Scale Factor: 3

Let's triple each side...

Area:
24

4 ×3

X
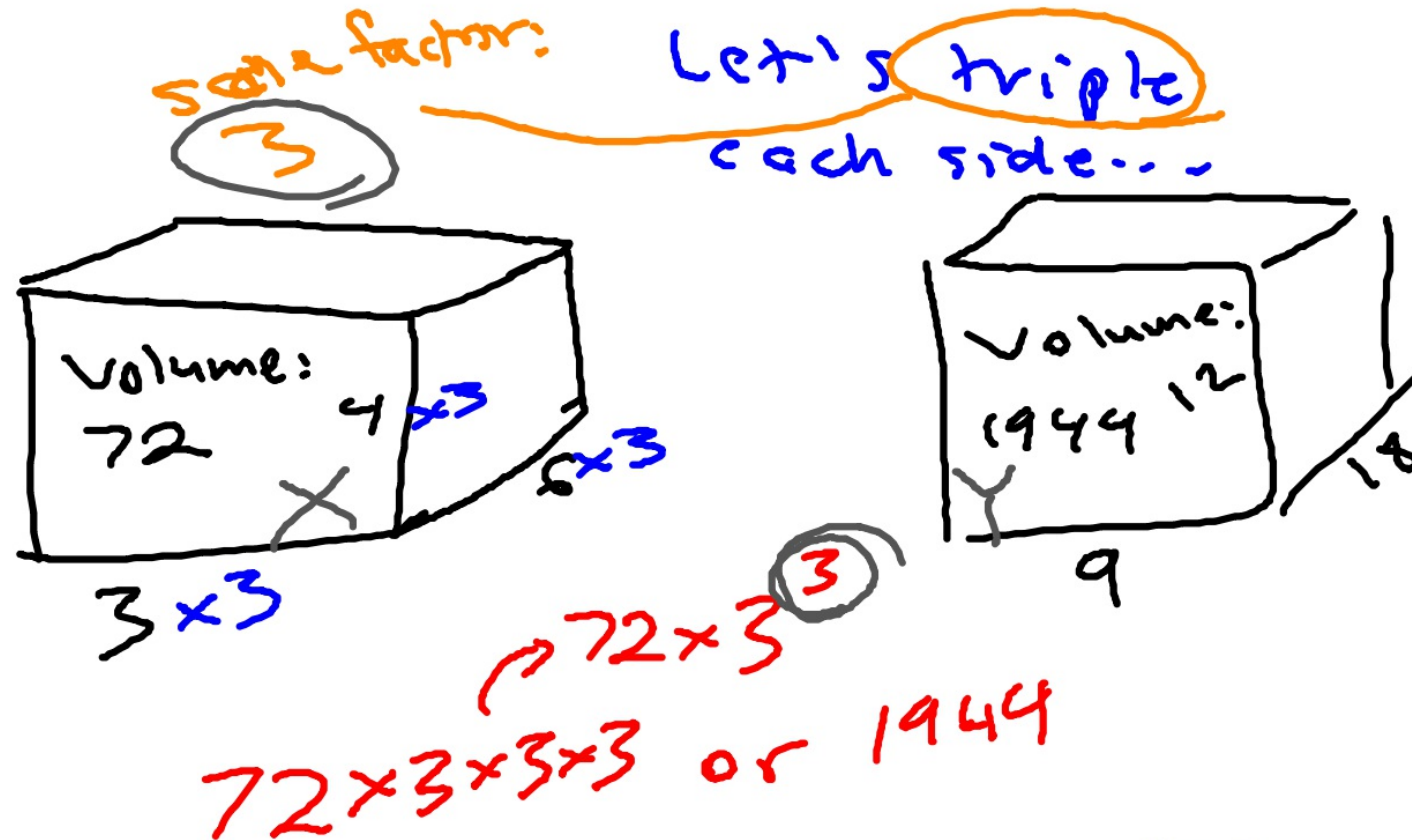
6 ×3  24 ×3 ×3

or 24(3)²  18

Area:
216

12

Y

18

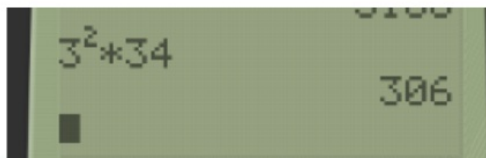## Surface Area of Similar Solids

If Solid X is similar to Solid Y by a scale factor, then the surface area of X is equal to the surface area of Y times the *square* of the scale factor.

scale factor:

$3$

Let's **triple**
each side...

Volume:
72

$4 \times 3$
$5 \times 3$
$3 \times 3$

X

Volume:
1944

$12$
$18$
$9$

Y

$72 \times 3^3$

$72 \times 3 \times 3 \times 3$ or $1944$
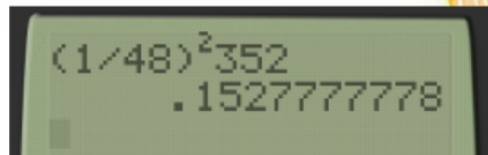
## Volume of Similar Solids

Ke

If Solid X is similar to Solid Y by a scale factor, then the volume of X
is equal to the volume of Y times the *cube* of the scale factor.

```
3²*34
              306
```

a. __306 in²__

b. __$\frac{11}{72}$ ft² or 0.15 ft²__

```
(1/48)²352
     .1527777778
```

**a.** The surface area of a triangular prism is 34 square inches. What is the surface area of a similar prism with dimensions that are 3 times as great as the original prism?

**b.** The world's largest box of raisins has a surface area of 352 square feet. If the dimensions of a similar box are smaller than the largest box by a scale factor of $\frac{1}{48}$, what is its surface area?

**Got It?** Do these problems to find out.

c. A square pyramid has a volume of 512 cubic centimeters. What is the volume of a square pyramid with dimensions one-fourth of the original?

d. A cylinder has a volume of 432 cubic meters. What is the volume of a cylinder with dimensions one-third of the original?

$512(1/4)^3$

8

*Show your work.*

c. **8 cm³** _____

d. **16 m³** _____

$432(1/3)^3$

16

1. The surface area of a rectangular prism is 35 square inches. What is the surface area of a similar solid with dimensions that have been enlarged by a scale factor of 7? (Example 1) **1,715 in$^2$**

*show your work.*

2. The volume of a cylinder is about 425 cubic centimeters. What is the volume, to the nearest tenth, of a similar solid with dimensions that are smaller by a scale factor of $\frac{1}{3}$? (Example 2) **15.7 cm$^3$**

3. A sink with a sliding lid in Josh's art studio measures 16 inches by 15 inches by 6 inches. A second sink used just for paintbrushes has a similar shape and is smaller by a scale factor of $\frac{1}{2}$. Find the volume and surface area of the second sink. (Example 3) **180 in$^3$; 213 in$^2$**

4. **@** **Building on the Essential Question** How is the volume of a prism affected when its dimensions are tripled?

**The volume is 27 times greater.**

① $35(7)^2$

② $425\left(\frac{1}{3}\right)^3$

**Rate Yourself!**

How confident are you about changes in dimensions? Check the box that applies.

For more help, go online to access a Personal Tutor.

Tutor

1. The surface area of a rectangular prism is 95 square centimeters. What is the surface area of a similar prism with dimensions that are 4 times as great as the original prism? (Example 1) **1,520 cm$^2$**

*Show your work.*

2. The surface area of a pyramid is 57.8 square inches. What is the surface area of a similar pyramid with dimensions that are 2 times as great as the original prism? (Example 1) **231.2 in$^2$**

3. A cereal box has a surface area of 280 square inches. What is the surface area of a similar box that is larger by a scale factor of 1.4? (Example 1) **548.8 in$^2$**

4. A glass display box has a surface area of 378 square inches. How many square inches of glass are used to create a glass display box with dimensions that are one-half those of the original? (Example 1) **94.5 in$^2$**

**5.** A cone has a volume of 9,728 cubic millimeters. What is the volume of a similar cone with dimensions that are one-eighth the dimensions of the original? (Example 2) __**19 mm³**__

**6.** A triangular prism has a volume of 350 cubic meters. If the dimensions are tripled, what is the volume of the new prism? (Example 2) __**9,450 m³**__

**7.** The model of a new apartment building is shown. The architect plans for the building to be 144 times the dimensions of the model. What will be the volume and surface area of the new building when it is completed? (Example 3)

**8,709,120 ft³; 277,632 ft²**


10 in.

28 in.

18 in.
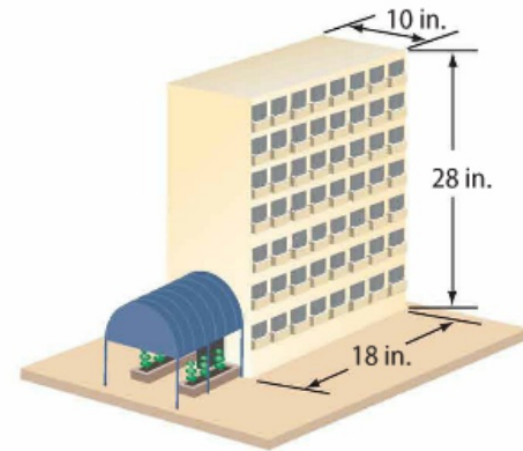
**8.** The world's largest cube puzzle is in Knoxville, Tennessee. It measures 6 feet on each side. The scale factor between a standard cube puzzle and the largest puzzle is $\frac{1}{24}$. Find the surface area and volume of the standard cube puzzle. (Example 3)

$\frac{3}{8}$ ft² or 0.375 ft², $\frac{1}{64}$ ft³ or 0.015625 ft³



**9** CCSS **Persevere with Problems** Two spheres are similar in shape. The scale factor between the smaller sphere and the larger sphere is $\frac{3}{4}$. If the volume of the smaller sphere is 126.9 cubic meters, what is the volume of the larger sphere? **300.8 m³**

**10.** CCSS **Persevere with Problems** A *frustum* is the solid left after a cone is cut by a plane parallel to its base and the top cone is removed.

a. Is the smaller cone that is removed similar to the original cone? Justify your response. **Yes, the ratios $\frac{3}{6}$ and $\frac{1.5}{3}$ are equal.**

b. What is the volume of the smaller cone? the larger cone? Use 3.14 for $\pi$. **7.065 in$^3$; 56.52 in$^3$**

c. What is the ratio of the volume of the smaller cone to the volume of the larger cone? **1:8**

d. What is the volume of the frustum? **49.455 in$^3$**

*Diagram labels: 3 in., 6 in., 1.5 in., frustum, 3 in.*
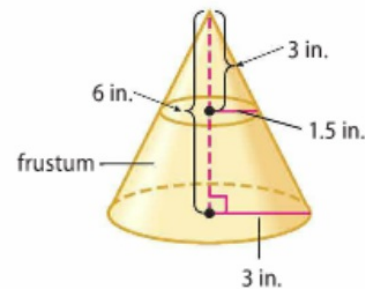
**11.** CCSS **Justify Conclusions** A cone has a volume of $x$ cubic inches. If the dimensions of a second cone are one-sixth the original cone, what is the volume of the second cone? Explain your reasoning.

**The volume of the first cone is $x$, so the first cone's volume multiplied by one-sixth cubed is the second cone's volume. The volume of the second cone is $\frac{1}{216}x$ in$^3$.**

**12.** CCSS **Reason Inductively** Determine whether the following statement is *true* or *false*. Explain your reasoning.

*All spheres are similar.*

**true; Sample answer: Spheres have only one measurement, the radius.**