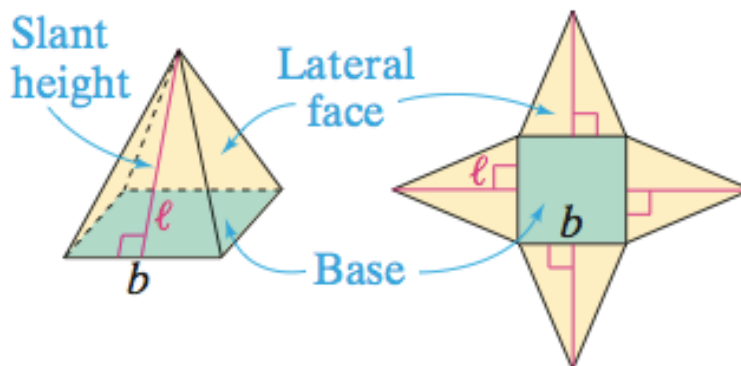
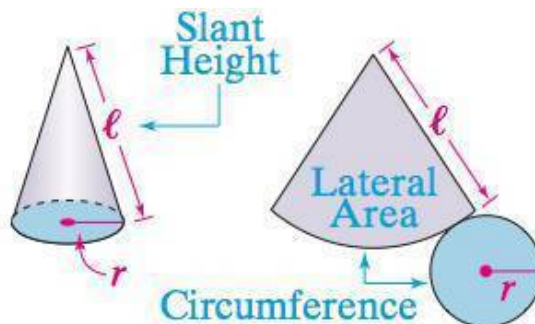


# PYRAMIDS AND CONES

A pyramid is a solid with a polygonal base and triangular lateral faces that meet at a vertex. In this lesson, you will work with regular pyramids. The base of a regular pyramid is a polygon with sides of equal length and angles of equal measure. The slant height of a pyramid is the height of a lateral face. The variable  $l$  is used to represent slant height. The net of a square pyramid is shown below.



A cone is a solid formed by one circular base and a curved surface that connects the base and the vertex. In this lesson, a cone is a right circular cone with the vertex of the cone directly over the center of the circular base.



## WHAT YOU'LL LEARN

- Finding the surface areas and volume of pyramids
- Finding the surface areas and volume of cones

The lateral area of a pyramid is one half the product of the perimeter of the base and the slant height. The surface area of a pyramid is the sum of the lateral area and the area of the base.

You learned that the volume of a prism is equal to  $Bh$ , where  $B$  is the area of the base and  $h$  is the height. From the figure in the previous page, it is clear that

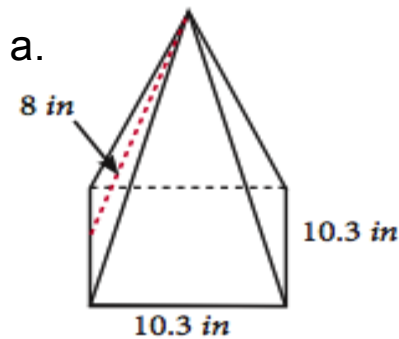
### SURFACE AREA OF A PYRAMID

$$\frac{1}{2} P_B \cdot l + A_B$$

$\frac{1}{2}$  PERIMETER OF THE BASE • SLANT HEIGHT (LATERAL AREA) + AREA OF THE BASE

### EXAMPLES

Find the surface area of the following:



SOLUTION a:

$$P = 10.3(4) = 41.2in$$

$$l = 8$$

$$B = (10.3)(10.3)$$

$$= 106.09in^2$$

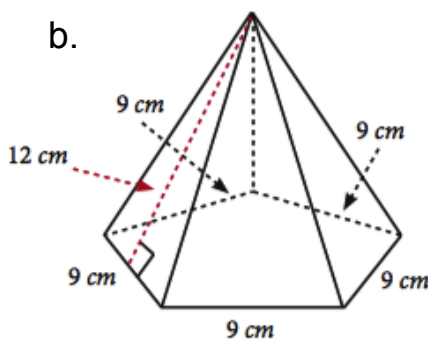
Surface Area:

$$SA = \frac{1}{2}Pl + B$$

$$SA = \frac{1}{2}(41.2)(8) + 106.09$$

$$SA = 164.8 + 106.09$$

$$SA \approx 270.89in^2$$



SOLUTION b:

$$\text{Given: } B = 139cm^2$$

$$P = 9(5) = 45$$

$$l = 12$$

$$B = 139$$

Surface Area:

$$SA = \frac{1}{2}Pl + B$$

$$SA = \frac{1}{2}(45)(12) + 139$$

$$SA = 270 + 139$$

$$SA = 409in^2$$

## SURFACE AREA OF A CONE

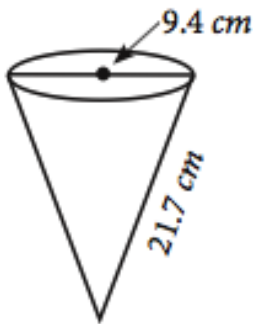
$$\pi r l + \pi r^2$$

LATERAL AREA + AREA OF THE BASE

### EXAMPLES

Find the surface area of the following:

a.



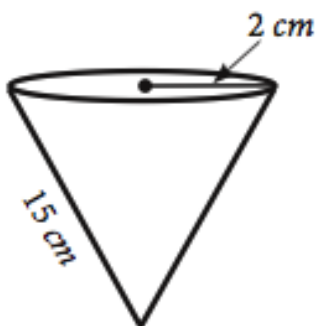
Given:

$$d = 9.4\text{cm}$$
$$l = 21.7\text{cm}$$

Surface Area:

$$SA = \pi r^2 + \pi r l$$
$$SA = \pi(4.7)^2 + \pi(4.7)(21.7)$$
$$SA = 22.09\pi + 101.99\pi$$
$$SA = 124.08\pi\text{cm}^2$$
$$SA \approx 389.81\text{cm}^2$$

b.



Given:

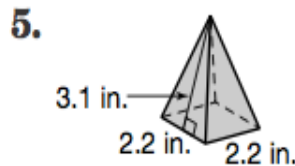
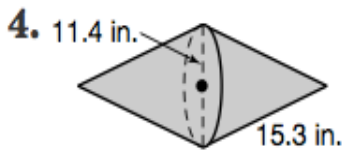
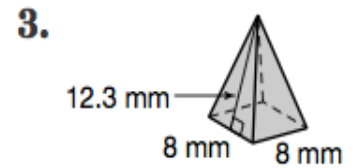
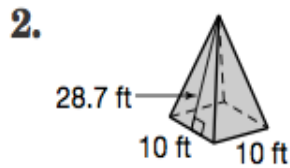
$$r = 2\text{cm}$$
$$l = 15\text{cm}$$

Surface Area

$$SA = \pi(2)^2 + \pi(2)(15)$$
$$SA = 4\pi + 30\pi$$
$$SA = 34\pi\text{cm}^2$$
$$SA \approx 106.81\text{cm}^2$$

## PRACTICE TEST:

Find the Surface Area of the following. Write complete solutions and answers in terms of  $\pi$ , then use the value of  $\pi$  in your calculator. Round off final answers to 2 decimal places.



## APPLICATIONS:

Solve the following problems completely. Write complete solutions and answers in terms of  $\pi$ , then use the value of  $\pi$  in your calculator. Round off final answers to 2 decimal places.

- 1) A cone has a radius of 10 inches and a height of 14 inches. Find the surface area.
- 2) The base of a regular pentagonal pyramid has a perimeter of 60 feet. The slant height of the pyramid is 9 feet. Find the lateral area of the pyramid.
- 3) A roof is shaped like a cone with a diameter of 12 feet and a slant height of 13 feet. One bundle of shingles covers 32 square feet. How many bundles should you buy to cover the roof?
- 4) A regular hexagonal pyramid has a base area of 392.9 square feet. The sides of the hexagon are 12.3 feet long. The slant height of the pyramid is 15.9 feet. What is the surface area of the pyramid?

- 5) A square pyramid has a base edge that measures 8 meters and a slant height of 30 meters.
- Find the perimeter of the base.
  - Find the lateral area.
- 6) A regular triangular pyramid has a slant height of 10 inches. The perimeter of the base is 24 inches. The base of the pyramid has an area of 27.7 square inches.
- Find the lateral area of the pyramid.
  - Find the surface area of the pyramid.
- 7) Maico made game pieces in the shape of square pyramids. Each piece has a base edge of 2 cm and a slant height of 4 cm. He will paint all of the pieces. He needs to know how much paint he needs.
- Find the surface area of one game piece.
  - Each game has 24 game pieces. Find the total surface area of one set of game pieces.
  - She wants to make 12 games. What is the total surface area for all 12 games?
  - A can of paint covers 400 square centimeters. How many cans of paint will he need?
- 8) A square pyramid has a perimeter of 50 inches and a slant height of 15.3 inches.
- Find the lateral area of the pyramid.
  - What is the length of one side of the base?
  - Find the area of the base.
  - Find the surface area of the pyramid.

### THINKING TIME:

- How can you determine the number of faces does a pyramid have?
- Want to find out how the formula was derived? Check this out!  
<http://www.rdrop.com/~half/math/cone/surface.area.xhtml>