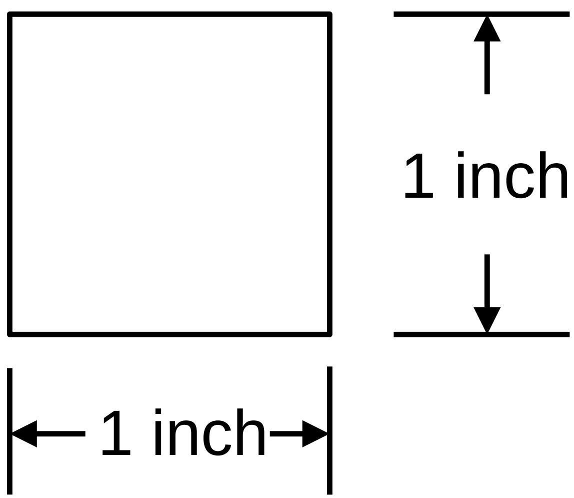
Math-2
Lesson 8-3:
Surface Area of:
Circles, Spheres, Cylinders, Cones, Pyramids, and Prisms

Describe the idea of area.

Area attempts to answer the question “how big is it?”



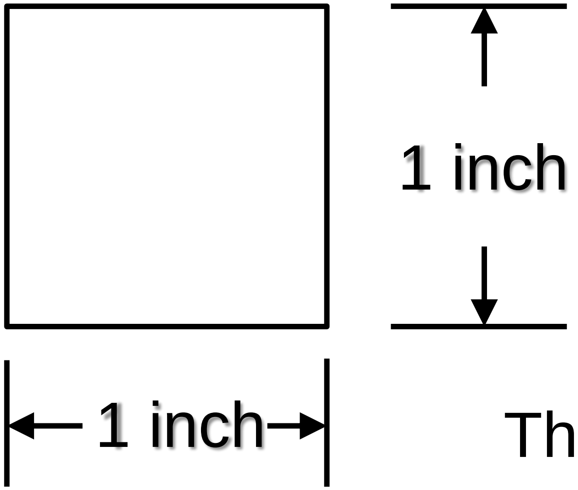
The area of this square is….?

area = length * width

area = (1 inch)(1 inch)

$$\text{area} = 1\,\text{inch}^2$$

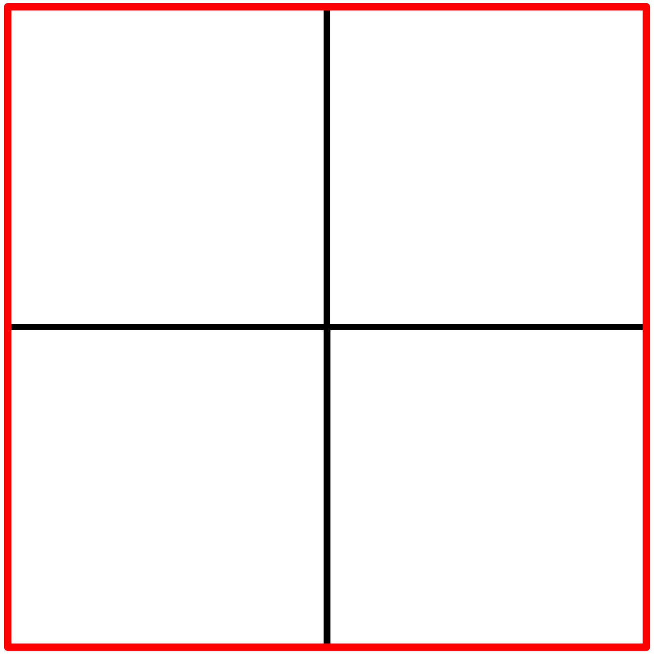
area = 1 “square inch”



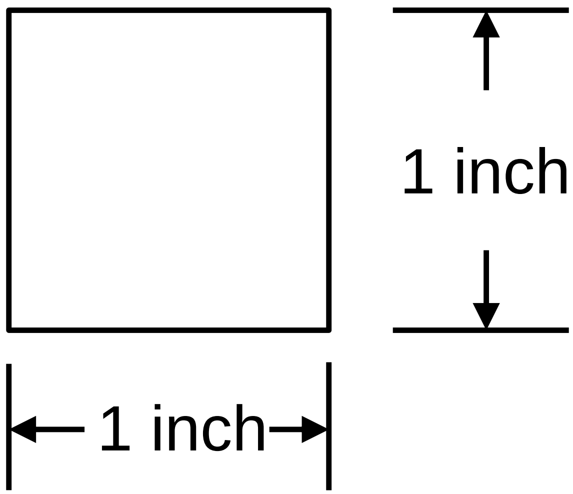
$$\text{area} = 4(1\,\text{inch}^2)$$

area = 4 “square inches”

The area of this square is….?



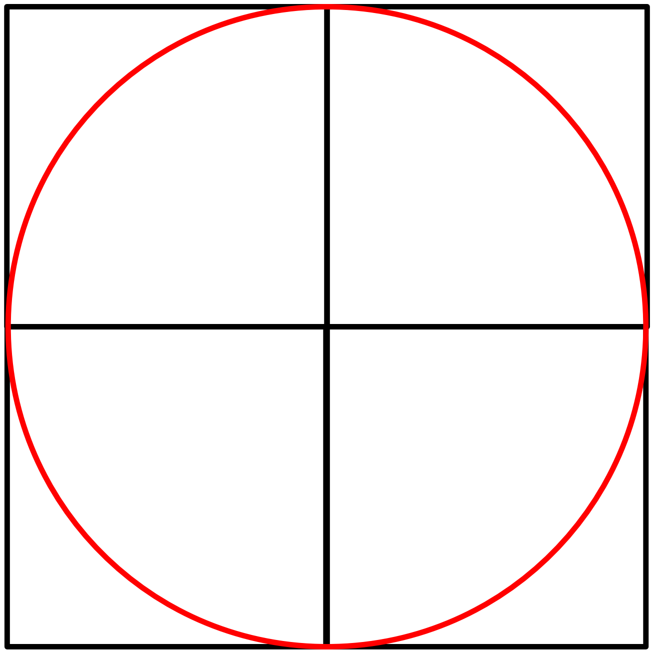
When we ask for an area, we really mean, “how many 1inch squares will fit in the area.”



The <u>area</u> of this circle is….?

"<u>how many 1inch squares will fit in the circle</u>."

$$area = \text{less than } 4\, inch^2$$



Will all those extra corners make up 1 sq. inch?

No. They make up slightly less than 1 sq. inch.

$$area = \text{slightly more than } 3\, inch^2$$

$$area = 3.1428\, inch^2$$

$$\pi = \frac{\text{distance around the circle}}{\text{distance across the circle}}$$

$$\pi = \frac{\text{Circumference}}{\text{diameter}}$$

$$\pi = \frac{\text{C}}{\text{D}}$$

$$\pi = \frac{\text{Circumference}}{\text{2 radii}}$$

$$\text{C} = \pi D$$

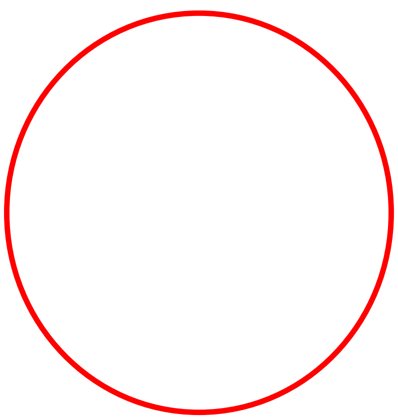
$$\pi = \frac{\text{C}}{\text{2r}}$$

$$\text{C} = 2\pi r$$

The <u>area</u> of this circle is….?

$$\text{area} = \pi\,\text{r}^2$$

What is the area of the circle given by the equation?

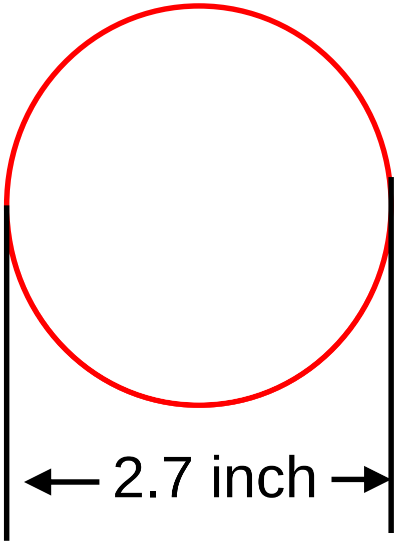


$$16 = x^2 + (y+2)^2$$

$$\text{area} = 16\pi$$

The area of this circle is….?

$$A = \pi r^2$$

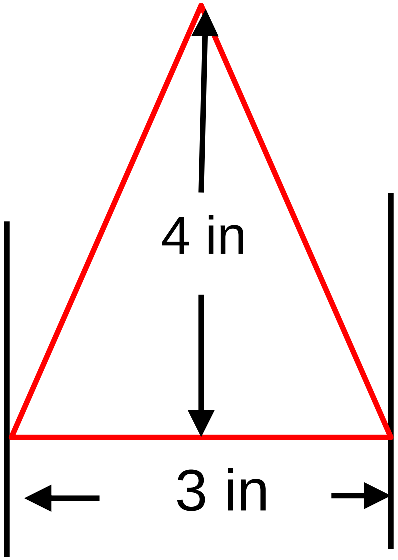


Is the given dimension a radius?

$$\text{area} = \pi \left(\frac{2.7}{2} \right)^2 \quad = 5.73\,\text{in}^2$$

If decimal dimensions are given in the problem, it is OK to have a decimal answer.

If the problem says to use 3.14 for "pi", DO NOT use the pi button on your calculator; use 3.14.



The area of this triangle is….?

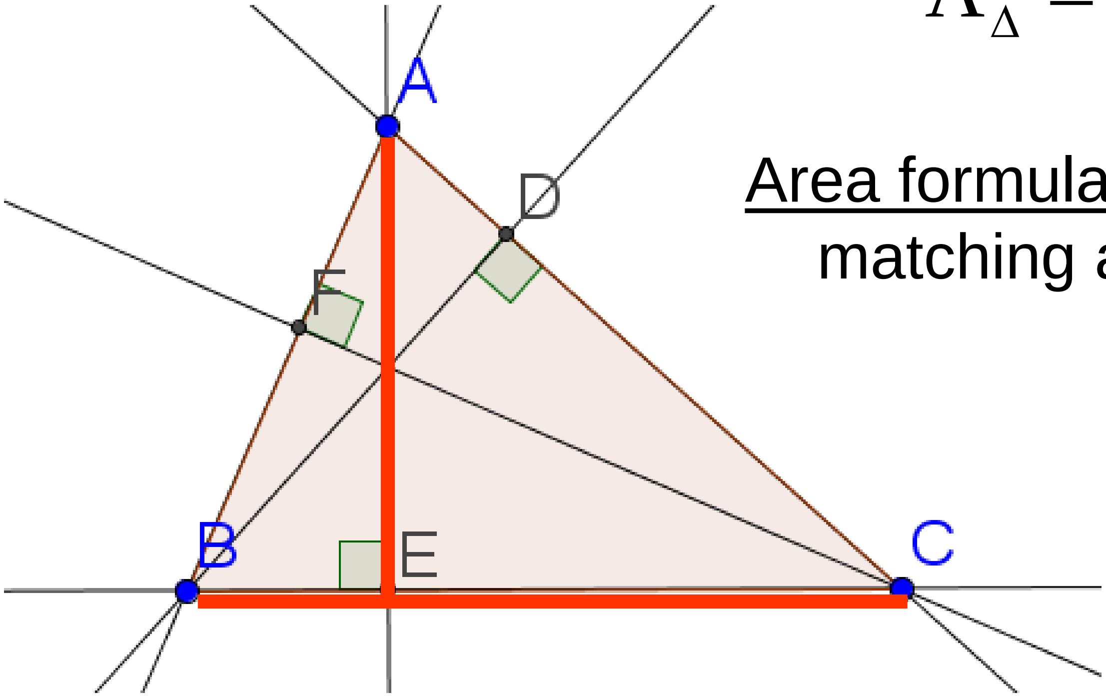
$$A_{\Delta} = \frac{1}{2} * \text{base} * \text{height}$$

Base (of a triangle): any side of the triangle.

height (of a triangle): the perpendicular distance (altitude) from any vertex of the triangle to its opposite side.

The altitude of a triangle.

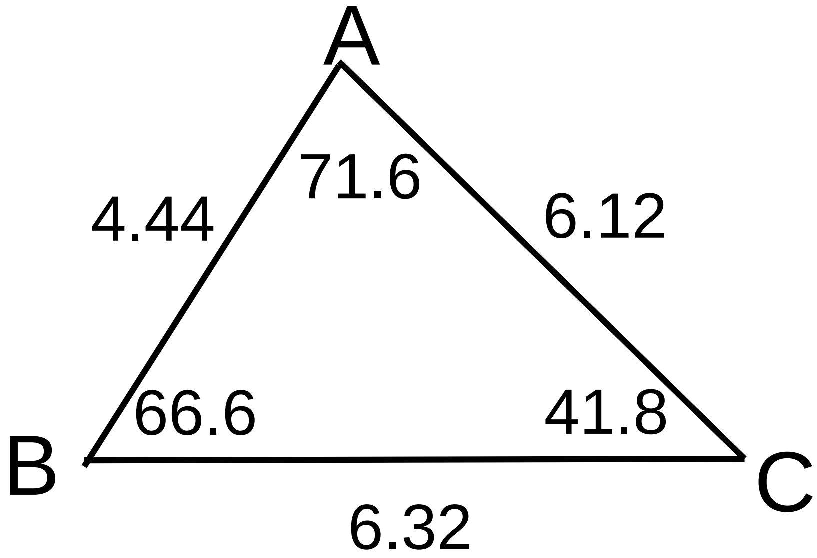
$$A_{\Delta} = \frac{1}{2} * \text{base} * \text{height}$$

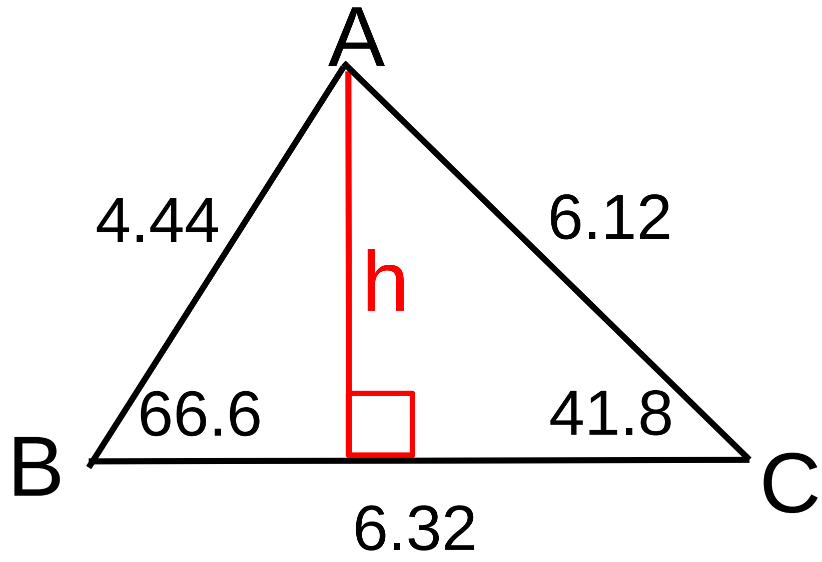


Area formula: requires the use of matching altitudes and sides.

Using segment BC as the base, requires the use of segment AE as the height.

Find the triangle area. (Use the altitude from point A as its height.)





$$A_{\Delta} = \frac{1}{2} * \text{base} * \text{height}$$

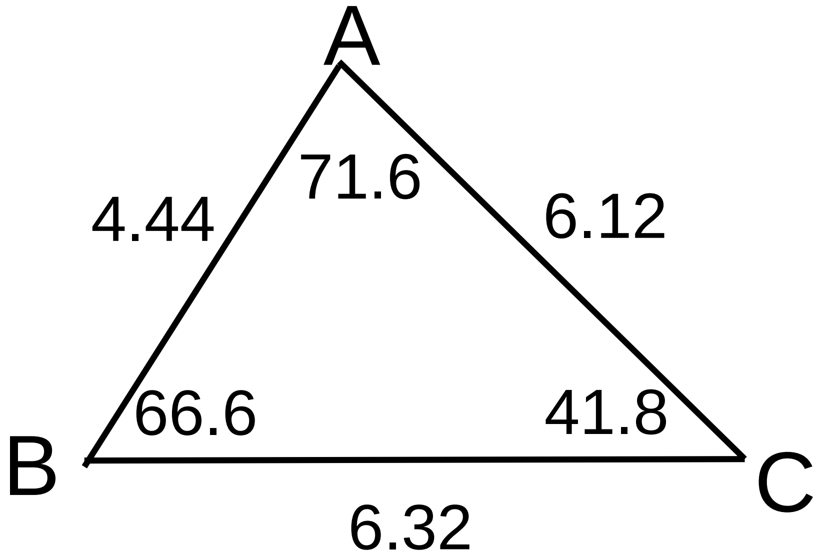
$$\frac{h}{6.12} = \sin 41.8^{\circ}$$

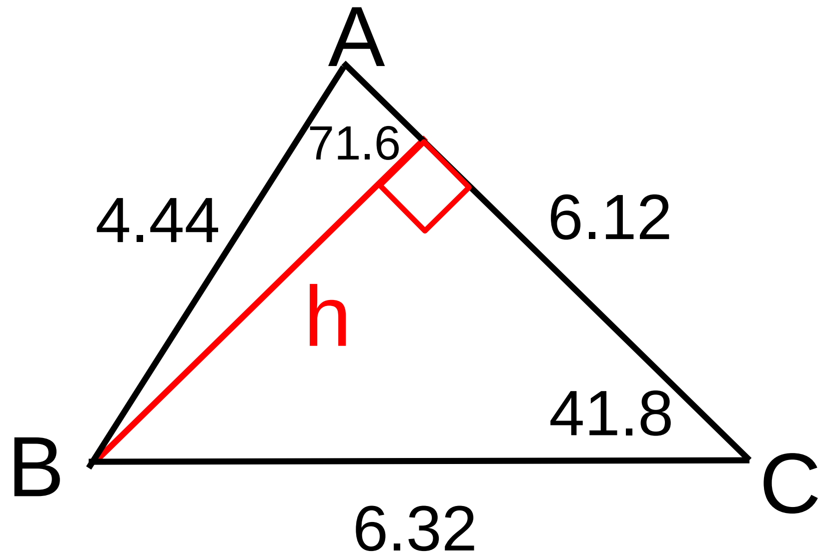
$$h = 6.12 \sin 41.8^{\circ}$$

$$A_{\Delta} = \frac{1}{2} * (6.32) * (6.12 sin(41.8))$$

$$A_{\Delta} = 12.89 \text{ units}^2$$

Find the triangle area. (Use the altitude from point B as its height.)





$$A_\Delta = \frac{1}{2} * \text{base} * \text{height}$$

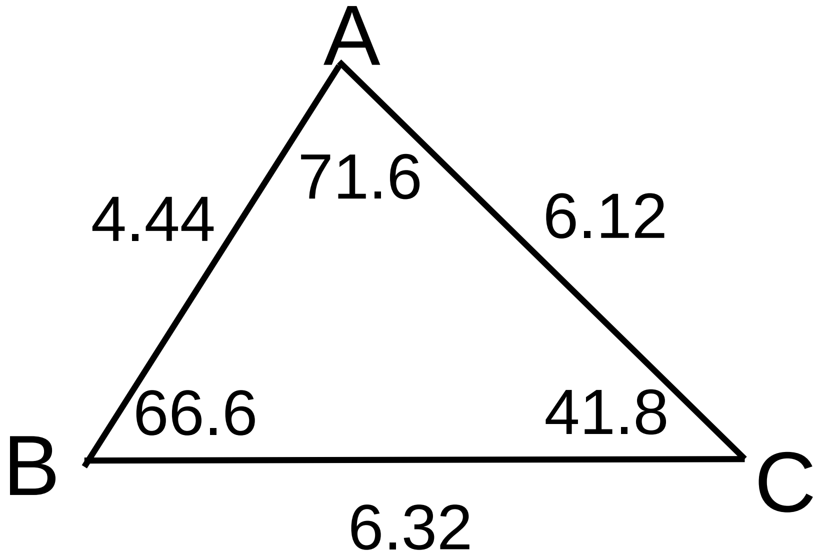
$$\frac{h}{6.32} = \sin 41.8°$$

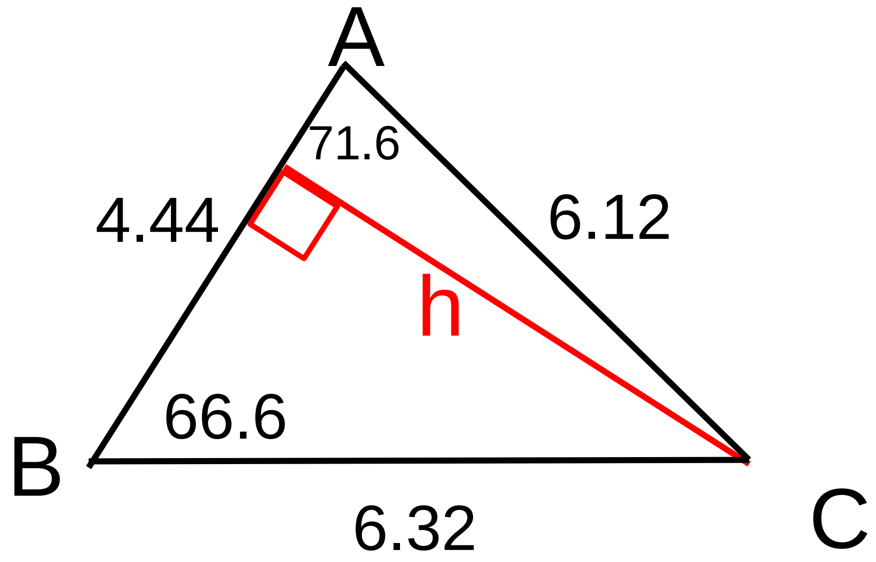
$$h = 6.32 \sin 41.8°$$

$$A_\Delta = \frac{1}{2} * (6.12) * (6.32 sin(41.8))$$

$$A_\Delta = 12.89 \text{ units}^2$$

Find the triangle area. (Use the altitude from point c as its height.)





$$A_\Delta = \frac{1}{2} * \text{base} * \text{height}$$

$$\frac{\text{h}}{6.12} = sin71.6°$$

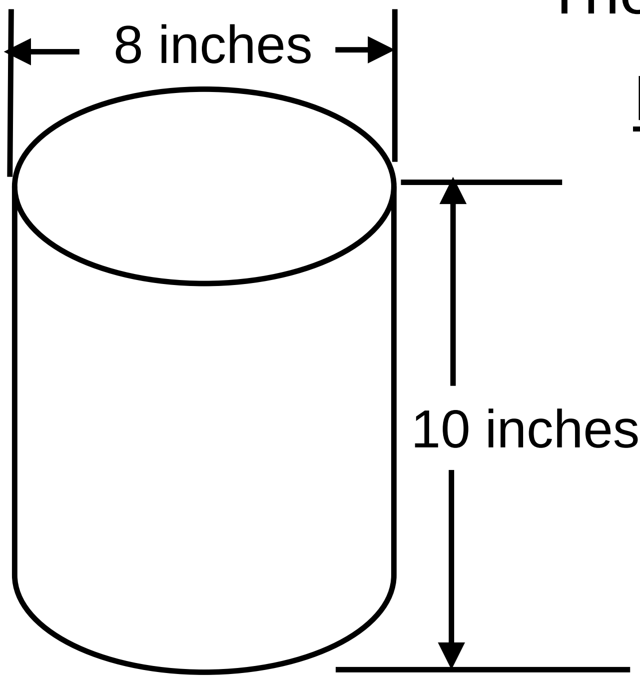
$$h = 6.12 \sin 71.6°$$

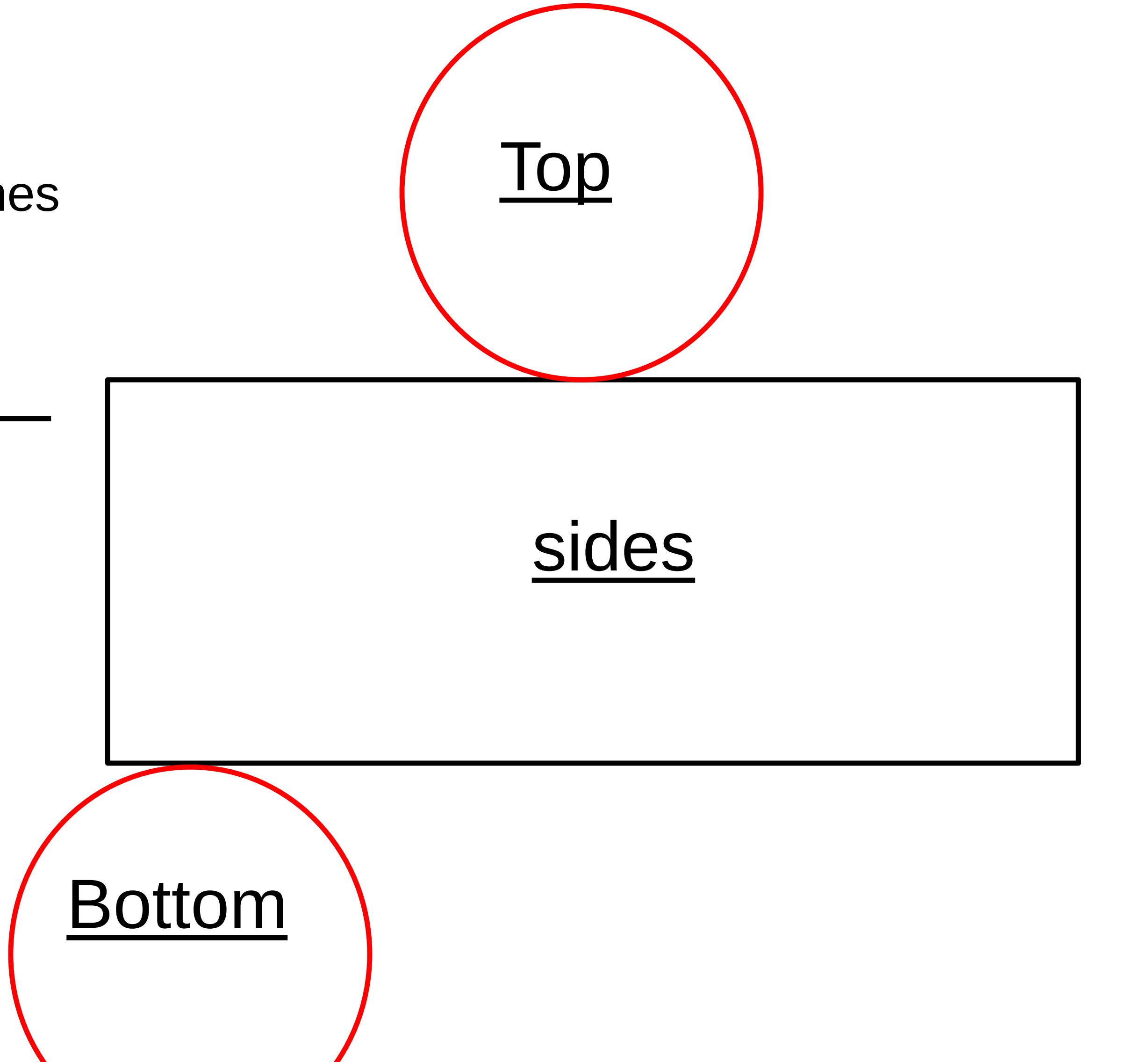
$$A_\Delta = \frac{1}{2} * (4.44) * (6.12sin(71.6))$$

$$A_\Delta = 12.89 \text{ units}^2$$

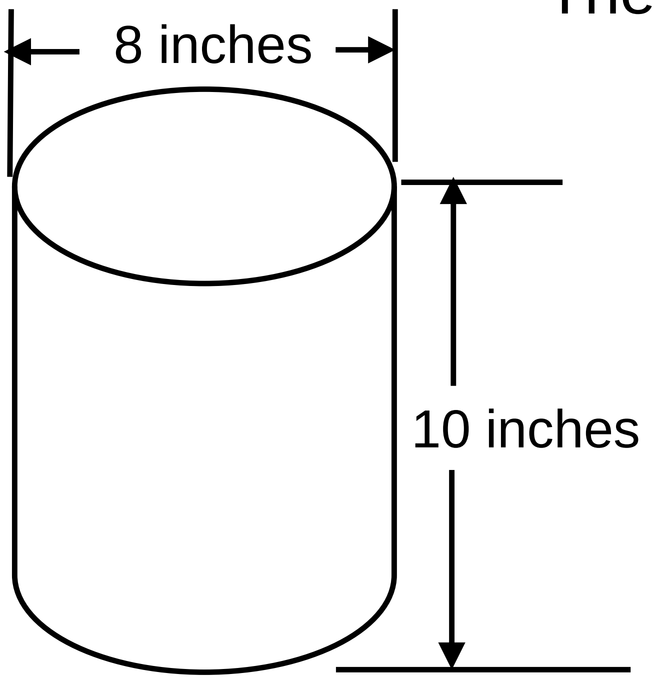
The surface area of a cylinder is….?

Net a the “flattened” version of a 3-dimensional shape.

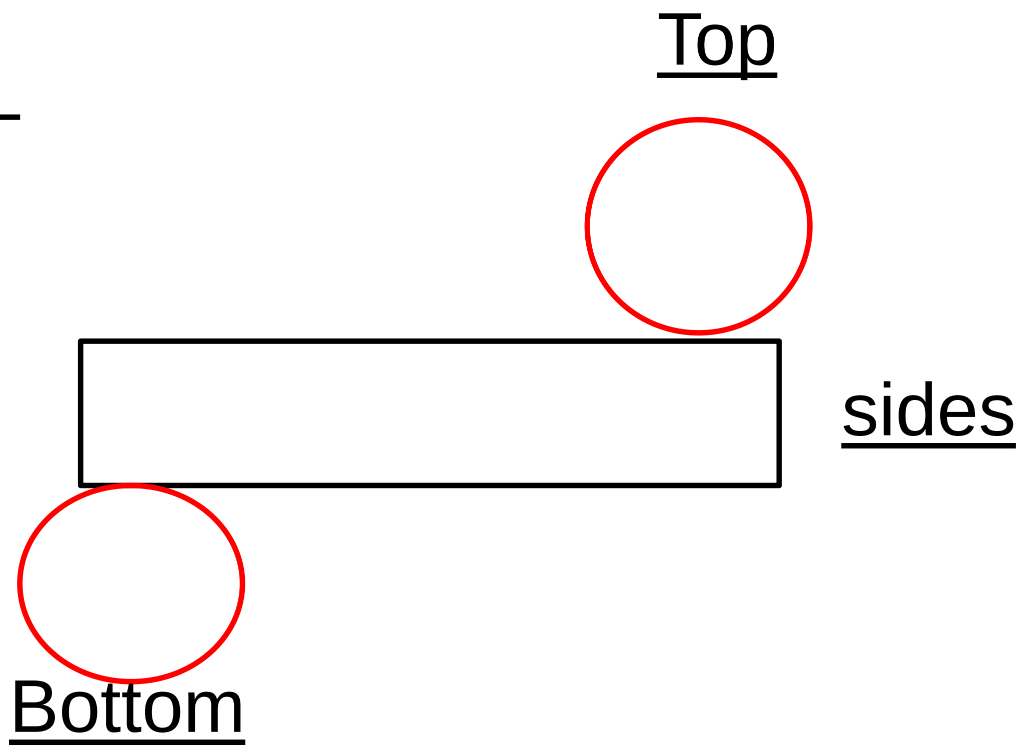


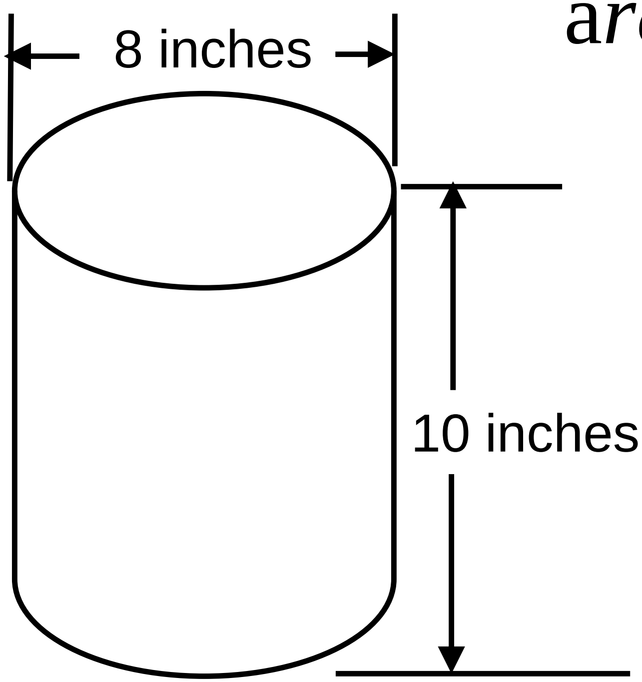


The surface area of a cylinder is….?



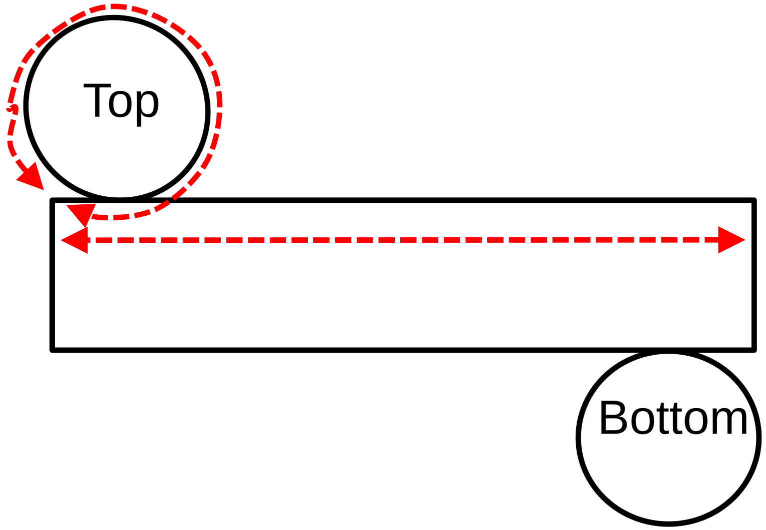
The surface area of a cylinder is made up of 2 circles and 1 rectangle.





$$area_{circle} = \pi r^2 = \pi (4in)^2$$

$$area_{circle} = 16\pi \text{ in}^2$$



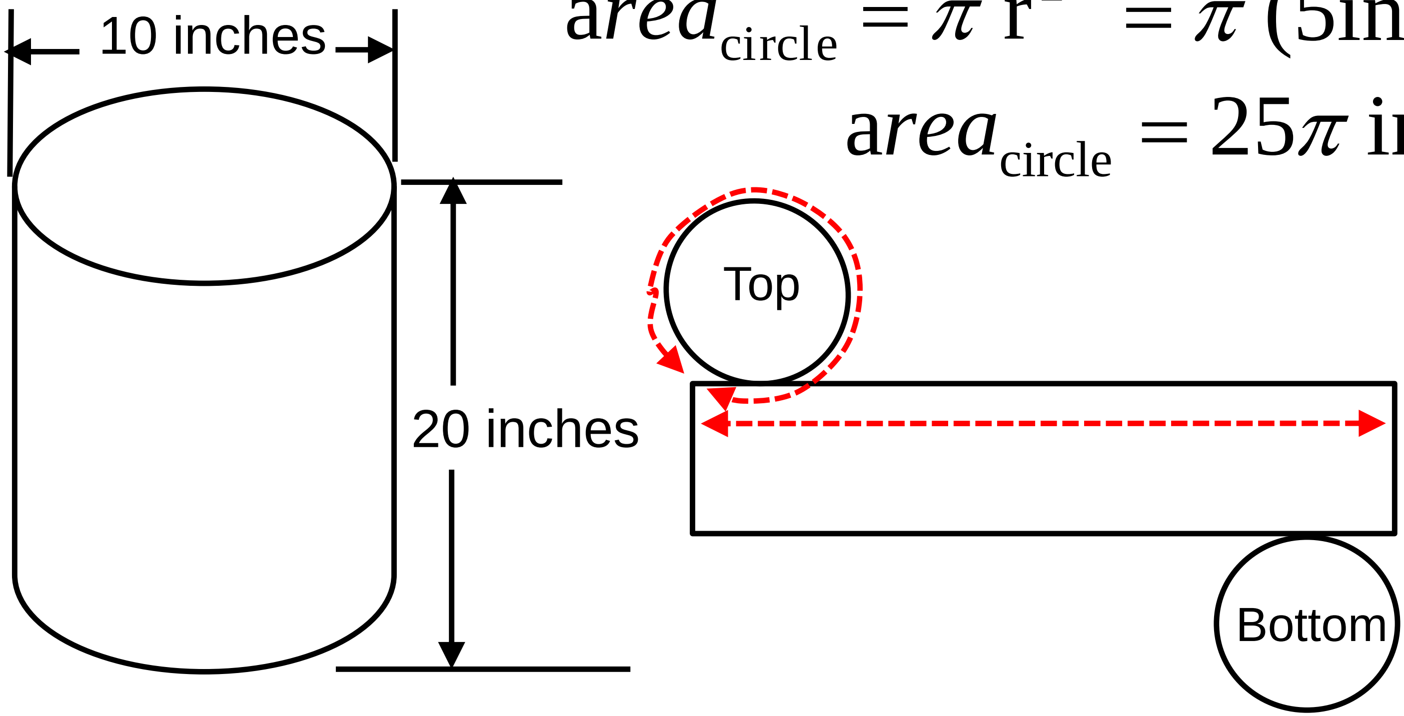
$$area_{rectangle} = l * w$$

$$\text{area}_{rectangle} = \text{height} * \text{circumference of top}$$

$$area_{rectangle} = h * (2\pi r) = 10in * (2\pi * 4in) = 80\pi \text{ in}^2$$

$$\text{Surface area}_{cylinder} = 16\pi \text{ in}^2 + 80\pi \text{ in}^2 + 16\pi \text{ in}^2$$

$$\text{Surface area}_{cylinder} = 112\pi \text{ in}^2$$



$$area_{circle} = \pi r^2 = \pi (5in)^2$$

$$area_{circle} = 25\pi \text{ in}^2$$

$$area_{rectangle} = l * w$$

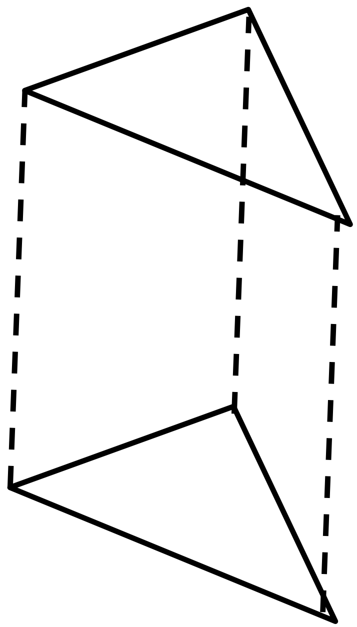
$$\text{area}_{\text{rectangle}} = \text{height} * \text{circumference of top}$$

$$area_{rectangle} = h * (2\pi r) = 20in * (2\pi * 5in) = 200\pi \text{ in}^2$$

$$\text{Surface area}_{\text{cylinder}} = 25\pi \text{ in}^2 + 200\pi \text{ in}^2 + 25\pi \text{ in}^2$$

$$\text{Surface area}_{\text{cylinder}} = 250\pi \text{ in}^2$$

Prism: a three-dimensional shape (a “solid”) that has two parallel polygonal bases and planer (“flat”) sides.



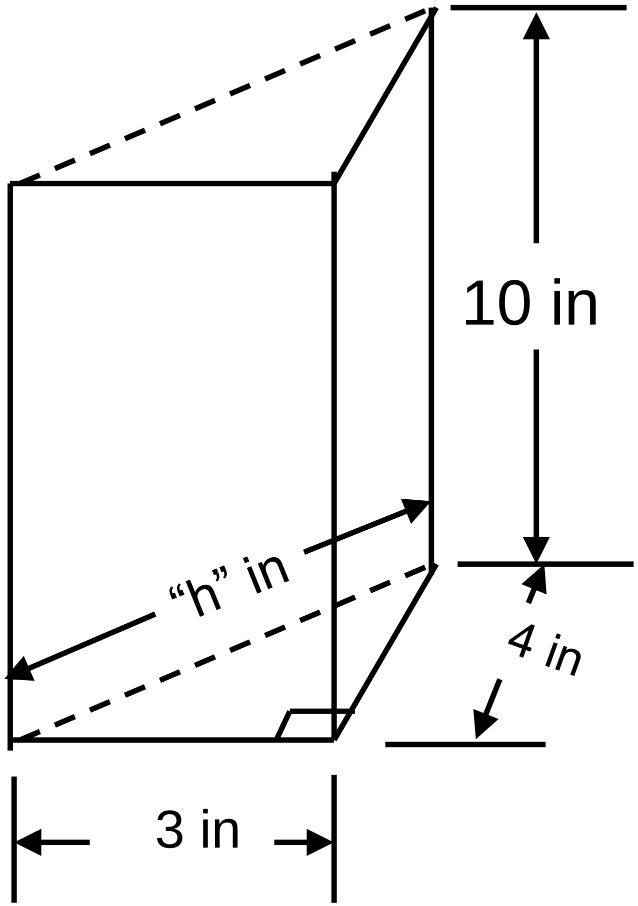
Prisms are named based upon the shape of their bases.

If the sides intersect the base at a right angle, we include that in the name:

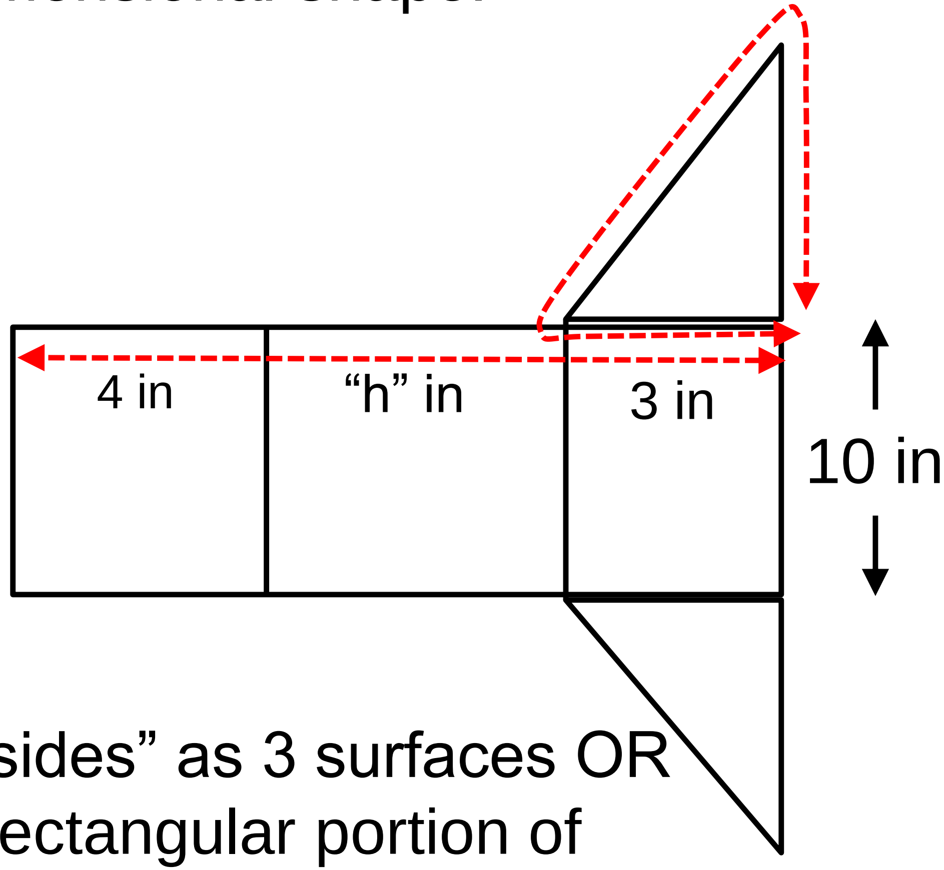
What is the name of the prism to the left?

“Right Triangular Prism”

What is the “surface area” of the prism?

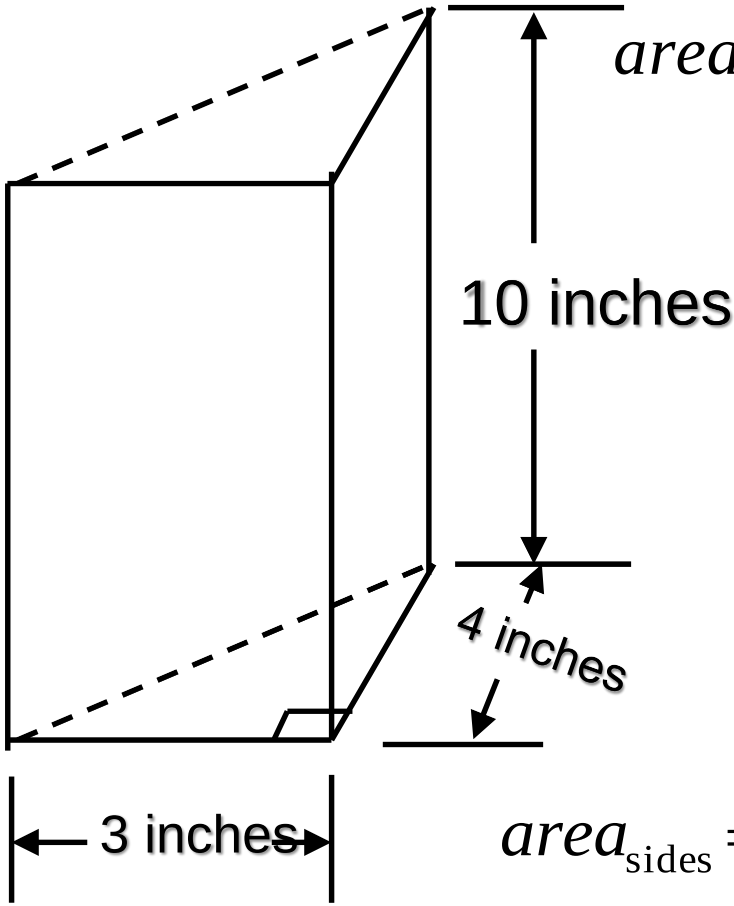


Net a the “flattened” version of a 3-dimensional shape.



You can think of the “lateral sides” as 3 surfaces OR you can think of it as the rectangular portion of the net.

What is the “surface area” of the prism?



$$area_{\text{prism}} = 2 * (\text{area of base}) + \text{area of sides}$$

What is the area of a triangle?

$$\text{area}_{\text{triangle}} = \frac{1}{2}(\text{base} * \text{height})$$

$$\text{area}_{\text{triangle}} = \frac{1}{2}(3\ \text{in} * 4\ \text{in})$$

$$\text{area}_{\text{triangle}} = 6\ \text{in}^2$$

$$area_{\text{side}} = \text{l} * w$$

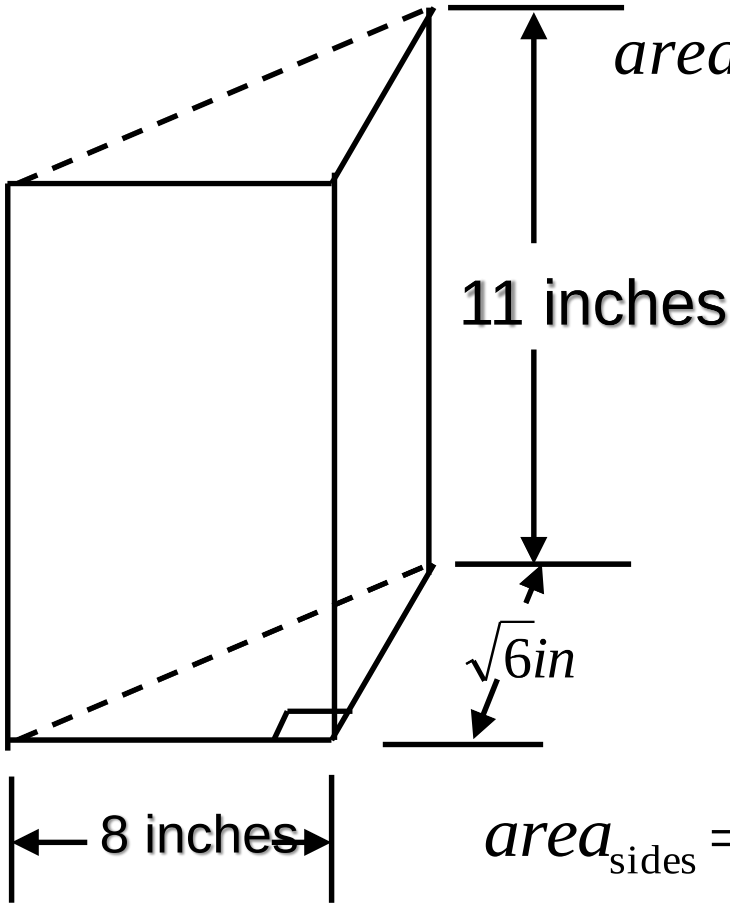
$$area_{\text{sides}} = (3in * 10in) + (4in * 10in) + (hyp * 10in)$$

$$area_{\text{sides}} = 30in^2 + 40in^2 + (5in * 10in)$$

$$area_{\text{sides}} = 30in^2 + 40in^2 + 50in^2 \quad = 120in^2$$

$$area_{\text{prism}} = 2 * (6\text{in}^2) + 120in^2 \quad = 132in^2$$

What is the “surface area” of the prism?



$$area_{\text{prism}} = 2*(\text{area of base}) + \text{area of sides}$$

What is the area of a triangle?

$$\text{area}_{\text{triangle}} = \frac{1}{2}(\text{base} * \text{height})$$

$$\text{area}_{\text{triangle}} = \frac{1}{2}(8 \text{ in} * \sqrt{6} \text{ in})$$

$$\text{area}_{\text{triangle}} = 4\sqrt{6} \text{ in}^2 = 9.8 \text{ in}^2$$

$$area_{\text{side}} = l * w$$

$$area_{\text{sides}} = (8in * 11in) + (\sqrt{6}in * 11in) + (hyp * 11in)$$

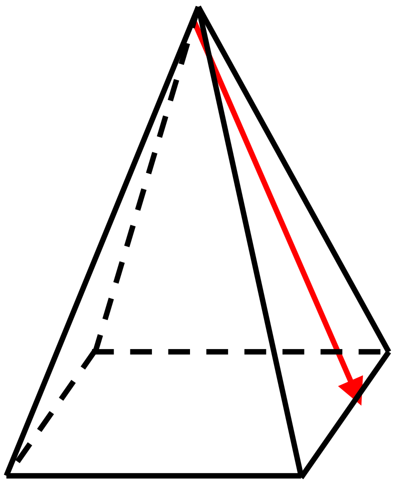
$$area_{\text{sides}} = 88in^2 + 11\sqrt{6}in^2 + (\sqrt{72}in * 11in)$$

$$area_{\text{sides}} = 88in^2 + 26.9in^2 + 93.3in^2 = 208.2in^2$$

$$area_{\text{prism}} = 2*(9.8\text{in}^2) + 208.2in^2 = 227.8in^2$$

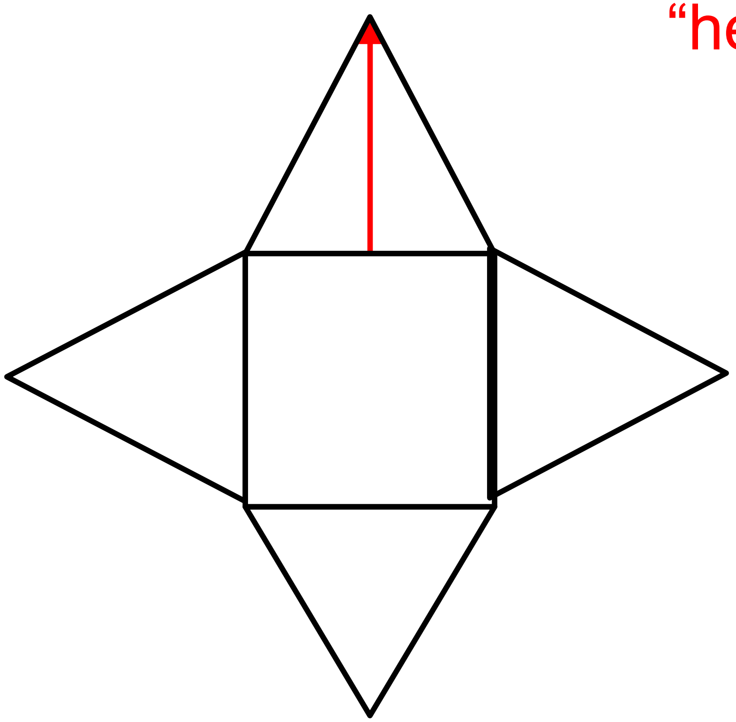
The surface area of a pyramid is….?

The sum of the area of the faces.

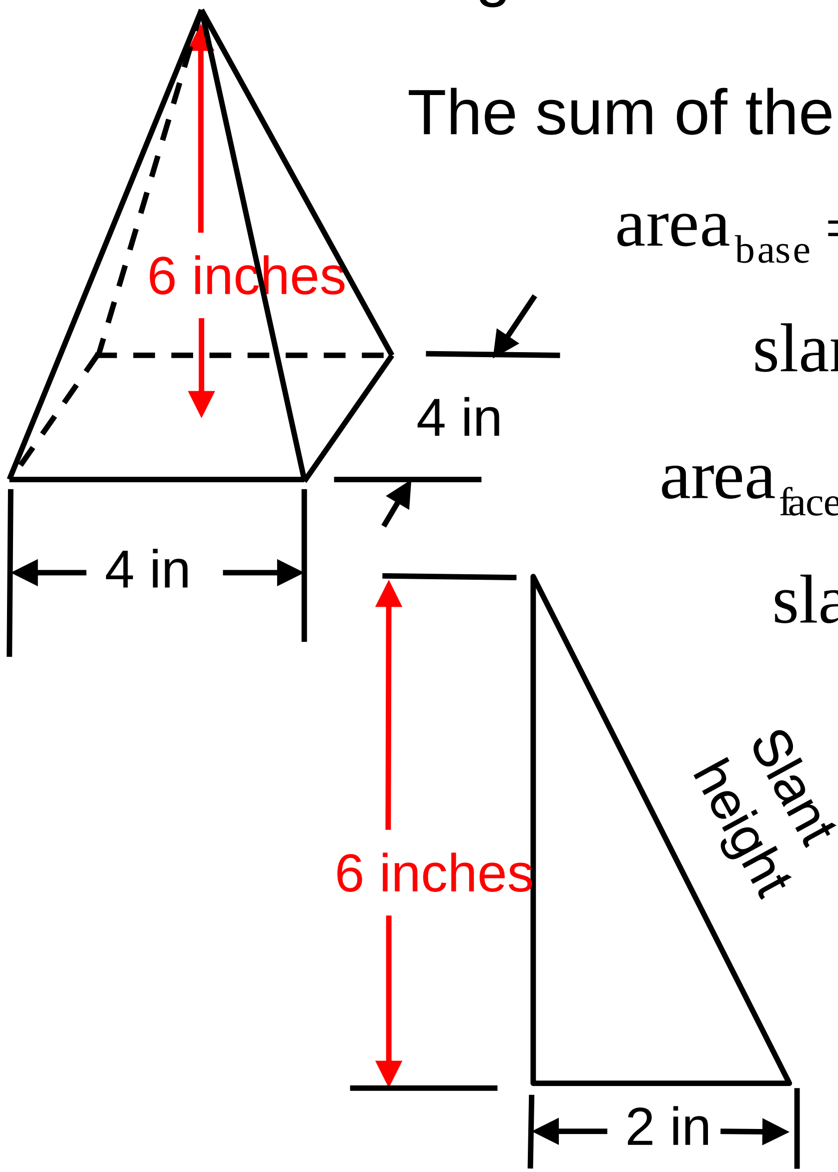


Rectangular Pyramid has a 4-sided base:
it has four triangular faces.

The "slant height" of the pyramid is the "height" of the triangular face.



The surface area of a rectangular pyramid is 1 rectangle and 4 triangles.



The sum of the area of the 5 faces.

$$\text{area}_{\text{base}} = l * w = 16 \text{ in}^2$$

$$\text{slant height} = \sqrt{(2in)^2 + (6in)^2}$$

$$\text{area}_{\text{face}} = \frac{1}{2} base * \text{slant height}$$

$$\text{slant height} = \sqrt{40 \text{ in}^2} = 6.3 \text{ in}$$

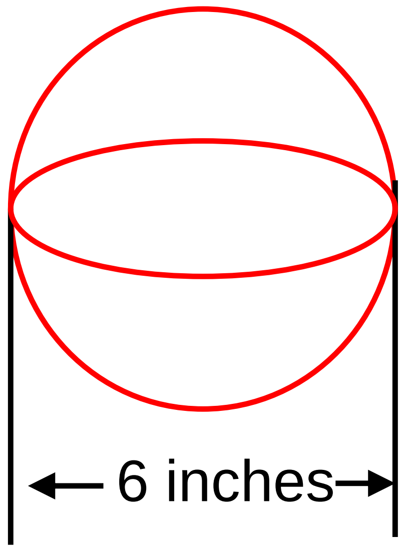
$$\text{area}_{\text{face}} = \frac{1}{2} * 4 \text{ in} * 6.3 \text{ in}$$

$$\text{area}_{\text{face}} = 12.6 \text{ in}^2$$

$$\text{area}_{\text{total}} = 4(12.6 \text{ in}^2) + 16 \text{ in}^2$$

$$\text{area}_{\text{total}} = 66.4 \text{ in}^2$$

The surface area of a sphere is….?



$$\text{surfarea}_{\text{sphere}} = 4\pi\, r^2$$

$$\text{surface area}_{\text{sphere}} = 4\pi\left(\frac{6}{2}\right)^2$$

$$\text{surface area}_{\text{sphere}} = 4\pi(3)^2$$

$$\text{surface area}_{\text{sphere}} = 4\pi * 9$$

$$\text{surface area}_{\text{sphere}} = 36\pi\, \text{in}^2 \qquad = 113.1 \text{in}^2$$

Cone

<u>Surface Area</u>

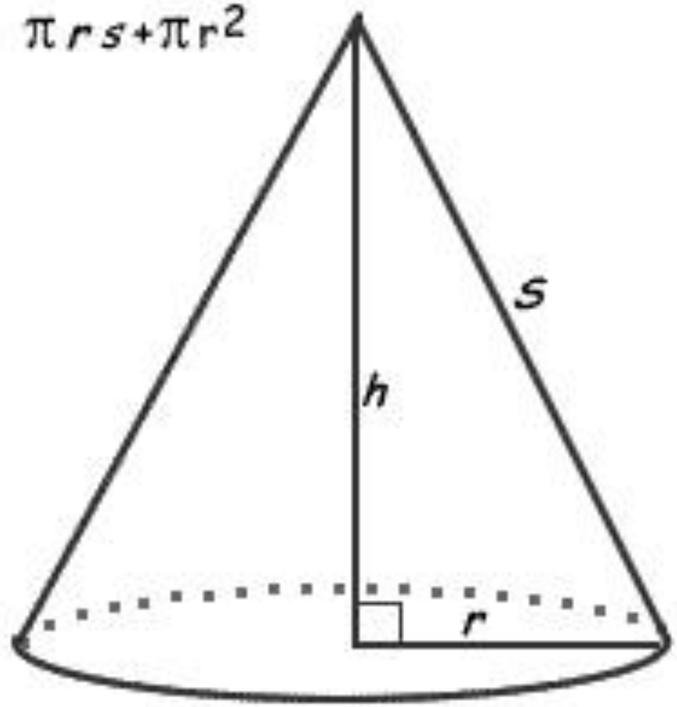
We will need to calculate the surface area of the cone and the base.

Area of the cone is $\pi r s$

Area of the base is πr^2

Therefore the Formula is:

$SA = \pi r s + \pi r^2$



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Cone

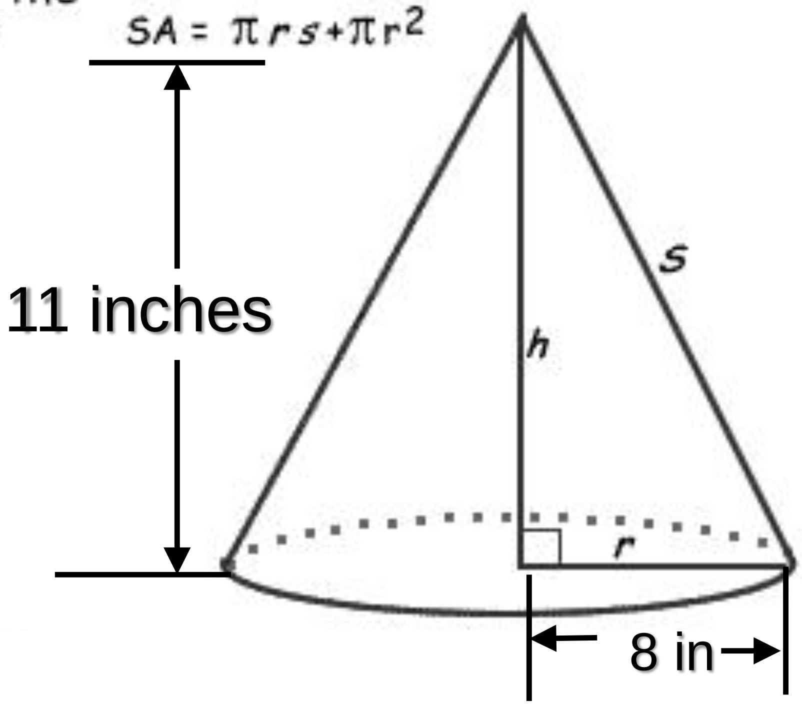
<u>Surface Area</u>

We will need to calculate the surface area of the cone and the base.

Area of the cone is $\pi r s$

Area of the base is πr^2

Therefore the Formula is: $SA = \pi r s + \pi r^2$



$$slant_{\text{height}} = ?$$

$$a^2 + b^2 = c^2$$

$$slant_{\text{height}} = \sqrt{8^2 + 11^2}$$

$$= \sqrt{185\,\text{in}^2}$$

$$= 13.6\,\text{in}$$

$$\text{area}_{\text{cone}} =$$

$$\pi * 8\,\text{in} * 13.6\,\text{in} + \pi * (8\,\text{in})^2$$

$$= 108.8\pi\,\text{in}^2 + 64\pi\,\text{in}^2$$

$$= 172.8\pi\,\text{in}^2$$

$$= 542.9\,\text{in}^2$$