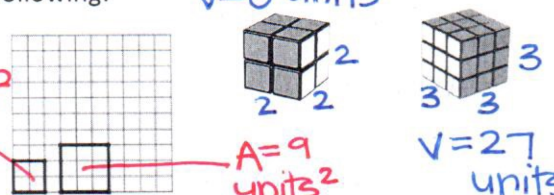
1-D length ft
2-D area ft^2
3-D volume ft^3

Objectives:

- I can use the pattern we discovered in similar figures where if k = Scale Factor, then the ratio of the perimeters $= k$, the ratio of areas $= k^2$, and the ratio of volumes $= k^3$, to solve for unknown measurements.

Ratios of Lengths, Areas, and Volumes

Calculate the lengths, areas, and volumes of the following: V=8 $units^3$ A=4 $units^2$ A=9 $units^2$ V=27 $units^3$ 2 units 3 units	List the ratios: Lengths: $\frac{2}{3}$ Areas: $\frac{4}{9}$ Volumes: $\frac{8}{27}$	What patterns do you notice? Top # x 2, Denom x 3 LCM for both num/denom $2^2=4$ $2^3=8$ Num → evens denom → odd



So, if the ratio of the lengths is a:b, then the ratios of the areas is $\frac{a^2}{b^2}$.

Also, if the ratio of the lengths is a:b ($\frac{a}{b}$), then the ratios of the volumes is $\frac{a^3}{b^3}$.

	In general terms
Ratio of Lengths / Scale Factor (k)	$k = \frac{a}{b}$
Ratio of Area	$k^2 = \frac{a^2}{b^2}$
Ratio of Volume	$k^3 = \frac{a^3}{b^3}$

Example 1: Two similar spheres have a radius of 10 meters and 20 meters.

a) What is the scale factor?	b) What is the ratio of the surface areas?	c) What is the ratio of their volumes?
$k = \frac{a}{b}$ $k = \frac{10}{20} = \boxed{\frac{1}{2}}$	$k^2 = \frac{1^2}{2^2} = \boxed{\frac{1}{4}}$	$k^3 = \frac{1^3}{2^3} = \boxed{\frac{1}{8}}$

Example 2: Two cylinders are similar. If the ratio of their volumes is 27:343, what is the ratio of their sides (edges)? What is the ratio of their surface areas?

length
k

$$k^3 = \frac{27}{343}$$

$$k = \sqrt[3]{\frac{27}{343}} = \frac{\sqrt[3]{27}}{\sqrt[3]{343}} = \boxed{\frac{3}{7} = k}$$

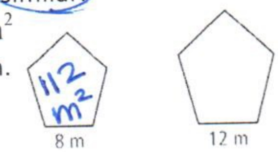
ratio of side lengths.

$$k^2 = \frac{3^2}{7^2} = \boxed{\frac{9}{49}}$$

ratio of areas.

Example 3: These two polygons are similar.

a) Area of smaller pentagon = 112 m^2
Find the area of the larger pentagon.



use ratios

$k = \frac{8}{12} = \frac{2}{3}$

$k^2 = \frac{2^2}{3^2} = \frac{4}{9}$

$\frac{4}{9} = \frac{112}{x}$

$\frac{\cancel{4}x}{\cancel{4}} = \frac{1008}{4}$

$\boxed{x = 252\,m^2}$

b) The ratio of the volumes of two similar cones is 8:125. What is the ratio of their heights? What is the ratio of their areas?

$k^3 = \frac{8}{125}$ so $k = \frac{\sqrt[3]{8}}{\sqrt[3]{125}} = \frac{2}{5}$

$\boxed{k = \frac{2}{5}}$ Heights

$\boxed{k^2 = \frac{4}{25}}$ Areas.

c) Two similar parallelograms have areas 72 m^2 and 32 m^2. The height of the larger parallelogram is 12 m. What is the height of the smaller parallelogram?

$k^2 = \frac{32}{72} = \frac{4}{9}$

$k = \frac{\sqrt{4}}{\sqrt{9}} = \frac{2}{3}$

Ratio of heights

$\frac{2}{3} = \frac{x}{12}$

$\frac{\cancel{3}x}{\cancel{3}} = \frac{24}{3}$

$\boxed{x = 8m}$

Example 4: If you need 2 ounces of frosting (area) to cover a small 3 inch diameter (length) cookie, how much frosting (area) would you need to cover a large 12 inch diameter (length) cookie? **In this scenario, think of ounces as AREA*

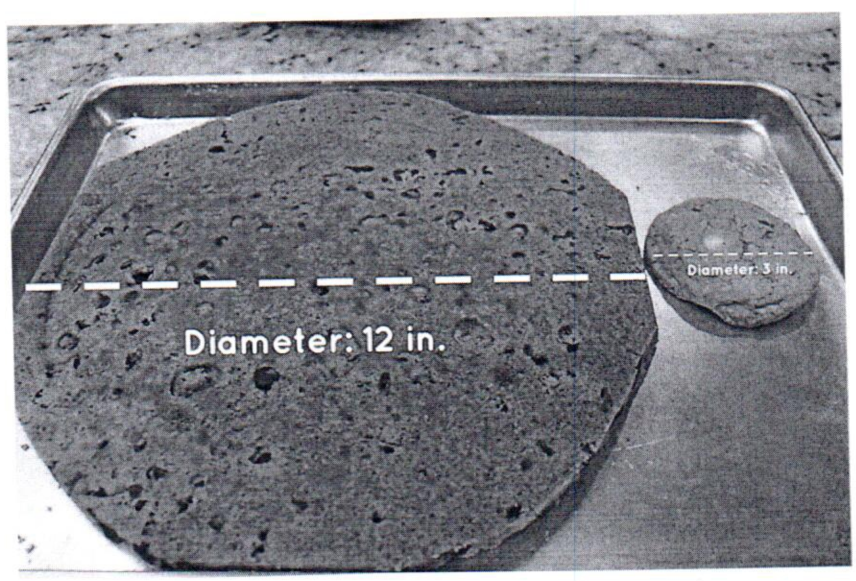
$k = \frac{3}{12} = \frac{1}{4}$

$k^2 = \frac{1^2}{4^2} = \frac{1}{16}$

$\frac{1}{16} = \frac{2}{x}$

$x = 32$

$\boxed{\text{32 oz of frosting}}$



Secondary Math 2 — 12.3 In Class Assignment — Name: ____________________ Period: _______

Similar Shapes

Problem Sets

1. Two similar pyramids have heights 6 m and 12 m.

   a. What is their scale factor?

   $k = \frac{6}{12} = \boxed{\frac{1}{2}}$

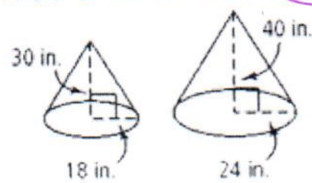
   b. What is the ratio of their volumes?

   $k^3 = \frac{1^3}{2^3} = \boxed{\frac{1}{8}}$

   c. What is the ratio of the surface areas?

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

2. Are the two cones below similar?

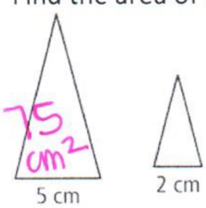


   $\boxed{\text{yes}}$

   $k_{radius} = \frac{18}{24} = \frac{3}{4}$ ✓

   $k_{heights} = \frac{30}{40} = \frac{3}{4}$ ✓

3. Area of larger triangle = 75 cm^2
   Find the area of the smaller triangle.



   $k = \frac{2}{5}$

   $k^2 = \frac{2^2}{5^2} = \frac{4}{25}$

   $\frac{4}{25} = \frac{x}{75}$

   $\frac{\cancel{25}x}{\cancel{25}} = \frac{300}{25}$

   $\boxed{x = 12 cm^2}$

4. Cylinder A has a height of 8 and is similar to Cylinder B, which has a height of 15. What is the ratio of the volumes of Cylinder A to Cylinder B?

   $k = \frac{8}{15}$

   $k^3 = \frac{8^3}{15^3} = \boxed{\frac{512}{3375}}$

5. Two similar cylinders have heights 3 cm and 2 cm. What is the ratio of their volumes?

6. Assume that a small boy is similar in shape to his father. If the father is three times as tall as his son, what is the ratio of the surface area of the father's skin to that of his son's?

7. Orcas and dolphins both belong to the same family. Assume their bodies are similar. An orca is typically about 32ft long, while a dolphin is about 8ft long.

   $k = \frac{8}{32} = \frac{1}{4}$ $\frac{\text{dolphin}}{\text{orcas}}$

   a. What is the ratio of the surface area of the orca to that of the dolphin?

   $k = \frac{4}{1}$ $\frac{\text{orcas}}{\text{dol}}$ $k^2 = \frac{4^2}{1^2} = \boxed{\frac{16}{1}}$

   b. What is the ratio of their volumes?

   $k = \frac{4}{1}$ so $k^3 = \frac{4^3}{1^3} = \boxed{\frac{64}{1}}$

8. If you need 3oz of shredded cheese (area) to cover a medium 12in (length) diameter pizza, how much shredded cheese would you need to cover a large 16in diameter (length) pizza?

   $k = \frac{12}{16} = \frac{3}{4}$

   $k^2 = \frac{9}{16}$

   $\frac{9}{16} = \frac{3}{x}$

   $\frac{9x}{9} = \frac{48}{9}$

   $\boxed{x = 5.3 \text{ oz}}$