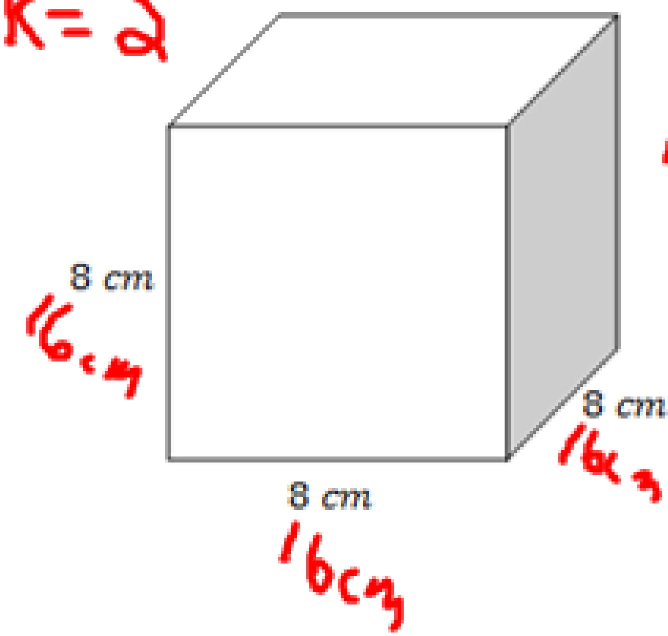
Get out your homework and have it ready to check.

Classwork - Changes in Dimensions

Warm Up: Find the surface area and volume of the cube below. Then double the dimensions and find the new surface area and volume of the new cube.

$k=2$



$SA = 8(8) = 64(6) = 384ft^2$ $\times 4$ OR 2^2

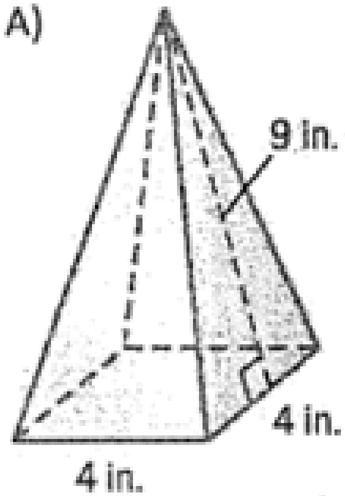
New $SA = 16(16) = 256(6) = 1536ft^2$

$V = 8(8)(8) = 512ft^3$ $\times 8$ OR 2^3

New $V = 16(16)(16) = 4096ft^3$

1) Find the lateral area and total surface area of the regular pyramids below. SHOW WORK

A)



$P = 16 in$

$L.A. = \frac{1}{2}(16)(9) = 72 in^2$

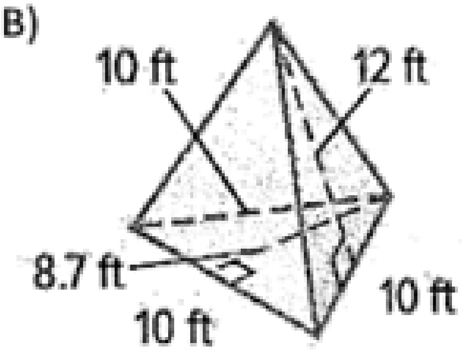
$B = 4 \cdot 4 = 16 in^2$

$SA. = 72 + 16$

$LA =$ $72 in^2$

$SA =$ $88 in^2$

B)



$P = 30 ft$

$L.A. = \frac{1}{2}(30)(12) = 180 ft^2$

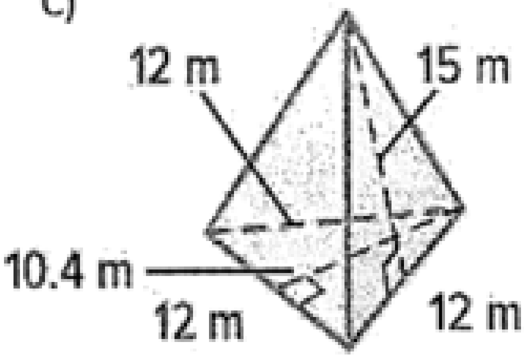
$B = \frac{1}{2}(10)(8.7) = 43.5 ft^2$

$SA = 180 + 43.5$

$LA =$ $180 ft^2$

$SA =$ $223.5 ft^2$

C)



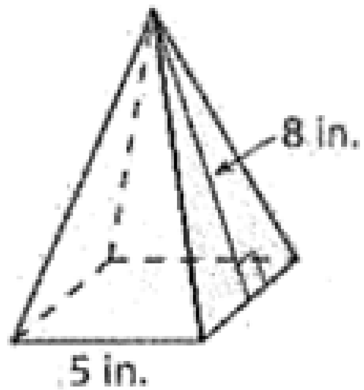
P=36m

L.A. = $\frac{1}{2}(36)(15) = 270m^2$

B = $\frac{1}{2}(10.4)(12) = 62.4m^2$

S.A. = 270 + 62.4m^2

D)



P= 20in

L.A. = $\frac{1}{2}(20)(8) = 80in^2$

B = 5·5 = 25in^2

SA = 80+25

LA = 270m^2

SA = 332.4m^2

LA = 90ft^2

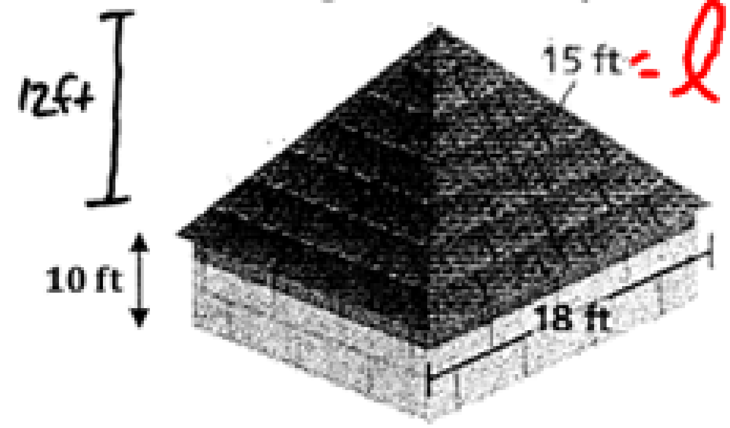
SA = 105.6ft^2

LA = 80in^2

SA = 1~~25~~05in^2

2) A roof of the building to the right is shaped like a square pyramid. **One bundle of shingles covers 25 square feet.**

A) How many bundles should you buy to cover the roof?



P= 72 ft

L.A. = $\frac{1}{2}$(72)(15) = 540 ft²

540 ÷ 25 = 21.6

LA = 540ft²

Number of bundles = 22 bundles

B) The height of the brick on the building is 10 feet. The total height of the building is 22 feet. What is the total volume of the building? SHOW WORK.

V of □ Prism = 10·18·18 = 3240 ft³

V of Pyramid = $\frac{1}{3}$(324)(12) = 1296 ft³

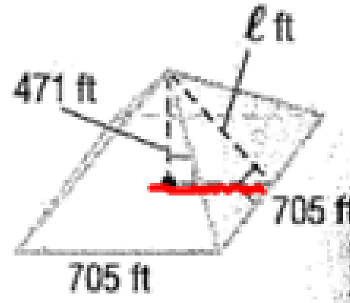
B = 18·18 = 324

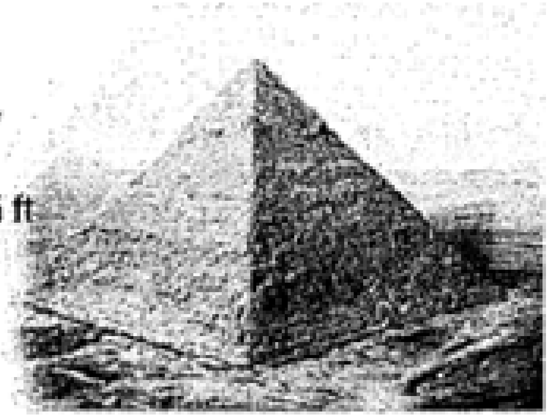
h = 12 ft

Volume = 4536ft³

V = 3240 + 1296

3) The Pyramid of Khafre in Egypt stands 471 feet tall. The sides of its square base are 705 feet in length. Find the lateral surface area of the Pyramid of Khafre. (Hint: *Use the Pythagorean Theorem to find the pyramid's slant height.)*





$705 \div 2 = 352.5\text{ ft}$

$471^2 + 352.5^2 = \ell^2$

~~$\sqrt{347791.25} = \sqrt{\ell^2}$~~

~~$572.8 = \ell$~~

$\sqrt{346097.25} = \sqrt{\ell^2}$

$P = 2820\text{ ft}$

$L.A. = \frac{1}{2}(2820)(588.3)$

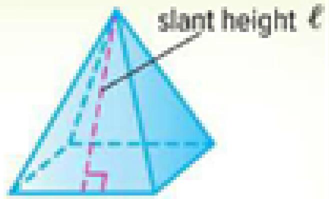
Slant Height = 588.3 ft

L.A. = $LA = 829503\text{ ft}^2$

Real-World Link

Watch

Monuments Stephen is creating a model of the Washington Monument for history class. The model will be $\frac{1}{100}$ of the monument's actual size.



The square pyramid that sits atop the monument's obelisk shape has a slant height of about 57.6 feet. Each side of the pyramid's base is about 34 feet.

1. What is the area of one of the triangular faces of the actual pyramid? ______________

2. What is the slant height of the pyramid on the model Stephen is creating? ______________

3. What is the length of one side of the base of the pyramid on the model? ______________

4. What is the area of one of the triangular faces of the model pyramid? ______________

5. Write a ratio comparing the area of the triangular side of the model to the actual monument.

____

6. MP **Make a Conjecture** Write a sentence about the surface area of the model pyramid compared with the actual pyramid.

Surface Area of Similar Solids

P. 642

k = scale factor

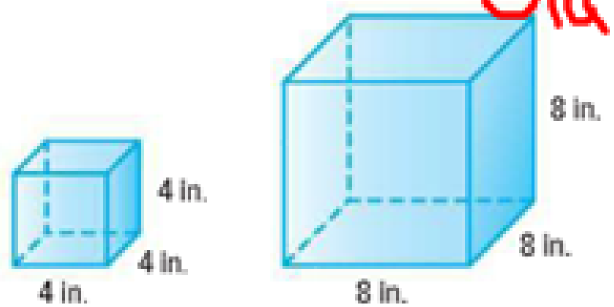
If Solid X is similar to Solid Y by a scale factor, then the surface area of X is equal to the surface area of Y times the *square* of the scale factor.

SA

Old SA $\cdot k^2$ = New SA

Cubes are **similar solids** because they have the same shape and their corresponding linear measures are proportional.

The cubes at the right are similar. The ratio of their corresponding edge lengths is $\frac{8}{4}$ or 2. The scale factor is 2. How are their surface areas related?



S.A. of Small Cube

$S.A. = 6(4 \cdot 4)$

There are 6 faces.

S.A. of Large Cube

$$S.A. = 6(2 \cdot 4)(2 \cdot 4)$$
$$= 2 \cdot 2(6)(4 \cdot 4)$$
$$= 2^2(6)(4 \cdot 4)$$

To find the surface area of the large cube, multiply the surface area of the small cube by the *square* of the scale factor, 2^2 or 4. This relationship is true for any similar solids.

Example

1. The surface area of a rectangular prism is 78 square centimeters. What is the surface area of a similar prism with dimensions that are 3 times as great as the dimensions of the original prism?

$S.A. = 78 \times 3^2$ Multiply by the square of the scale factor.

$S.A. = 78 \times 9$ Square 3.

$S.A. = 702 \text{ cm}^2$ Simplify.

$k = 3$

Got it? Do these problems to find out.

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?

A) $34 \cdot 3^2 = 306 \text{ in}^2$

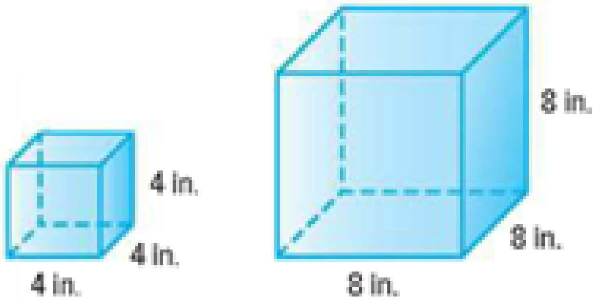
B) $352 \cdot \left(\frac{1}{48}\right)^2 = \frac{11}{72} \text{ ft}^2$ OR 0.15 ft^2

Volume of Similar Solids

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.

Refer to the cubes below.

Old Vol • k^3 = New Vol



Volume of Small Cube

$V = 4 \cdot 4 \cdot 4$

Volume of Large Cube

$$V = (2 \cdot 4)(2 \cdot 4)(2 \cdot 4)$$
$$= 2 \cdot 2 \cdot 2(4 \cdot 4 \cdot 4)$$
$$= 2^3(4 \cdot 4 \cdot 4)$$

The volumes of similar solids are related by the *cube* of the scale factor.

Example

2. **A triangular prism has a volume of 432 cubic yards. If the dimensions of the prism are reduced to one third of the original dimensions, what is the volume of the new prism?**

$V = 432 \times \left(\frac{1}{3}\right)^3$ Multiply by the cube of the scale factor.

$V = 432 \times \frac{1}{27}$ Cube $\frac{1}{3}$.

$V = 16 \text{ yd}^3$ Simplify.

The volume of the new prism is 16 cubic yards.

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?

c) $512 \cdot \left(\frac{1}{4}\right)^3 = 8\ cm^3$

d) $432 \cdot \left(\frac{1}{3}\right)^3 = 16\ m^3$