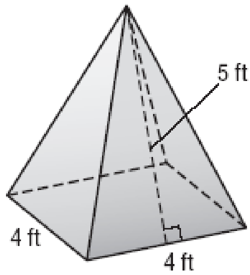
The triangular sides of a pyramid are called **lateral faces**. The altitude or height of each lateral face is called the **slant height**. The surface area of a pyramid is the sum of the areas of the lateral faces, or **lateral area**, plus the area of the base.

EXAMPLE 1 **Find the surface area of the square pyramid.**



SOLUTION
(Erase to reveal)

Find the lateral area and the base area.

Area of each lateral face

$A = \frac{1}{2}bh$	Area of a triangle
$A = \frac{1}{2}(4)(5)$	$b = 4$, $h = 5$
$A = 10$	Simplify.

$\frac{bh}{2} = \frac{(4)(5)}{2}$

$= 10\ ft^2$

Area of base

$A = s^2$	Area of a square
$A = 4^2$ or 16	$s = 4$

The surface area
40 + 16 or 56 squ

$S^2 = (4)(4)$

$= 16\ ft^2$

Total Surface Area

$= 4(10) + 16$

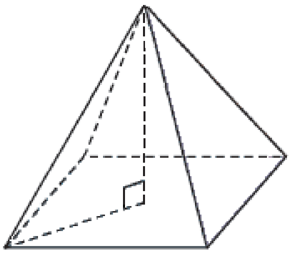
$= 56\ ft^2$

A **right pyramid** is a 3-dimensional object that has triangular faces and a base that is a polygon. ?

The shape of the base determines the name of the pyramid. ?

The triangular faces meet at a point called the **apex.** ?

The *height* of the pyramid is the perpendicular distance from the apex to the centre of the base. ?

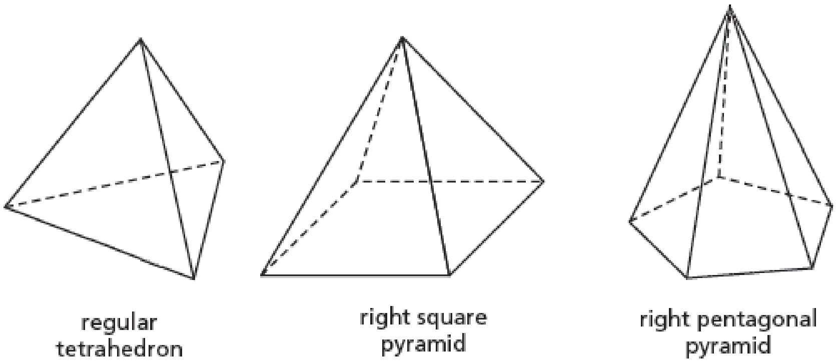


A = A base + A of triangular lateral faces

1.4 Surface Areas of Right Pyramids and Right Cones

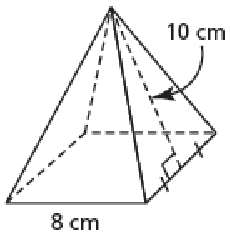
When the base of a right pyramid is a regular polygon, the triangular faces are congruent. Then the **slant height** of the right pyramid is the height of a triangular face.

?



The surface area of a right pyramid is the sum of the areas of the triangular faces and the base.

This right square pyramid has a slant height of 10 cm and a base side length of 8 cm.



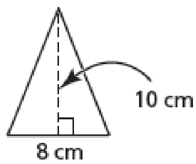
?

?

The area, A, of each triangular face is:

$$A = \frac{1}{2}(8)(10)$$

$$A = 40$$

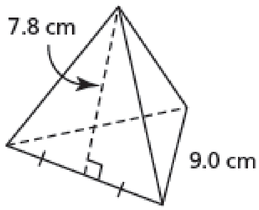


?

?

Example 1 Determining the Surface Area of a Regular Tetrahedron Given Its Slant Height

Jeanne-Marie measured then recorded the lengths of the edges and slant height of this regular tetrahedron. What is its surface area to the nearest square centimetre?



SOLUTION

(Erase to reveal)

The surface area of the tetrahedron is approximately 140 cm^2.

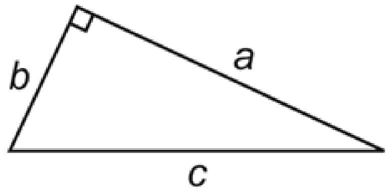
$$A = 4\left(\frac{1}{2}bh\right)$$
$$= 4\left(\frac{1}{2}\right)(9)(7.8)$$
$$= 140.4$$

CHECK YOUR UNDERSTANDING

Activate Prior Learning:

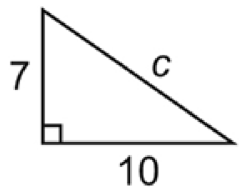
The Pythagorean Theorem

In any right triangle, the sum of the squares of the two shorter sides is equal to the square of the longer side.



$a^2 + b^2 = c^2$

What is the unknown length in this right triangle?



$c^2 = a^2 + b^2$

$= 10^2 + 7^2$

$= 100 + 49$

$c = \sqrt{149}$

$= 12.2$

Example 2 Determining the Surface Area of a Right Rectangular Pyramid

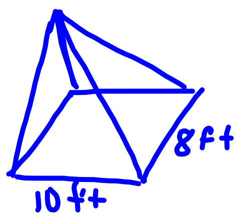
A right rectangular pyramid has base dimensions 8 ft. by 10 ft., and a height of 16 ft. Calculate the surface area of the pyramid to the nearest square foot.

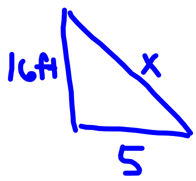
SOLUTION

(Erase to reveal)

The surface area of the pyramid is approximately 379 square feet.

Front / Back





$x^2 = 16^2 + 5^2$
$= 256 + 25$
$= 281$
$x = \sqrt{281}$
$= 16.76$

$l^2 = 4^2 + 16^2$
$= 16 + 256$
$= 272$
$= 16.49$

$A = \frac{1}{2} bh \times 2$
$= \frac{1}{2}(10)(16.49) \times 2$
$= 164.9$

Side Δ's
$A = \frac{bh}{2} \times 2$
$= 8(16.96)$
$= 135.68$

CHECK YOUR UNDERSTANDING

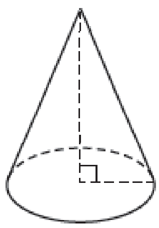
Bottom $A = 10(8)$
$= 80$

Total Area $= 135.68 + 164.90 + 80$
$= 380.58 \text{ ft}^2$

A *right circular cone* is a 3-dimensional object that has a circular base and a curved surface. ?

The *height* of the cone is the perpendicular distance from the apex to the base. ?

The *slant height* of the cone is the shortest distance on the curved surface between the apex and a point on the circumference of the base. ?



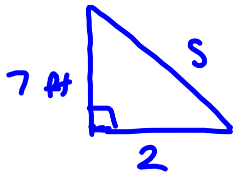
$$A = \pi r^2 + \pi r s$$

Example 3 Determining the Surface Area of a Right Cone

A right cone has a base radius of 2 ft. and a height of 7 ft.
Calculate the surface area of this cone to the nearest square foot.

SOLUTION The surface area of the cone is approximately 58 square feet.

(Erase to reveal)



$$s^2 = 7^2 + 2^2$$
$$= 49 + 4$$
$$= 53$$
$$s = \sqrt{53}$$
$$= 7.3$$

$$A = \pi r^2 + \pi r s$$
$$= \pi(2)^2 + \pi(2)(7.3)$$
$$= 58.4 \text{ ft}^2$$

CHECK YOUR UNDERSTANDING

1.4 Surface Areas of Right Pyramids and Right Cones

Homework...

Worksheet - Surface Area of Pyramids and Cones.pdf

Solutions...

1) 113.1 in^2	2) 40 m^2	3) 188.5 mm^2	4) 63.3 yd^2
5) 84 ft^2	6) 263.9 cm^2	7) 208 m^2	8) 301.6 in^2
9) 123.7 ft^2	10) 263.2 mm^2	11) 95.7 cm^2	12) 210 yd^2
13) 74.4 cm^2	14) 152 yd^2	15) 857.7 in^2	

Attachments

Worksheet - Surface Area of Prisms and Cylinders.pdf

Worksheet - Surface Area of Pyramids and Cones.pdf