Lesson #8.6 – Scale Factors & 3D Shapes

Here we will look at the relationship between the scale factor and the surface area and volume of 3-D objects.

$SA = 4\pi r^2$
$V = \frac{4}{3}\pi r^3$

Example1: Consider a collection of similar spheres:

Sphere	Radius (cm)	Surface Area (cm^2)	Volume (cm^3)
A	1	$4\pi(1)^2 = 12.6$	$\frac{4}{3}\pi(1)^3 = 4.19$
B	3	$4\pi(3)^2 = 113.1$	$\frac{4}{3}\pi(3)^3 = 113.0$
C	5	$4\pi(5)^2 = 314.2$	$\frac{4}{3}\pi(5)^3 = 523.6$

Using the results from the table above compete the following table:

Sphere	Scale Factor	Ratio of SA (cm^2)	Ratio of Volumes (cm^3)
B to A	$\frac{3}{1} = 3$	$\frac{113}{12.6} = 9$ $(3)^2$	$\frac{113}{4.2} = 27$ $(3)^3$
C to A	$\frac{5}{1} = 5$	$\frac{314}{12.6} = 25$ $(5)^2$	$\frac{523}{4.2} = 125$ $(5)^3$
C to B	$\frac{5}{3} = 1.\overline{6}$	$\frac{314}{113} = 2.7$ or $\frac{5^2}{3^2}$	$\frac{523.6}{113} = 4.63$ $\frac{5^3}{3^3}$

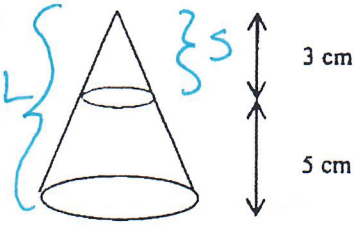
What relationship is there between the scale factor and the ratio of the surface areas of the two spheres?

$$SF^2 = \frac{SA_{model}}{SA_{actual}}$$

What relationship is there between the scale factor and the ratio of the volumes of the two spheres?

$$SF^3 = \frac{V_{model}}{V_{actual}}$$

Example 2: A plane parallel to the base of a cone divides the cone into two pieces. Find the ratio of:



a) The surface area of the large cone to the surface area of the small cone.

$$SF^2 = \frac{8^2}{3^2} = \frac{64}{9}$$

b) The volume of the large cone to the volume of the small cone.

$$SF^3 = \frac{8^3}{3^3} = \frac{512}{27}$$

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