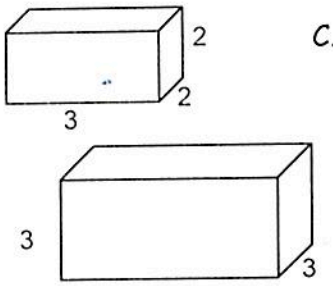
1. Are the following solids similar? How do you know? What is the similarity ratio?

A.



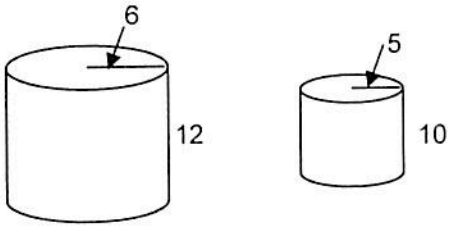
6 : 3 → 2:1
6 : 3 → 2:1 Similar :
4 : 2 → 2:1 ratio: $\frac{1}{2}$

B.



3 : 6 → 1:2
2 : 3 not similar
2 : 3

C.



6 : 5
12 : 10 → 6:5
similar :
ratio : $\frac{6}{5}$

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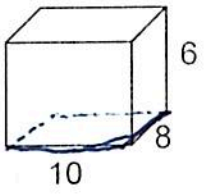
2. P = 36 B = 80

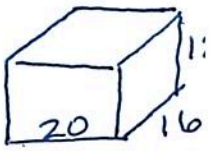


Lateral LA = ~~192~~ 216

Total SA = ~~352~~ 376

V = 480

Now double each side of the rectangular prism and fill in chart:



	Perimeter	B (area of base)	Lateral Area	Surface Area	Volume
New Prism	72	320	768	1408	3840
Original Prism	36	80	~~192~~ 216	~~352~~ 376	480

Since we doubled the side lengths, the **similarity ratio**, or scale factor, is **2:1**.
(dimensions)
What is the ratio of the:

A) perimeters of one base $\frac{72}{36} \rightarrow \frac{2}{1}$

B) areas of one base $\frac{320}{80} \rightarrow \frac{4}{1}$

C) LAs $\frac{768}{\sim\sim 192 \sim\sim\ 216} \rightarrow \frac{4}{1}$

D) SAs $\frac{1408}{\sim\sim 352 \sim\sim\ 376} \rightarrow \frac{4}{1}$

E) Volumes $\frac{3840}{480} \rightarrow \frac{8}{1}$

3. Can you make a conjecture about the ratio of lengths, areas, and volumes if you know the similarity ratio?

Ratio of lengths = $\frac{a}{b}$	Ratio of areas = $\frac{a^2}{b^2}$	Ratio of volumes = $\frac{a^3}{b^3}$

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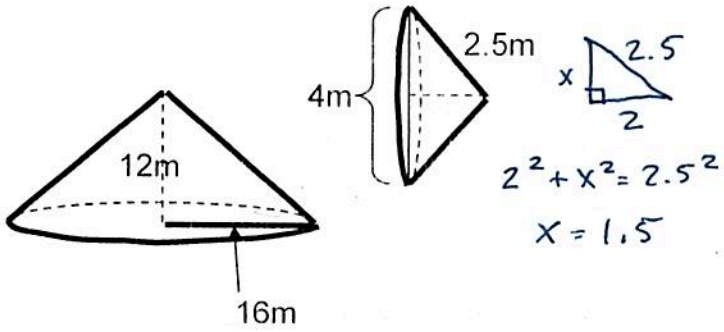
D	A	V
Dimensions	Area	Volume
$\frac{a}{b}$	$\frac{a^2}{b^2}$	$\frac{a^3}{b^3}$

ELABORATE

This relationship holds for all similar solids. This means that if you know the similarity ratio of two similar solids, you also know the ratio of their lengths, areas and volumes. ** always reduce first

1. The cones to the right are similar.



A. What is the ratio of the height of the larger cone to the height of the smaller cone?

$\frac{12m}{1.5m} \rightarrow \frac{8}{1}$ (dimensions)

$2^2 + x^2 = 2.5^2$

$x = 1.5$

B. Find the ratio of the surface areas.

$\frac{a^2}{b^2} \rightarrow \frac{8^2}{1^2} \rightarrow \boxed{\frac{64}{1}}$

C. If the volume of the larger cone is 6144 cubic meters, what is the volume of the smaller cone?

$\frac{a^3}{b^3} \rightarrow \frac{8^3}{1^3} \rightarrow \frac{512}{1}$ $\qquad \frac{512}{1} = \frac{6144}{x}$ $\qquad \boxed{x = 12\,m^3}$

2. What is the similarity ratio of two squares with areas 225 m^2 and 400 m^2.

$\frac{225}{400} \rightarrow \frac{9}{16} \rightarrow \frac{\sqrt{9}}{\sqrt{16}} \rightarrow \boxed{\frac{3}{4}}$

$\left(\frac{a^2}{b^2}\right)$

3. The volume of two similar cones is 1024π and 54π. Find the ratio of their radii.

$\frac{1024}{54} \rightarrow \frac{512}{27} \rightarrow \frac{\sqrt[3]{512}}{\sqrt[3]{27}} \rightarrow \boxed{\frac{8}{3}}$

$\left(\frac{a^3}{b^3}\right)$

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EVALUATE

Simplify first

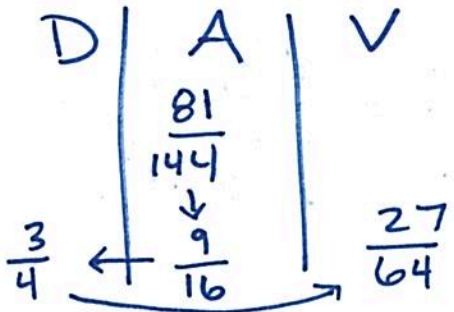
Directions: All work must be shown to receive full credit. Figures are not drawn to scale.

1. Two similar cylinders have lateral areas 81π m^2 and 144π m^2. Find the ratios of:

   a. the heights $\frac{3}{4}$

   b. the surface areas $\frac{9}{16}$

   c. the volumes $\frac{27}{64}$

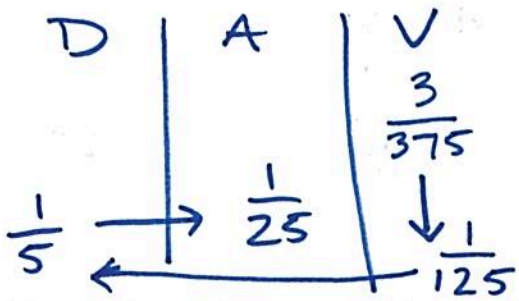


2. Two similar pyramids have volumes 3 in^3 and 375 in^3. Find the ratios of:

   a. the slant heights $\frac{1}{5}$

   b. the base areas $\frac{1}{25}$

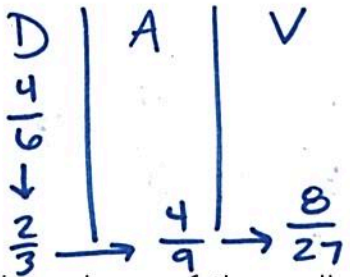
   c. the surface areas $\frac{1}{125}$



3. Two similar cones have radii of 4 cm and 6 cm. The surface area of the smaller cone is 36π cm^2. Find the surface area of the larger cone.

$\frac{4}{6} = \frac{36}{x}$

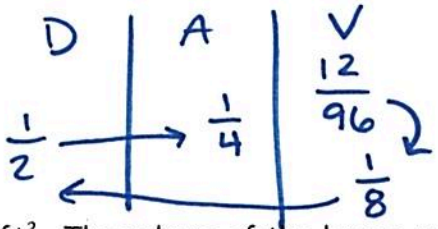
$x = 81\pi$ cm^2



4. Two similar cones have volumes 12π cm^3 and 96π cm^3. The lateral area of the smaller cone is 15π cm^2. Find the lateral area of the larger cone.

$\frac{1}{4} = \frac{15}{x}$

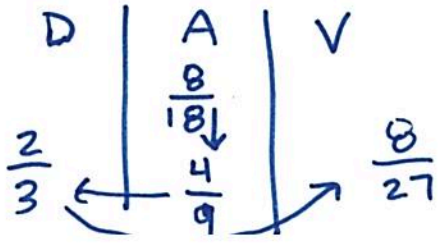
$x = 60\pi$ cm^2



5. Two similar pyramids have lateral areas 8 ft^2 and 18 ft^2. The volume of the larger pyramid is 108 ft^3. Find the volume of the smaller pyramid.

$\frac{8}{27} = \frac{x}{108}$

$x = 32$ ft^3



6. The base areas of two similar prisms are 32 cm^2 and 200 cm^2. The height of the smaller prism is 7 cm. Find the volume of the larger prism.

$\frac{2}{5} = \frac{7}{x} = 17.5$ $V = Bh$

$V = 200(17.5)$

$V = 3500\ cm^3$

D	A	V
	32	
	200	
$\frac{2}{5}$	$\frac{4}{25}$	

7. A cone and a hemisphere have the same height and base. What is the ratio of their volume?

$\frac{C}{H} = \frac{\frac{1}{3}\pi r^2 h}{\frac{1}{2}\left(\frac{4}{3}\pi r^3\right)} = \frac{\frac{1}{3}\pi r^2 h}{\frac{4}{6}\pi r^3}$ $\frac{6}{4} \cdot \frac{\frac{1}{3}h}{\frac{4}{6}r}$ $\frac{6h}{12r} = \boxed{\frac{h}{2r}}$

8. A cylindrical water tank will hold 1000 gallons of water. Another tank has a radius and height that are 3 times those of the first tank. How many gallons will the larger tank hold?

D	A	V
1		1
$\frac{1}{3}$		$\frac{1}{27}$

$\frac{1}{27} = \frac{1000}{X}$

$X = 27{,}000$ gallons

9. An ice-cream carton has a volume of 64 fluid ounces. A second ice-cream carton has dimensions that are $\frac{3}{4}$ the size of the larger carton. Which is the volume of the smaller carton?

$\frac{1}{\frac{3}{4}} \rightarrow \frac{4}{3} \rightarrow \frac{64}{27} = \frac{64}{X}$

27 fl oz.

D	A	V
1		
$\frac{3}{4}$		
$\frac{4}{3}$		$\frac{64}{27}$

10. The radius of Sphere B is eight times that of Sphere A.

a) What effect does it have on the surface area of the Sphere B?

64 times larger than A

b) What effect does it have on the volume of the Sphere B?

512 times larger than A