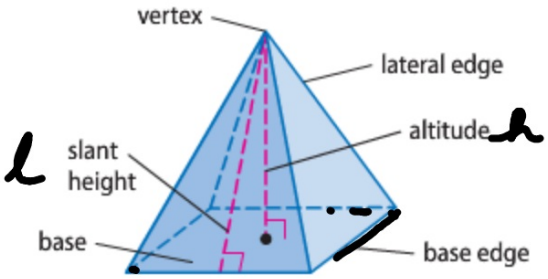
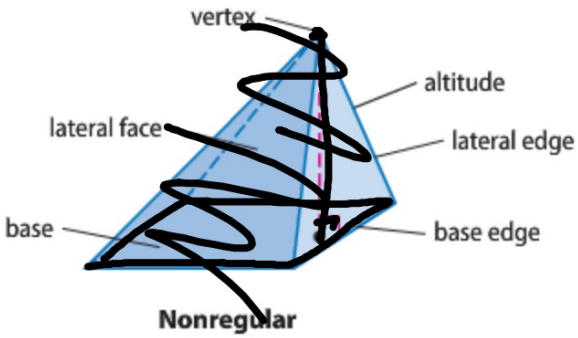
Geometry 12.3
Find lateral areas and surface areas of pyramids.
Find lateral areas and surface areas of cones.

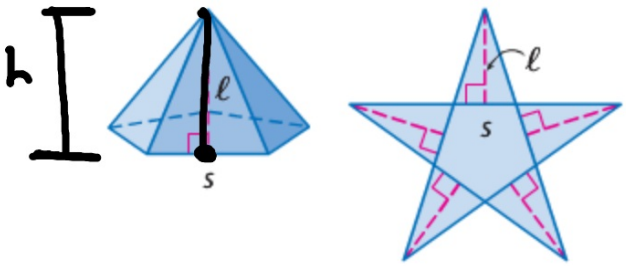
pyramid
apex/vertex
regular pyramid
base → polygon
face triangles
slant height ← a face
altitude base vertex ⊥
right cone
oblique cone



Regular Pyramid



Nonregular Pyramid



popcorn box

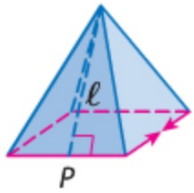
LA = p · h rect. faces

KeyConcept Lateral Area of a Regular Pyramid

Words The lateral area L of a regular pyramid is $L = \frac{1}{2}P\ell$, where ℓ is the slant height and P is the perimeter of the base.

Symbols $L = \frac{1}{2}P\ell$

Model

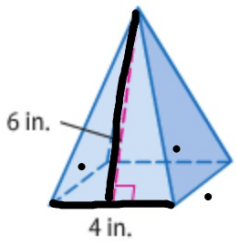


$LA = \frac{1}{2}Pl$ Δ faces

Prisms LA=pl....sides are rectangles
Pyramids LA=1/2pl...sides are triangles

Example 1 Lateral Area of a Regular Pyramid

Find the lateral area of the square pyramid.



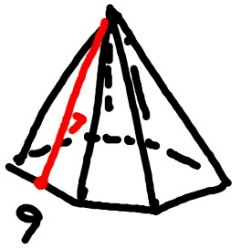
$LA = \frac{1}{2} p \cdot l$

$= \frac{1}{2} \cdot 16 \cdot 6$

$= 48 \text{ in}^2$

1. Find the lateral area of a regular hexagonal pyramid with a base edge of 9 centimeters and a lateral height of 7 centimeters.

ℓ



$LA = \frac{1}{2} p \cdot \ell$

$= \frac{1}{2} \cdot 54 \cdot 7$

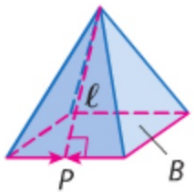
$= 189 \text{ cm}^2$

SA = LA + 1 B

KeyConcept Surface Area of a Regular Pyramid

Words The surface area S of a regular pyramid is $S = \frac{1}{2}P\ell + B$, where P is the perimeter of the base, ℓ is the slant height, and B is the area of the base.

Model

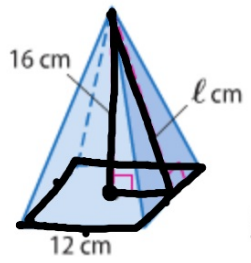


Symbols $S = \frac{1}{2}P\ell + B$

$= \frac{1}{2}P\ell + B$

Example 2 Surface Area of a Square Pyramid

Find the surface area of the square pyramid to the nearest tenth.



$16^2+6^2=\ell^2$

$292=\ell^2$

$\ell = 17.088$

$SA = LA + B$

$= \frac{1}{2} \cdot 48 \cdot 17.09 + 12 \cdot 12$

$= 410.16 + 144$

$= 554.2 \text{ cm}^2$

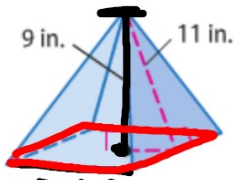
438.3 in²

$9^2 + x^2 = 11^2$

$x^2 = 40$

Guided Practice

2A.



12.65

6.32

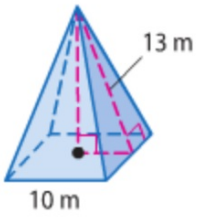
$SA = LA + B$

$= \frac{1}{2} \cdot 50.60 \cdot 11 +$

$= 278.28 + 160.02$

$=$

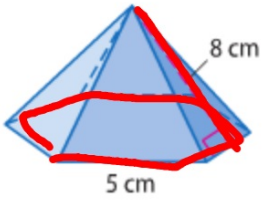
2B.



SohcahToa

Example 3 Surface Area of a Regular Pyramid

Find the surface area of the regular pyramid. Round to the nearest tenth.



apothem

$A = \frac{1}{2}ap$

$= \frac{1}{2} \cdot 4.33 \cdot 30$

$= 64.95$

$SA = \frac{1}{2}p \cdot l + B$

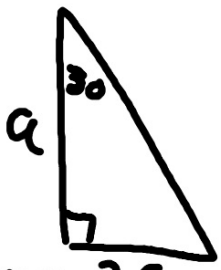
$= \frac{1}{2} \cdot 30 \cdot 8 +$

$= 120 + 64.95$

$= 184.95$ cm^2

~~cm^2~~

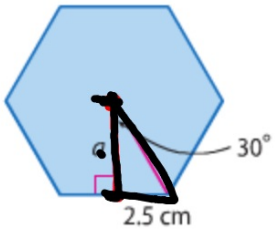
185.0



$\tan 30 = \frac{2.5}{a}$

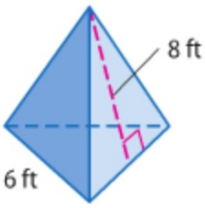
$a(0.577) = 2.5$

$a = 4.33$

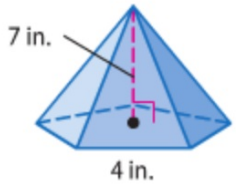


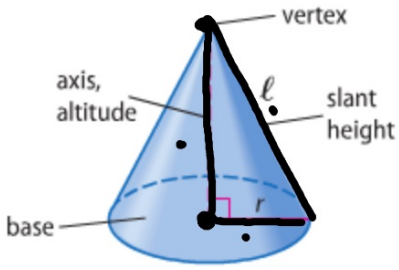
GuidedPractice

3A.

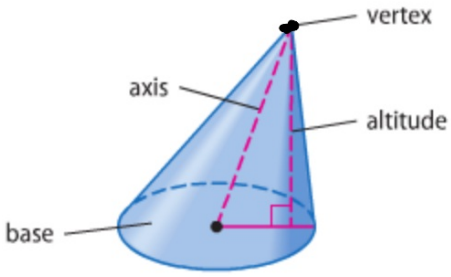


3B.





Right Cone



Oblique Cone

$LA = \frac{1}{2} p \ell$

$SA = \frac{1}{2} p \ell + 1B$

$A = \pi r^2$ $C = \pi d$

KeyConcept Lateral and Surface Area of a Cone

Words

The lateral area L of a right circular cone is

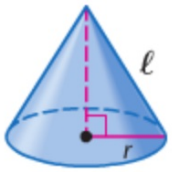
$LA = \frac{1}{2} p l$

The surface area S of a right circular cone is

$SA = \frac{1}{2} p l + 1B$

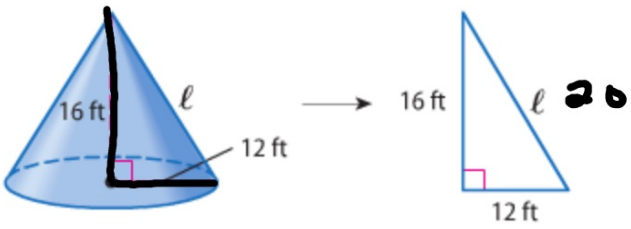
Symbols

Model



Real-World Example 4 Lateral Area of a Cone

ARCHITECTURE The conical slate roof at the right has a height of 16 feet and a radius of 12 feet. Find the lateral area.



$LA = \frac{1}{2} p \cdot \ell$

$= \frac{1}{2}\pi \cdot 24 \cdot 20$

$12^2 + 16^2 = \ell^2$

$400 = \ell^2$

$20 = \ell$

753.9822

754.0 ft^2

GuidedPractice

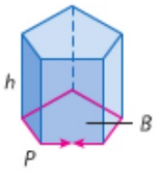
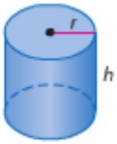
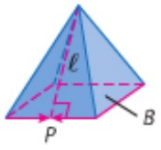
4. ICE CREAM A waffle cone is $5\frac{1}{2}$ inches tall and the diameter of the base is $2\frac{1}{2}$ inches. Find the lateral area of the cone. Round to the nearest tenth.

12.3 p. 854
7-21
55, 56, 57

WatchOut!

Bases The bases of right prisms and right pyramids are not always regular polygons.

ConceptSummary Lateral and Surface Areas of Solids

Solid	Model	Lateral Area	Surface Area
prism		$L = Ph$	$S = L + 2B$ or $S = Ph + 2B$
cylinder			
pyramid		$L = \frac{1}{2}P\ell$	$S = \frac{1}{2}P\ell + B$
cone