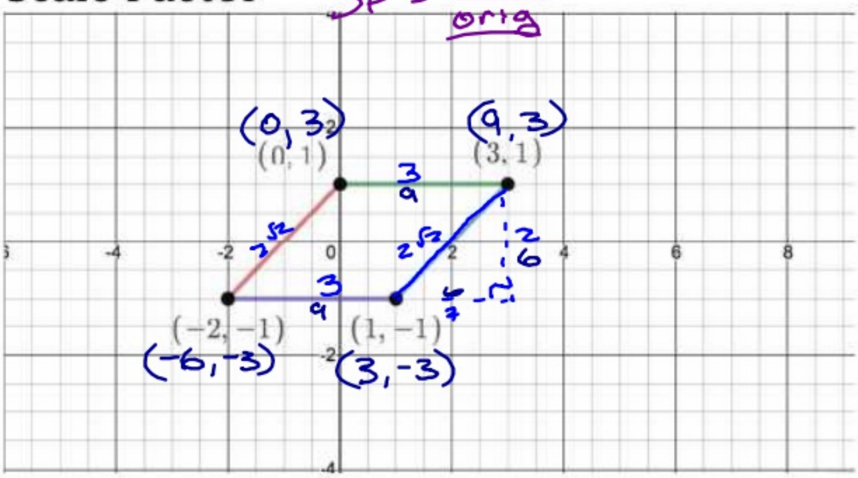
Scale Factor

$SF = \frac{\text{New}}{\text{orig}}$



$1^2 + 2^2 = c^2$
$4 + 4 = c^2$
$8 = c^2$
$2\sqrt{2} = c$
$6^2 + 6^2 = c^2$
$36 + 36 = c^2$
$72 = c^2$
$6\sqrt{2} = c$

A. Apply the transformation (x, y) → (3x, 3y)

SF P $\frac{34.97}{11.66} = 3$ | SF A $= \frac{54}{6} = 9$

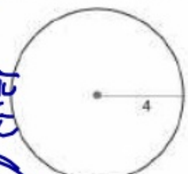
Original Dimensions	Dimensions after (x, y)→ (3x, 3y)
P= $3+2\sqrt{2}+3+2\sqrt{2}$ $= 11.66$	$9+6\sqrt{2}+9+6\sqrt{2}$ $= 34.97$
A= $3 \cdot 2$ $= 6$	$A = 9 \cdot 6$ $= 54$

1. Describe the changes that occurred in Step A.

Proportional Dimension Change

A. In a proportional dimension change, you use the same factor to change each dimension of a figure.

Find the circumference and area of the circle. Then multiply the radius by 5 and find the new circumference and area. Describe the changes that took place.



Circ: $C_o = 2\pi r$
$= 2\pi 4$
$= 8\pi$
$C_N = 2\pi(20)$
$= 40\pi$

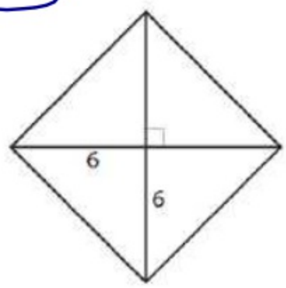
$SF = \frac{40\pi}{8\pi}$ $= 5$

$A_o = \pi r^2$
$= \pi(4)^2$
$= 16\pi$
$A_N = \pi(20)^2$
$= 400\pi$

$SF: \frac{400\pi}{16\pi}$ $= 25$

B.

Find the perimeter and area of the figure. Then multiply the length and height by $\frac{1}{3}$ and find the new perimeter and area. Describe the changes that took place.



Original Figure

$P =$ ______

$A =$ ______

Transformed Figure

$P =$ ______

$A =$ ______

The perimeter changes by a factor of ______, and the area changes by a factor of ______.

Graphs and Volume Day 4 IN CLASS

Effects of Changing Dimensions Proportionally 2-D SCALE FACTORS		
Change in Dimensions	Perimeter or Circumference	Area
All dimensions multiplied by *a*. =	a^1	a^2

Proportional Dimension Change For a Solid (3D Object)

2. Madison just bought a softball with a diameter of 3.8 inches. What is the volume of her softball? The SA of a sphere is given by the following equation $SA = 4\pi r^2$. What is the SA of her softball?

$r = 1.9$ in. $\quad V = \frac{4}{3}\pi r^3$ $\quad (2.5)^1 = 2.5$

Basketball $r \cdot 2.5 = 4.75$

Softball	Basketball
V= $\frac{4}{3}\pi(1.9)^3$ $= 9.145\pi$	V= $\frac{4}{3}\pi(4.75)^3$ $= 142.895\pi$
SA= $4\pi(1.9)^2$ $= 14.44\pi$	SA= $4\pi(4.75)^2$ $= 90.25\pi$

$SF_V = \frac{142.895\pi}{9.145\pi} = 15.625$ $\quad (2.5)^3 =$

$SF_{SA} = \frac{90.25\pi}{14.44\pi} = 6.25$ $\quad (2.5)^2 = 6.25$

James' basketball's diameter is 2.5 times as big as Madison's softball. What is the volume of James' basketball? What is the surface area of his basketball?

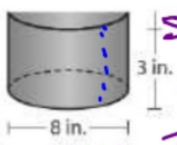
cubed. $\quad$ Squared

The volume changes by a factor of $(2.5)^3$, and the surface area changes by a factor of $(2.5)^2$.

Effects of Changing Dimensions Proportionally 3-D SCALE FACTORS		
Change in Dimensions	Surface Area	Volume
All dimensions multiplied by *a*.	a^2	a^3

$r^2x + r^2x + 2rhx$

3. A farmer has made a scale model of a new cylindrical grain silo. Find the volume of the model. Use the scale ratio 1in:36in to find the volume of the new silo. Find the volume's scale factor. Be consistent with units of measurement. What would the Surface Area scale factor be?



$r = 4$

SF: $\frac{36}{1} = 36$

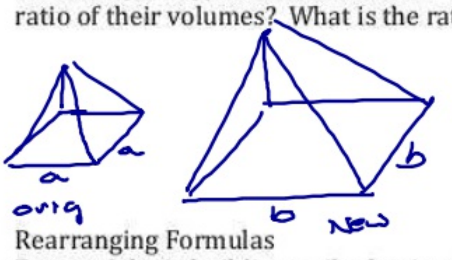
SF Volume: $(36)^3$

$V_o = \pi r^2 h$
$= \pi(4)^2(3)$
$= 48\pi \text{ in}^3 \cdot (36)^3$
$V = 2239488\pi \text{ in}^3$

SA: $(4) + (4) + \boxed{}$
$= \pi r^2 + \pi r^2 + 2\pi r h$
$= \pi(4)^2 + \pi(4)^2 + 2\pi 4(3)$
$= 16\pi + 16\pi + 24\pi$
$= 56\pi \text{ in}^2 \cdot (36)^2$
$SA_N = 72576\pi \text{ in}^2$

Graphs and Volume Day 4 IN CLASS

4. Two square pyramids are similar. If the ratio of a pair of corresponding edges is *a:b*, what is the ratio of their volumes? What is the ratio of their surface areas?



$SF: \frac{New}{orig}$

$SF: \frac{b}{a}$

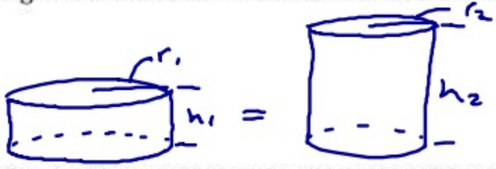
$SF_V = \left(\frac{b}{a}\right)^3$

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

Rearranging Formulas

Farmer John is building a silo that is cylindrical in shape. However, he has limited space. His original silo design is 24 feet in diameter with a volume of 2880π cubic feet. $V = \pi r^2 h$

5. If he changes the size of the bottom of the silo (makes it smaller) to fit his space, what could he do to his design in order to still maintain the same volume?



$2880\pi = \pi (12)^2 h$

$\frac{2880\pi}{144\pi} = \frac{\pi 144}{\pi 144} h$

$h = 20$ ft.

6. Farmer John decides to change the diameter of the silo to 20 feet. What would his new height need to be to maintain a volume of 2880π cubic feet?

a. Rearrange the volume formula to solve for height.

$V = \pi r^2 h$

$\frac{V}{\pi r^2} = h$

b. Put in known values and find the height.

$\frac{2880\cancel{\pi}}{\cancel{\pi}(10)^2} = h$

$28.80 = h$

Often, we are given a formula but the parameter we are interested in is inside the equation. So, we first need to solve for that parameter.

Solve the following volume equations for height:

Cone: $3 \cdot V = 3 \cdot \frac{1}{3} \pi r^2 h$

$\frac{3V}{\pi r^2} = h$

Square Pyramid: $V = \frac{1}{3} \cdot l \cdot l \cdot h$

$\frac{3V}{l^2} = h$