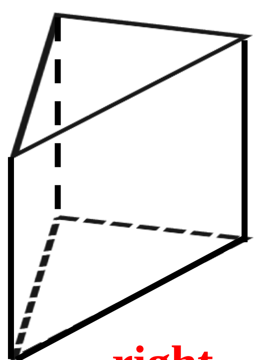
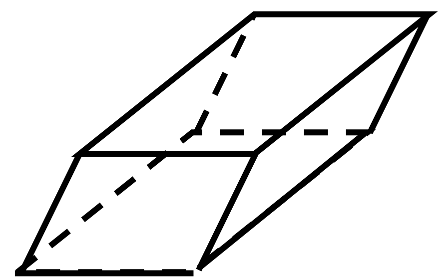
Surface Area of 3-d Objects:

Prisms:

A prism is a polyhedron with two opposite faces that are identical polygonal regions called the bases. The vertices of the bases are joined with segments to form the lateral faces which are parallelograms. If the lateral faces are rectangles, the prism is called a right prism, otherwise, it's called an oblique prism.



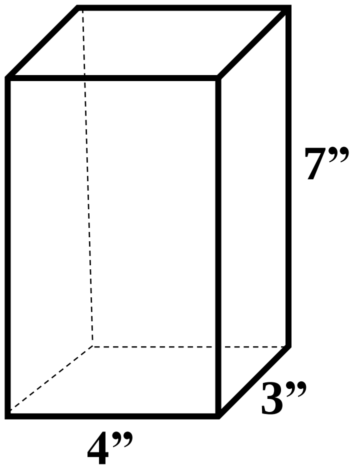
right



oblique

The surface area is the sum of the areas of the two bases and the areas of the lateral faces.

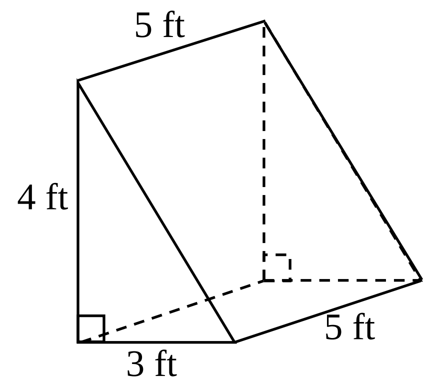
Right rectangular prism:



$$S.A. = \underbrace{2(4)(3)}_{\text{top and bottom}} + \underbrace{2(4)(7)}_{\text{two sides}} + \underbrace{2(3)(7)}_{\text{two sides}}$$

$$= 24 + 56 + 42 = \boxed{122\,in^2}$$

Right triangular prism:



$$S.A. = \underbrace{(3)(5)}_{\text{bottom}} + \underbrace{2 \cdot \frac{1}{2}(3)(4)}_{\text{two triangles}} + \underbrace{(4)(5)}_{\text{rectangle}} + \underbrace{(5)^2}_{\text{square}}$$

$$= 15 + 12 + 20 + 25 = \boxed{72\ ft^2}$$

A cube has a total surface area of 384 square units. What is the length of one of its edges?

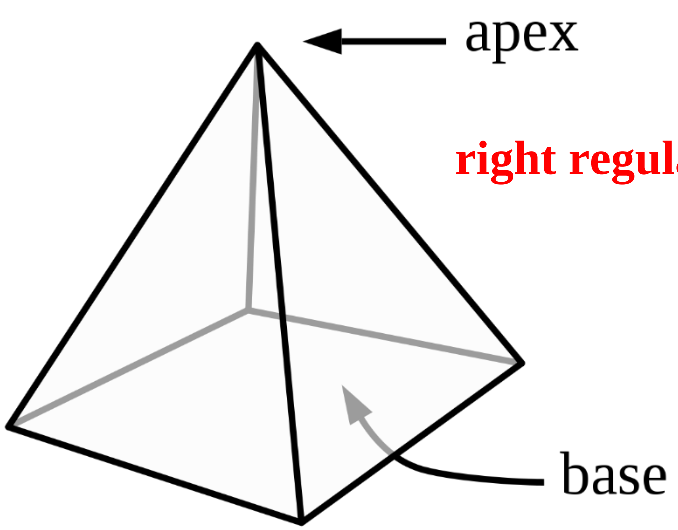
The surface area of a cube is $6s^2$**, so** $6s^2 = 384 \Rightarrow s^2 = 64 \Rightarrow s = 8\,units$**.**

If the length of the side of a cube is multiplied by 4, how will the surface area of the larger cube compare to the surface area of the original cube?

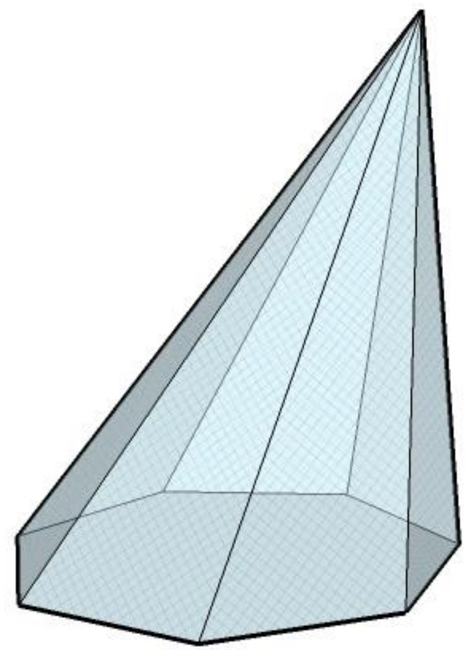
$6s^2$ **is the original surface area.** $6(4s)^2 = 16 \cdot 6s^2$ **is the new surface area, so the larger cube has 16 times the original surface area.**

__Pyramids:__

A pyramid is a polyhedron formed by connecting the vertices of a polygonal region called the base to another point not in the plane of the base called the apex using segments. Pyramids whose bases are regular polygonal regions are classified into two groups: If the lateral faces are isosceles triangles, then it's a right regular pyramid. Otherwise, it's an oblique regular pyramid.



right regular

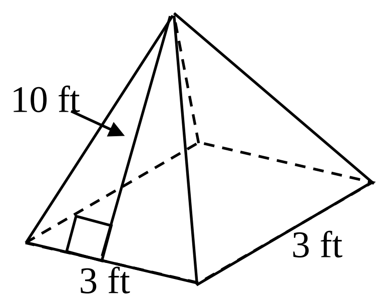


oblique regular

For right regular pyramids, the height of the lateral faces is called the slant height of the pyramid.

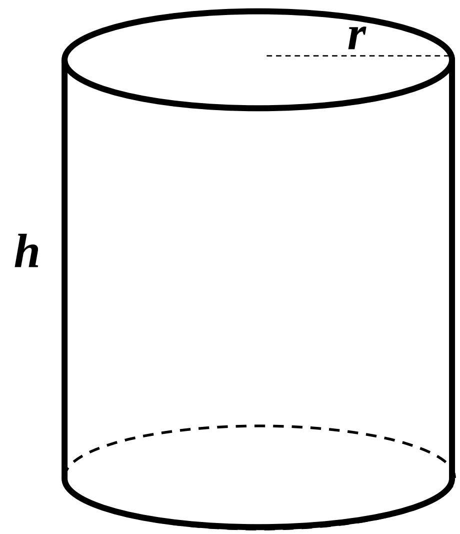
The surface area is the sum of the area of the base and the areas of the triangular lateral faces.

Right square pyramid:

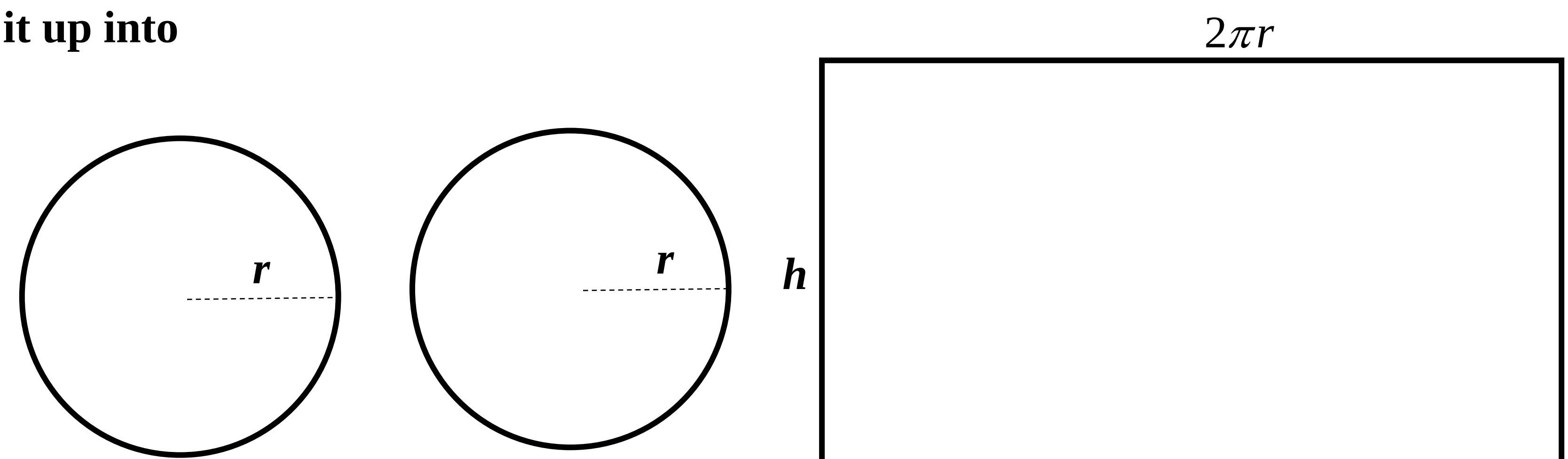


$$S.A. = \underbrace{(3)^2}_{\text{square base}} + \underbrace{4 \cdot \frac{1}{2} \cdot (3)(10)}_{\text{four triangular lateral faces}} = 9 + 60 = \boxed{69\ ft^2}$$

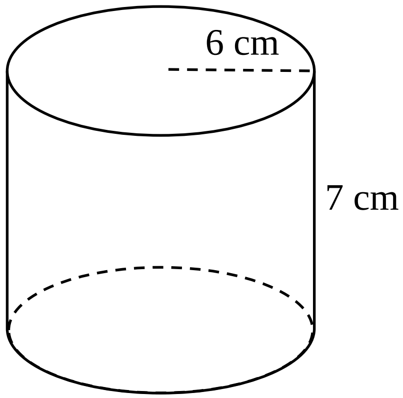
Right Circular Cylinders:



Open it up into

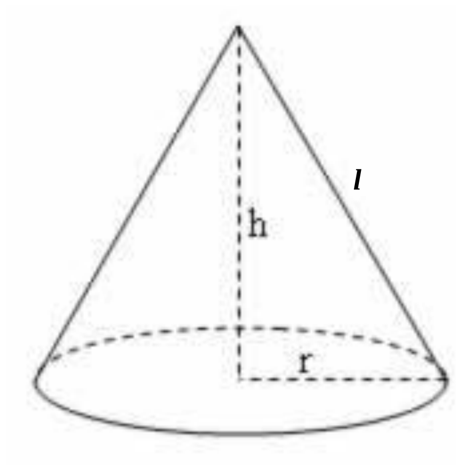


$$S.A. = \pi r^2 + \pi r^2 + 2\pi rh = 2\pi r^2 + 2\pi rh$$



$$S.A. = 2\pi r^2 + 2\pi rh = 2\pi \cdot 6^2 + 2\pi(6)(7) = 72\pi + 84\pi = \boxed{156\pi\, cm^2}$$

Right Circular Cone:



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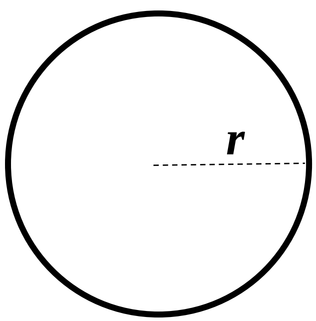
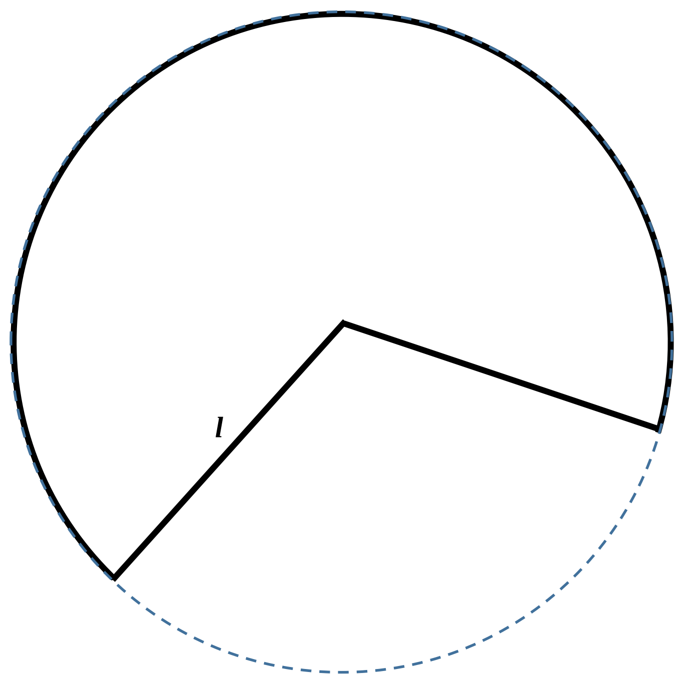
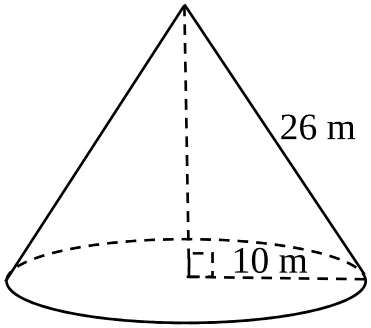




$$S.A. = \pi r^2 + \left(\frac{2\pi r}{2\pi l}\right)\pi l^2$$
$$= \pi r^2 + \pi r l$$
$$= \pi r^2 + \pi r\sqrt{r^2 + h^2}$$



$$S.A. = \pi r^2 + \pi r l = \pi \cdot 10^2 + \pi(10)(26) = 100\pi + 260\pi = \boxed{360\pi\, m^2}$$