Surface Areas of Pyramids and Cones

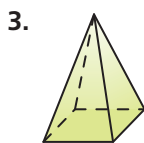## Vocabulary
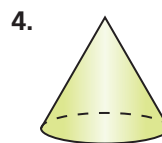
Review

Label each diagram *cone* or *pyramid*.

1.

2.

3.

4.
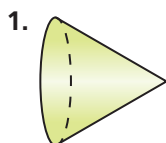
Vocabulary Builder

slant height (noun) **slant hyt**

slant height, ℓ

Related Words: regular pyramid, lateral face

Definition: The **slant height** ℓ of a regular pyramid is the length of the altitude of a lateral face of the pyramid. The **slant height** ℓ of a cone is the distance from the vertex of a cone to a point on the circumference of the base.

Math Usage: The **slant height** of a regular pyramid divides the lateral face into two congruent right triangles.

Use Your Vocabulary

5. Circle the figure that shows a three-dimensional figure with *slant height* 5 m.

5 m   5 m   5 m
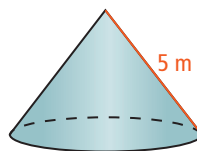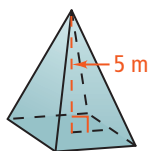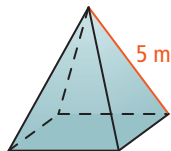
**6.** Is the *slant height* the same as the *height* of a pyramid or cone?   Yes / No

7. The *slant height* of the cone at the right is [ ] in.

2 in.   3 in.

Theorem 11-3   Lateral and Surface Areas of a Pyramid

The lateral area (L.A.) of a regular pyramid is half the product of the perimeter p of the base and the slant height ℓ of the pyramid.

The surface area (S.A.) of a regular pyramid is the sum of the lateral area and the area B of the base.
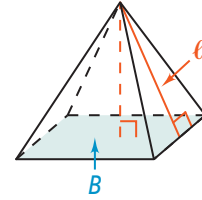
8. In a square pyramid with base side length s, $p = \boxed{}$.

9. If the base of a regular pyramid has a perimeter of $6q$ and its side length is 6, the pyramid has $\boxed{}$ sides.

Draw a line from each description in Column A to the corresponding formula in Column B.

Column A	Column B
10. lateral area (L.A.) of a pyramid	$\frac{1}{2}p\ell$
11. surface area (S.A.) of a pyramid	$\frac{1}{2}p\ell + B$

Problem 1 Finding the Surface Area of a Pyramid

Got It? A square pyramid has base edges of 5 m and a slant height of 3 m. What is the surface area of the pyramid?

12. Complete the problem-solving model below.

Know
The base is a square with side length $\boxed{}$ m.
Slant height ℓ is $\boxed{}$ m.

Need
Lateral area
Surface area

Plan
Find the perimeter $\boxed{}$ of the base.
Find the area $\boxed{}$ of the base.
Use p and ℓ to find $\boxed{}$
Use L.A. and B to find $\boxed{}$

13. Find p.

$$p = 4(s)$$
$$= 4(\boxed{})$$
$$= \boxed{}$$

14. Find B.

$$B = s^2$$
$$= \boxed{}^2$$
$$= \boxed{}$$

15. L.A. $= \frac{1}{2}p\ell$

$$= \frac{1}{2}(\boxed{})(\boxed{})$$
$$= \boxed{}$$

16. S.A. $=$ L.A. $+ B$

$$= \boxed{} + \boxed{}$$
$$= \boxed{}$$

17. The surface area of the pyramid is $\boxed{}$ m^2.

Lesson 11-3

Got It? What is the lateral area of the hexagonal pyramid at the right? Round to the nearest square foot.

42 ft
$18\sqrt{3}$ ft
36 ft

18. Circle the correct equation for the perimeter of the hexagonal base.

| $42 \cdot 36 = 1512$ | $6 \cdot 18 = 108$ | $\frac{1}{2}(36)(18\sqrt{3}) \approx 561$ | $6 \cdot 36 = 216$ |

19. The slant height ℓ of the pyramid is the hypotenuse of a right triangle. Label the legs of the right triangle at the right.

ℓ ___ ft
___ ft
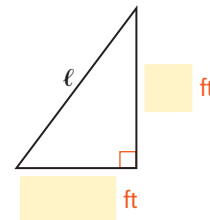
20. Use the Pythagorean Theorem to find the slant height ℓ of the pyramid.

$\ell = \sqrt{\boxed{}^2 + \boxed{}^2}$

$= \sqrt{\boxed{} + \boxed{}}$

$= \sqrt{\boxed{}}$

21. Use the formula L.A. $= \frac{1}{2}p\ell$ to find the lateral area of the pyramid.

L.A. $= \frac{1}{2}(\boxed{})(\boxed{}) \approx \boxed{}$

22. The lateral area of the hexagonal pyramid is about $\boxed{}$ ft².
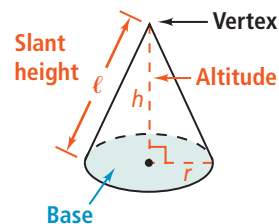
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take note

Theorem 11-4   Lateral and Surface Areas of a Cone

The lateral area of a right cone is half the product of the circumference of the base and the slant height of the cone.

L.A. $= \frac{1}{2} \cdot 2\pi r \cdot \ell$, or L.A. $= \pi r \ell$

The surface area of a cone is the sum of the lateral area and the area of the base.

23. S.A. $=$ L.A. $+ \boxed{}$

Vertex
Slant height ℓ
Altitude
h
r
Base

Got It? The radius of the base of a cone is 16 m. Its slant height is 28 m. What is the surface area in terms of π?

24. Use the justifications at the right to find the surface area.

S.A. $=$ L.A. $+ B$ Use the formula for surface area.

$= \boxed{} + \boxed{}$ Substitute the formulas for L.A. and B.

$= \pi(\boxed{})(\boxed{}) + \pi(\boxed{})^2$ Substitute for r and for ℓ.

$= \pi(\boxed{}) + \pi(\boxed{})$ Simplify.

$= \pi(\boxed{})$ Add.

25. The surface area of the cone in terms of π is $\boxed{}$ m².

Got It? What is the lateral area of a traffic cone with radius 10 in. and height 28 in.? Round to the nearest whole number.
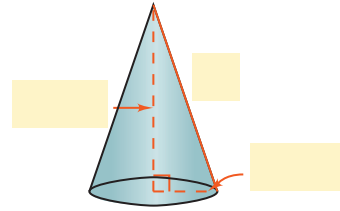
26. Let ℓ be the slant height of the cone. Label the missing dimensions on the cone at the right.

27. Use the Pythagorean Theorem to find ℓ.

$$\ell = \sqrt{\boxed{}^2 + \boxed{}^2}$$

$$= \sqrt{\boxed{} + \boxed{}}$$

$$= \sqrt{\boxed{}}$$

28. Use the formula for lateral area of a cone.

$$\text{L.A.} = \pi(\boxed{})(\boxed{})$$

$$= \pi(\boxed{})(\boxed{})$$

$$\approx \boxed{}$$

29. To the nearest square inch, the lateral area of the traffic cone is $\boxed{}$ in.^{2}.

Lesson Check • Do you UNDERSTAND?

Compare and Contrast How are the formulas for the surface area of a prism and the surface area of a pyramid alike? How are they different?

30. Use the descriptions in the list at the right. Write the letter for each description under the correct polyhedron.

Prism	**Pyramid**

A. Base is a polygon.

B. Faces are rectangles.

C. Faces are triangles.

D. S.A. = L.A. + B

E. S.A. = L.A. + 2B

F. Uses height

G. Uses perimeter

H. Uses slant height

31. How are the formulas alike? How are they different?

Math Success

Check off the vocabulary words that you understand.

☐ pyramid ☐ slant height ☐ lateral area ☐ surface area ☐ cone

Rate how well you can *find the surface area of pyramids and cones*.

Need to review 0 2 4 6 8 10 Now I get it!

Lesson 11-3