TOPIC: **12.7 Explore Similar Solids**	NAME: KEY DATE:

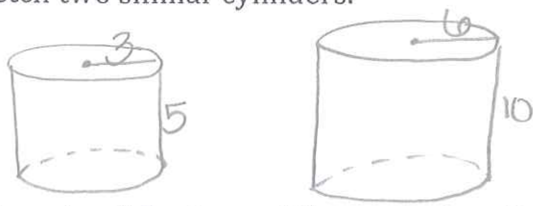
ESSENTIAL QUESTION: If two solids are similar, what is the ratio of their surface areas and what is the ratio of their volumes?

QUESTIONS:

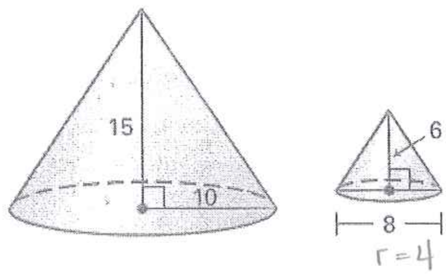
VOCABULARY: Similar solids

Two solids of the same type with proportional linear measures (lengths)

A1. Sketch two similar cylinders.



A2. Determine if the two solids are similar. Explain why or why not.



$\frac{15}{10} \stackrel{?}{=} \frac{6}{4}$

$\frac{3}{2} = \frac{3}{2}$

yes, Both cones and lengths are proportional

Theorem 12.13: Similar Solids Theorem

If two similar solids have a scale factor of $\boldsymbol{a : b}$, then

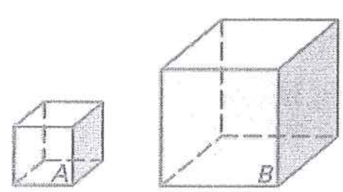
the corresponding area ratio would be a^2 : b^2, and

the corresponding volume ratio would be a^3 : b^3.

If given area: scale factor $= \frac{\sqrt{a}}{\sqrt{b}}$

If given volume: scale factor $= \frac{\sqrt[3]{a}}{\sqrt[3]{b}}$

A3. Find the scale factor, the surface area ratio, and the perimeter ratio of Solid B to Solid A.



$V = 64\text{ m}^3$ $\quad V = 512\text{ m}^3$

Scale factor $\frac{B}{A} = \frac{\sqrt[3]{512}}{\sqrt[3]{64}} = \frac{8}{4} = \frac{2}{1}$

SA $= \frac{2^2}{1^2} = \boxed{\frac{4}{1}}$

Perimeter = length ratio $= \boxed{\frac{2}{1}}$

SUMMARY:

Given figure A and B are similar:

Length → Area: $\frac{a}{b} \rightarrow \frac{a^2}{b^2}$

Length → Volume: $\frac{a}{b} \rightarrow \frac{a^3}{b^3}$

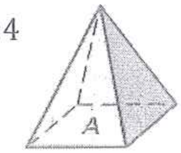
Area → Length: $\frac{a^2}{b^2} = \frac{\sqrt{a}}{\sqrt{b}}$

Volume → Length: $\frac{a^3}{b^3} \rightarrow \frac{\sqrt[3]{a}}{\sqrt[3]{b}}$

QUESTIONS:

A3. Solid A (shown) is similar to Solid B (not shown) with the given scale factor of A to B. Find the surface area and volume of Solid B.

a. Scale factor of 1:4
$SA = 154\ yd^2$
$V = 64\ yd^3$



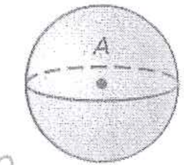
$A_{rat} = \frac{1^2}{4^2} = \frac{1}{16}$

$\frac{1}{16} = \frac{154}{SA}$ $SA(B) = \boxed{2464\ yd^2}$

$V_{rat} = \frac{1^3}{4^3} = \frac{1}{64}$ $\frac{1}{64} = \frac{64}{V(B)}$

$V(B) = \boxed{4096\ yd^3}$

b. Scale Factor of 3:2
$SA = 324\pi\ cm^2$
$V = 972\pi\ cm^3$



$A_{rat} = \frac{3^2}{2^2} = \frac{9}{4}$

$\frac{9}{4} = \frac{324\pi}{SA}$ $\boxed{SA(B) = 452.39\ cm^2}$

$V_{rat} = \frac{3^3}{2^3} = \frac{27}{8}$

$\frac{27}{8} = \frac{972\pi}{V}$ $\boxed{V(B) = 904.78\ cm^3}$

A4. The scale factor of two similar solids is 2:5. The volume of the smaller Solid A is 200π. Which equation could you use to find the volume of the larger Solid B?

$\frac{2}{5} = \frac{A}{B}$

~~A.~~ $\frac{200\pi}{Volume\ of\ B} = \frac{2^2}{5^2}$

~~B.~~ $\frac{200\pi}{Volume\ of\ B} = \frac{5^3}{2^3}$

$V_{rat} = \frac{2^3}{5^3} = \frac{8}{125}$

~~C.~~ $\frac{200\pi}{Volume\ of\ B} = \frac{2}{5}$

$\boxed{\text{D. } \frac{200\pi}{Volume\ of\ B} = \frac{2^3}{5^3}}$

$\frac{8}{125} = \frac{200\pi}{V(B)}$

A5. A model train is built with a scale of 1:12. The model train has a surface area of 94 square inches. What is the surface area of the actual train?

$Scale = Length_{rat} = \frac{1}{12}$ $\frac{1}{144} = \frac{94}{(SA)}$

$A_{ration} = \frac{1^2}{12^2} = \frac{1}{144}$ $SA(actual) = \boxed{13{,}536\ in^2}$

A6. Determine whether the statement is *true* or *false.*

a. Two cones with the same height are always similar. False
Bases can be different

b. A cylinder can be similar to a sphere. False
Different types of solids

c. Tripling the radius of a sphere triples its surface area. False
Radius → length, SA is squared 1:3 → 1:9

d. Doubling the side length of a cube doubles its volume. False
side → length, Volume is cubed
1:2 → 1:8