

11.7 Surface area of pyramids and cones with work

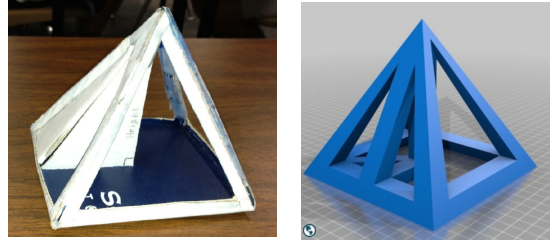
11.7 Surface Area of Pyramids and Cones



Are 15 ft and 12 ft the heights?

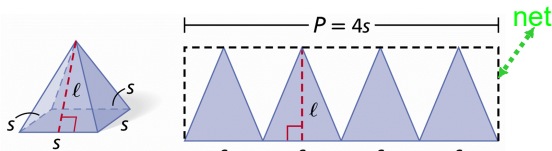
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Identifying the parts of a pyramid



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Based on the diagram below derive the formula for finding the lateral surface area and total surface area of a pyramid.



ℓ = slant height P = perimeter B = Area of base
The lateral faces of a regular pyramid can be arranged to cover half of a rectangle with a height equal to the slant height of the pyramid. The width of the rectangle is equal to the base perimeter of the pyramid.

$$\text{Lateral} = (1/2)P\ell$$

LA

$$\text{Total} = (1/2)P\ell + B$$

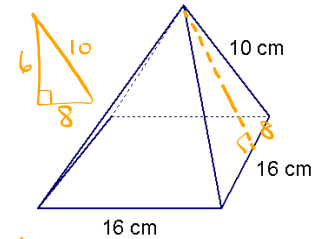
SA

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Example 1:

Find the surface area of the regular pyramid.

$$\begin{aligned} T &= LA + B \\ &= \frac{1}{2}P\ell + s^2 \\ &= \frac{1}{2}(64)(6) + (16)^2 \\ &= \boxed{448 \text{ cm}^2} \end{aligned}$$



$$(\frac{1}{2})(64)(6) + (16)^2 = 448$$

$$LA = 192 \text{ cm}^2$$

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Finding Surface Areas of Right Cones

Recall that a circular cone, or cone, has a circular base and a vertex that is not in the same plane as the base. The altitude, or height, is the perpendicular distance between the vertex and the base. In a right cone, the height meets the base at its center and the slant height is the distance between the vertex and a point on the base edge.

The lateral surface of a cone consists of all segments that connect the vertex with points on the base edge. When you cut along the slant height and lay the right cone flat, you get the net shown at the left. In the net, the circular base has an area of πr^2 and the lateral surface is a sector of a circle. You can find the area of this sector by using a proportion, as shown below.

$$\frac{\text{Area of sector}}{\text{Area of circle}} = \frac{\text{Arc length}}{\text{Circumference of circle}}$$

$$\frac{\text{Area of sector}}{\pi r^2} = \frac{2\pi r}{2\pi \ell}$$

$$\text{Area of sector} = \pi r^2 \cdot \frac{2\pi r}{2\pi \ell}$$

$$\text{Area of sector} = \pi r \ell$$

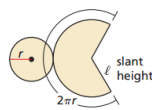
The surface area of a right cone is the sum of the base area and the lateral area, $\pi r \ell$.

Set up proportion.

Substitute.

Multiply each side by $\pi \ell$.

Simplify.



Core Concept

Surface Area of a Right Cone

The surface area S of a right cone is

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

where r is the radius of the base and ℓ is the slant height.



Example 2:

Find the surface area of the right cone.



$$\begin{aligned} SA &= \pi r^2 + \pi r \ell \\ &= \pi(5)^2 + \pi(5)(13) \\ &= \boxed{90\pi \text{ in}^2} \\ &\approx 282.743 \text{ in}^2 \end{aligned}$$

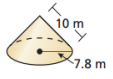
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Practice:

1. Find the surface area of the cone.



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

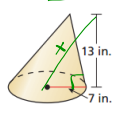
$$= \pi (7.8)(10) + \pi (7.8)^2$$

$$= 138.84\pi \text{ m}^2$$

$$\approx 436.179 \text{ m}^2$$

$7.8(10) + 7.8^2$
138.84
 138.84π
436.178724

2. Find the total area of the cone.



$$7^2 + 13^2 = x^2$$

$$49 + 169 = x^2$$

$$\sqrt{218} = x$$

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

$$= \pi (7)(\sqrt{218}) + \pi (7)^2$$

$$= 70\sqrt{218} + 49\pi \text{ in}^2$$

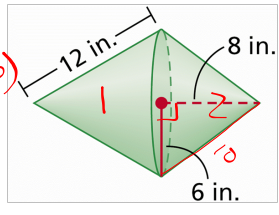
$$\approx 478.633 \text{ in}^2$$

$7\pi\sqrt{218} + 49\pi$
478.6334576

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Example 3:

Find the surface area of the composite figure.



$$T = \pi r l + \pi r l$$

$$= \pi (6)(12) + \pi (6)(8)$$

$$= 132\pi \text{ in}^2$$

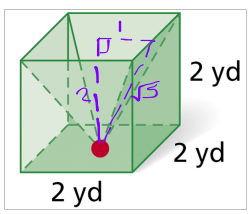
$$\approx 414.690 \text{ in}^2$$

$S = (\text{left cone lateral area}) + (\text{right cone lateral area})$
 $= 60\pi \text{ in}^2 + 72\pi \text{ in}^2 = 132\pi \text{ in}^2$

Mar 21-8:34 AM

Practice 3:

How much glass is needed to make the figure below? (There is no top)



$$T = 4sh + s^2 + \frac{1}{2}P\ell$$

$$= 4(2)(2) + (2)^2 + \frac{1}{2}(8)(5)$$

$$= 16 + 4 + 4\sqrt{5}$$

$$= 20 + 4\sqrt{5} \text{ yd}^2$$

$$\approx 28.944 \text{ yd}^2$$

Surface of Composite = Lateral Area of Cube + one base + Lateral Area of Pyramid

$$= 20 + 4\sqrt{5} \approx 28.9 \text{ yd}^2$$

Mar 21-8:37 AM

HW: pg. 643

A: 5, 11, 27 - 30

B: 1 - 11 (o), 27 - 30

C: 1 - 12, 27 - 30

ANSWERS:

28. about 380.13 cm²

30.23

Mar 9-8:09 AM

Attachments

deriving polygon formula.JPG