

Activity 35

Surface Area of Pyramids and Cones

Surface Area of Pyramids

$$\text{Total surface area} = \frac{1}{2}Pl + B$$

$$\text{Lateral surface area} = \frac{1}{2}Pl$$

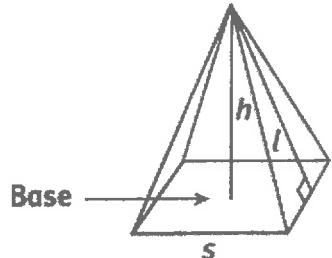
P = perimeter of the base

l = slant height

B = area of the base

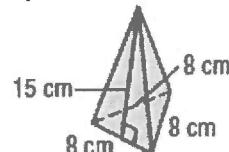
NOTE: Do not plug in the height of the pyramid, as represented by the variable h , into the surface area formula of a pyramid! Use the slant height, represented by l , which is the altitude of the lateral face.

Oftentimes, you will need to use the Pythagorean Theorem, a special right triangle or a trigonometric ratio to find the slant height.



Examples: Find the total surface area and the lateral area of each regular pyramid.

1)



$$LA = \frac{1}{2}Pl$$

$$LA = \frac{1}{2}(24)(15)$$

$$LA = 180 \text{ cm}^2$$

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

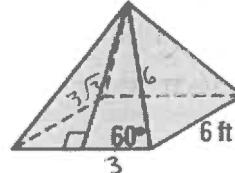
$$SA = \frac{1}{2}(24)(15) + (16\sqrt{3})$$

$$SA = 180 + 16\sqrt{3} \text{ cm}^2$$

$$B = \frac{s^2(\sqrt{3})}{4}$$

$$B = \frac{(8)^2(\sqrt{3})}{4} = \frac{64\sqrt{3}}{4} = 16\sqrt{3}$$

2)



$$LA = \frac{1}{2}Pl$$

$$LA = \frac{1}{2}(24)(3\sqrt{3})$$

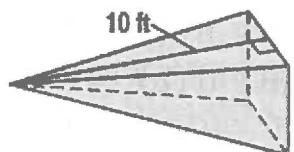
$$LA = 36\sqrt{3} \text{ ft}^2$$

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

$$SA = \frac{1}{2}(24)(3\sqrt{3}) + 36$$

$$SA = 36 + 36\sqrt{3} \text{ ft}^2$$

3)



$$LA = \frac{1}{2}Pl$$

$$LA = \frac{1}{2}(14)(10)$$

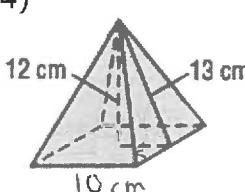
$$LA = 70 \text{ ft}^2$$

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

$$SA = \frac{1}{2}(14)(10) + 12.25$$

$$SA = 82.25 \text{ ft}^2$$

4)



$$LA = \frac{1}{2}Pl$$

$$LA = \frac{1}{2}(40)(13)$$

$$LA = 260 \text{ cm}^2$$

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

$$SA = \frac{1}{2}(40)(13) + 100$$

$$SA = 360 \text{ cm}^2$$

5, 12, 13

5) Find the lateral area of a right pyramid whose slant height is 18 mm and whose base is a square with area 121 mm².

$$LA = \frac{1}{2}Pl$$

$$LA = \frac{1}{2}(44)(18)$$

$$LA = 396 \text{ mm}^2$$

$$P = 4s$$

$$s = \sqrt{121} = 11 \text{ mm}$$

$$P = 4(11) = 44 \text{ mm}$$

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Surface Area of Pyramids and Cones

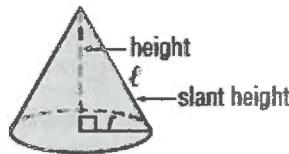
Surface Area of Cones

$$\text{Total surface area} = \pi r l + \pi r^2 \text{ or } \pi r(l+r)$$

$$\text{Lateral surface area} = \pi r l$$

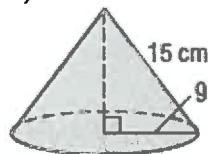
NOTE: As in pyramids, do not plug in h as the height of the cone when finding its surface area.

Again, you will often need to use the Pythagorean Theorem, a special right triangle or a trigonometric ratio to find its slant height.



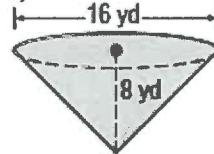
Examples: Find the total surface area and the lateral area of each right cone.

1)



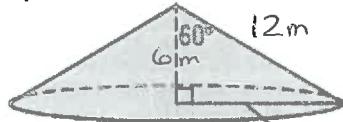
$$\begin{aligned} LA &= \pi r l \\ LA &= \pi(9)(15) \\ LA &= 135\pi \text{ cm}^2 \\ SA &= \pi r(l+r) \\ SA &= \pi(9)(15+9) \\ SA &= 216\pi \text{ cm}^2 \end{aligned}$$

2)



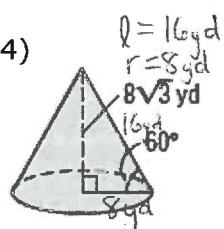
$$\begin{aligned} LA &= \pi r l \\ LA &= \pi(8)(8\sqrt{2}) \\ LA &= 64\sqrt{2}\pi \text{ yd}^2 \\ SA &= \pi r(l+r) \\ SA &= \pi(8)(8\sqrt{2} + 8) \\ SA &= (64 + 64\sqrt{2})\pi \text{ yd}^2 \end{aligned}$$

3)



$$\begin{aligned} LA &= \pi r l \\ LA &= \pi(6\sqrt{3})(12) \\ LA &= 72\sqrt{3}\pi \text{ m}^2 \\ SA &= \pi r(l+r) \\ SA &= \pi(6\sqrt{3})(12+6\sqrt{3}) \\ SA &= (108+72\sqrt{3})\pi \text{ m}^2 \end{aligned}$$

4)



$$\begin{aligned} l &= 16 \text{ yd} \\ r &= 8 \text{ yd} \\ 8\sqrt{3} &\text{ yd} \\ 16 &\text{ yd} \\ 60^\circ & \\ 8 &\text{ yd} \\ LA &= \pi r l \\ LA &= \pi(8)(16) \\ LA &= 128\pi \text{ yd}^2 \\ SA &= \pi r(l+r) \\ SA &= \pi(8)(16+8) \\ SA &= 192\pi \text{ yd}^2 \end{aligned}$$

5) Calculate the surface area of the cylindrical rocket and "nose cone" if the slant height of the nose cone is 8 feet.

$$\text{area of circle} + \text{lateral area of cylinder} + \text{lateral area of cone}$$

$$\pi(3)^2 + 2\pi(3)(20) + \pi(3)(8)$$

$$9\pi + 120\pi + 24\pi$$

$$A = 153\pi \text{ ft}^2$$

