$\frac{new}{old}$ $SA = 6s^2$

Geometry: Changes in Dimensions for Similar Figures  Name: KEY

Fill in the chart below for cubes. Include units with each answer.

| Original Cube Edge | New Cube Edge | Scale Factor | Surface area of the original cube | Surface area of the new cube | Give the scale factor for surface area | Volume of the original cube | Volume of the new cube | Give the scale factor for volume |
|---|---|---|---|---|---|---|---|---|
| 1 cm. | 3 cm. | $\frac{3}{1}$ | 6 $cm^2$ | 54 $cm^2$ | $\frac{54}{6} = 9$ | $1^3 = 1 cm^3$ | $3^3 = 27 cm^3$ | $\frac{27}{1}$ |
| 4 cm. | 2 cm. | $\frac{2}{4} = \frac{1}{2}$ | 96 $cm^2$ | 24 $cm^2$ | $\frac{24}{96} = \frac{1}{4}$ | $4^3 = 64 cm^3$ | $2^3 = 8 cm^3$ | $\frac{8}{64} = \frac{1}{8}$ |
| 3 cm. | 4 cm. | $\frac{4}{3}$ | 54 $cm^2$ | 96 $cm^2$ | $\frac{96}{54} = \frac{16}{9}$ | $3^3 = 27 cm^3$ | $4^3 = 64 cm^3$ | $= \frac{64}{27}$ |
| 3 | 6 cm. | $\frac{2}{1}$ | 54 $cm^2$ | 216 $cm^2$ | $\frac{216}{54} = 4$ | $3^3 = 27 cm^3$ | $6^3 = 216 cm^3$ | $\frac{216}{27} = 8$ |
| 2 cm. | 1.5 | $\frac{3}{4}$ | 24 $cm^2$ | 13.5 $cm^2$ | $\frac{13.5}{24} = \frac{9}{16}$ | $2^3 = 8 cm^3$ | $1.5^3 = 3.375 cm^3$ | $\frac{3.375}{8} = \frac{27}{64}$ |

$\frac{3}{4} = \frac{x}{2}$

1) Compare the scale factors by filling in the tables for each row in the table above.

| Cube Edge | Surface Area |
|---|---|
| 3 | 9 |
| $\frac{1}{2}$ | $\frac{1}{4}$ |
| $\frac{4}{3}$ | $\frac{16}{9}$ |
| $\frac{2}{1}$ | 4 |
| $\frac{3}{4}$ | $\frac{9}{16}$ |
| $\frac{a}{b}$ | $\left(\frac{a}{b}\right)^2$ |

| Cube Edge | Volume |
|---|---|
| 3 | 27 |
| $\frac{1}{2}$ | $\frac{1}{8}$ |
| $\frac{4}{3}$ | $\frac{64}{27}$ |
| 2 | 8 |
| $\frac{3}{4}$ | $\frac{27}{64}$ |
| $\frac{a}{b}$ | $\left(\frac{a}{b}\right)^3$ |

**Summary of scale factor ratios for similar figures:**

| **The two figures being compared must be similar!** | | | |
|---|---|---|---|
| | **Linear Measurements** | **Area Measurements** | **Volume Measurements** |
| **Units** | cm; in; etc. | $cm^2$; square in.; etc. | $cm^3$; cubic in; etc |
| **Scale factor** | $\frac{a}{b}$ | $\frac{a^2}{b^2} = \left(\frac{a}{b}\right)^2$ | $\frac{a^3}{b^3} = \left(\frac{a}{b}\right)^3$ |
| **Concepts** | **Figures must be similar!**<br>2D - sides, perimeter, diagonals<br>3D – length, width, height, slant height, etc. | **Figures must be similar!**<br>2D – areas of triangles, quadrilaterals, and polygons<br>3D – lateral area, and surface area | **Figures must be similar!**<br>2D - NOTHING<br>3D – volume only |

Examples:

1) The scale factor used to create a similar rectangular prism is $\frac{4}{3}$. If the surface area of the original rectangular prism was 24 sq., ft., what is the surface area of the newly created rectangular prism?

$\left(\frac{4}{3}\right)^2 = \frac{new}{24}$ new $= 42\frac{2}{3}$ ft$^2$

$\frac{16}{9} = \frac{new}{24}$

2) A new cylinder is created by using a scale factor of $\frac{2}{3}$. If the volume of the new cylinder is 54 cm$^3$, what is the volume of the original cylinder?

$\left(\frac{2}{3}\right)^3 = \frac{54}{old}$

$\frac{8}{27} = \frac{54}{old}$ old $= 182\frac{1}{4}$ cm$^3$

3) A new box is created by multiplying each of the dimensions by 5. How will the surface area of the new box compare to the surface area of the original box?

$\frac{new}{old} = \frac{6(5x)^2}{6x^2} = \frac{6 \cdot 25x^2}{6x^2} = \frac{150x^2}{6x^2}$

A) 5 times the surface area of the original box.

B) 10 times the surface area of the original box.

C) 25 times the surface area of the original box.

D) 125 times the surface area of the original box.

Explain your choice.

scale factor is $\frac{125}{1}$

4) A rectangular prism has dimensions 2 ft by 3 ft by 4 ft. Another rectangular prism has dimensions 4 ft by 6 ft by 5 ft. Does the scale factor table apply to these two rectangular prisms?

Why or why not? $2 \times 3 \times 4 = 24$ ft$^3$ $4 \times 6 \times 5 = 120$ ft$^3$

$\frac{2}{4}$ $\frac{3}{6}$ $\frac{4}{5}$ $\leftarrow$ no, scale factor is not the same