

Objective: Find the surface area of cones

Concept

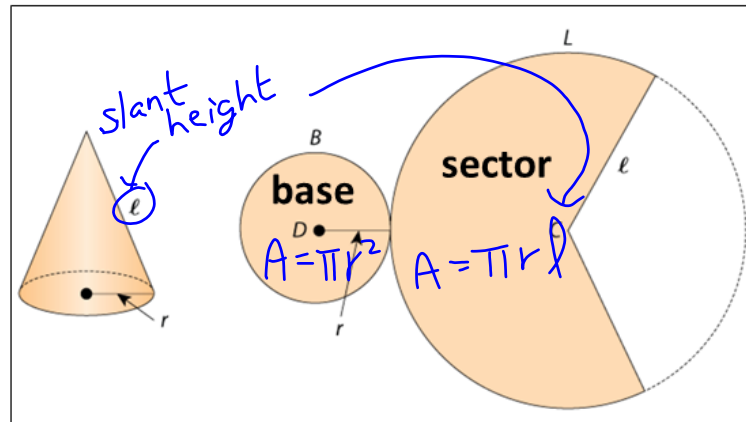
**Surface Area of a Cone**

The **surface area,  $S$** , of a cone is equal to the sum of the area of the sector,  $L$ , and the area of the circular base,  $B$ .

$$S = L + B$$

$$S = \pi r \ell + \pi r^2$$

Where  $B$  is the area of the circular base and  $L$  is the area of the side of the cone, called a sector.

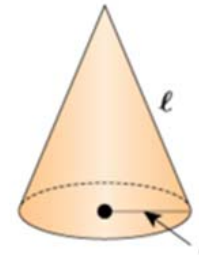


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**Steps to find the Surface Area of a Cone**

1. Find the **radius,  $r$** , of the circular base.
2. Find the **slant height,  $\ell$** , of the cone.
3. Find the surface area:  $S = L + B \rightarrow S = \pi r \ell + \pi r^2$

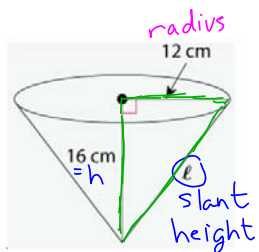


The **Lateral Area** of a cone is the area of the side of the cone.

To find the **Lateral Area** of the a cone, use:  $L = \pi r \ell$ .

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Ex) A company packages popcorn in containers in the shape of a right cone. Each container will be wrapped completely in cellophane, side and top. Estimate the amount of cellophane needed to wrap each container. Round to the nearest tenth of a square centimeter.



★ Total Surface Area  
 $S = L + B$   
 $S = \pi r l + \pi r^2$

① find  $r$  and  $l$

ⓐ  $r = 12 \text{ cm}$

ⓑ  $l = ?$

A right triangle with legs  $r = 12 \text{ cm}$  and  $h = 16 \text{ cm}$ , and hypotenuse  $l$ . The hypotenuse is labeled 'hyp.' in pink. The equations below show the calculation of  $l$ .

$$r^2 + h^2 = l^2$$

$$12^2 + 16^2 = l^2$$

$$\sqrt{12^2 + 16^2} = \sqrt{l^2}$$

$$l = \sqrt{12^2 + 16^2}$$

$$l = 20 \text{ cm}$$

② surface area =  $S = \pi r l + \pi r^2$

$$S = \pi(12 \text{ cm})(20 \text{ cm}) + \pi(12 \text{ cm})^2$$

$$\approx 1206.4 \text{ cm}^2$$

③ The amount of cellophane needed to wrap each container is about  $1206.4 \text{ cm}^2$ .

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Ex) Shelley plans to make eight conical party hats for her niece's birthday party. She wants each hat to be 18 inches tall and the bases of each to be 9 inches in diameter. How much material will she use to make the hats to the nearest square inch?



↓  
 \* lateral area  
 $L = \pi r l$

① find  $r$  and  $l$

②  $r = \frac{\text{diameter}}{2} = \frac{9 \text{ in}}{2} = 4.5 \text{ in}$

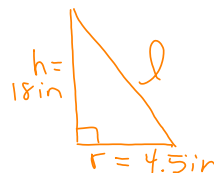
③  $l = ?$

$$r^2 + h^2 = l^2$$

$$4.5^2 + 18^2 = l^2$$

$$l = \sqrt{4.5^2 + 18^2}$$

$$l \approx 18.55 \text{ in}$$



② Lateral area for 1 hat

$$L = \pi r l \rightarrow L = \pi (4.5 \text{ in})(18.55 \text{ in})$$

$$L \approx 262 \text{ in}^2$$

③  $262 \text{ in}^2 \times 8 \text{ hats}$

$$\approx 2096 \text{ in}^2$$

④ Shelley will need about 2096 square inches of material to make 8 party hats.

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Closure

Explain the difference between the height of a cone and the slant height of a cone.

The height is the perpendicular/vertical distance from the base to its apex.

The slant height is the length of the side of the cone.

