Chapter 11: Things To Know

Section 11.1 Solids and Cross Sections
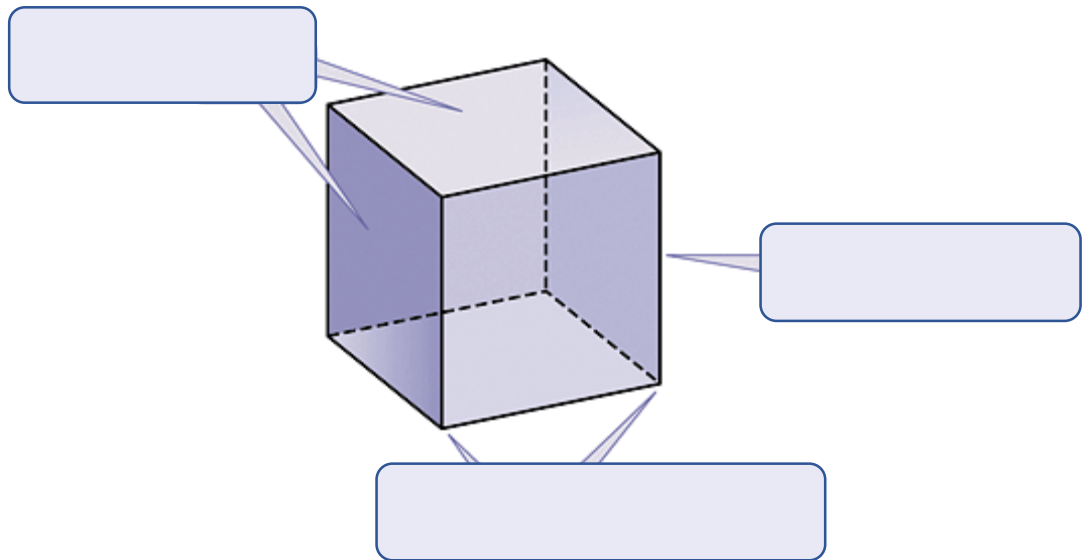
| Objectives	Vocabulary
1. Recognize Polyhedra and Their Parts. 2. Visualize Cross Sections of Solids. 3. Visualize Solids Formed by Revolving a Region About a Line.	• polyhedron • face • edge • vertex • polyhedra • net • cross section • topographic map • contour map

A _____ is a solid, or three-dimensional figure, whose surface is made up of polygons..

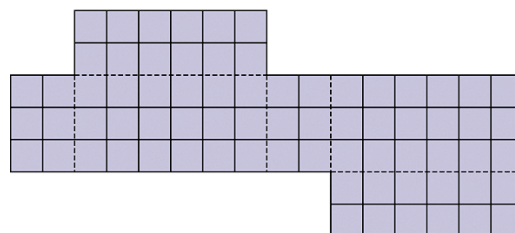**Label the diagram:**

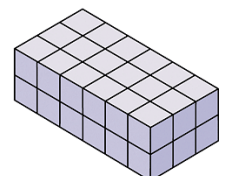**Example** Identifying Vertices, Edges, and Faces
How many vertices, edges, and faces are in the polyhedron at the right? List them.
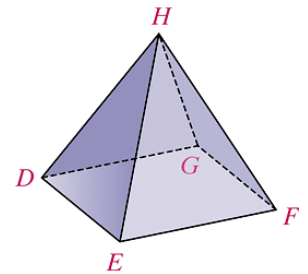
A _____ is a pattern that we can cut and fold to make a solid.

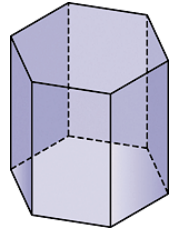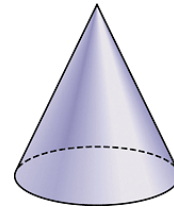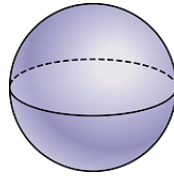
This net folds to become this solid.
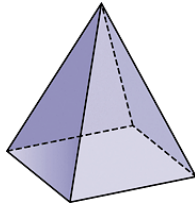
Euler's Formula
The following formula about faces (F), vertices (V) and edges (E) is true for all polyhedra.
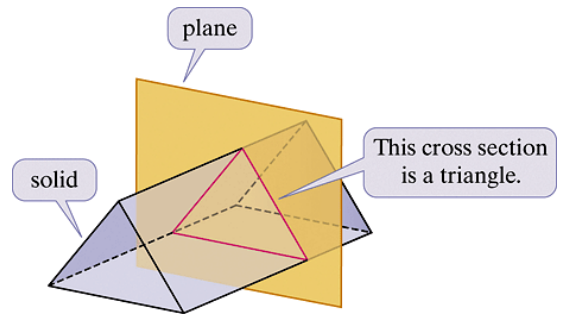
Example Using Euler's Formula
How many vertices, edges, and faces does the polyhedron at the right have? Use your results to verify Euler's Formula.

**Example** Which of the three solids shown are polyhedra?

A _____
is the intersection of a solid and a plane. We can think of this as a very thin slice of the solid.

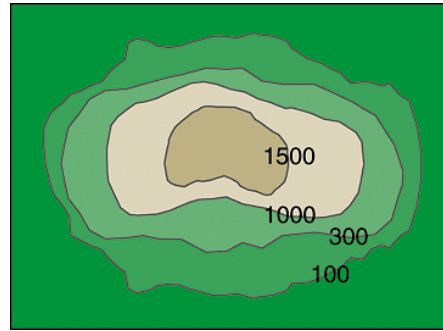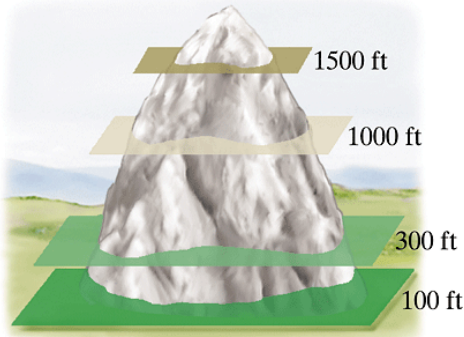plane

solid

This cross section is a triangle.

Example Describing a Cross Section
What is the cross section formed by the plane and solid shown? (Assume that each plane is perpendicular or parallel to the circular bases of the solid.)

a.

b.
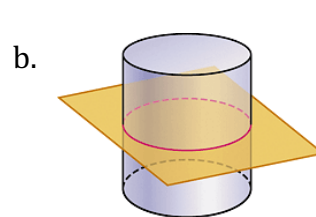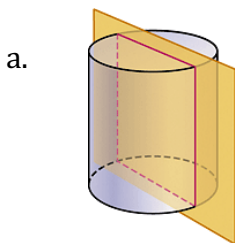
Cross Section

A _____ or _____
shows elevation contour lines, in addition to detailed physical characteristics of the landscape.

Example Reading a Contour Map

Use the given contour map to answer the question.

a. Which hill is greater in elevation?
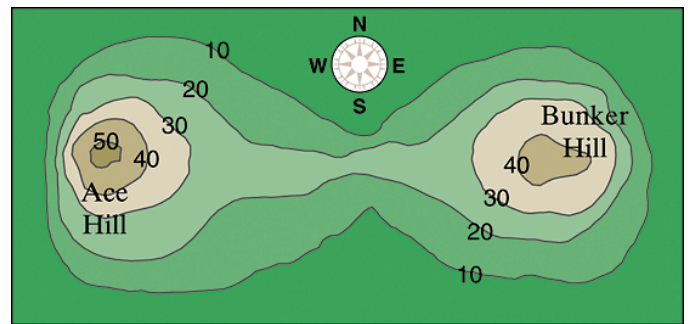
Elevation in meters.

b. Which side of Ace hill—north, south, east, or west—is steepest?

Rotating a Solid
We are interested in visualizing the end result of revolving a plane region about a line ℓ.

For example, what is the end result of rotating a rectangular region about line ℓ?
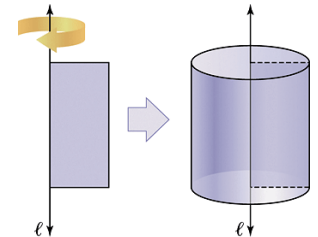
Example Visualizing Solids of Revolution
Describe the solid of revolution obtained by rotating the given plane region about the line ℓ.

Section 11.2 Surface Area of Prisms and Cylinders

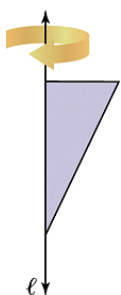| Objectives	Vocabulary
1. Find the Surface Area of a Prism. 2. Find the Surface Area of a Cylinder.	• surface area • prism (base, lateral face, altitude, height, lateral area) • right prism • oblique prism • cylinder (base, altitude, height, lateral area, surface area) • right cylinder • oblique cylinder

The _____ of a solid is just what the phrase says—it is the area of the surface of the solid. Thus, one way to find this surface area is to find the sum of the areas of the rectangles.

Surface Area =
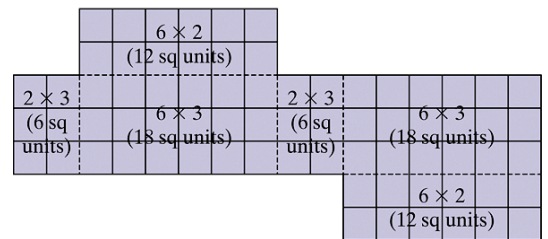
A _____ is a polyhedron with two

congruent, parallel faces, called _____.

The other faces are _____.
You can name a prism using the shape of its bases.
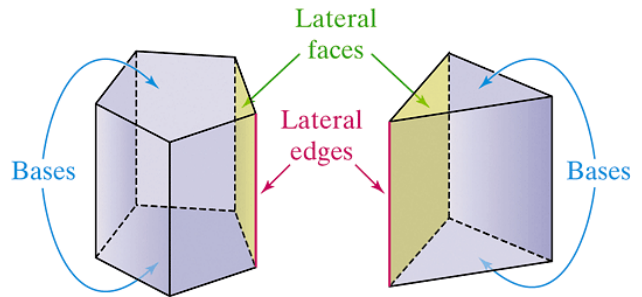
An _____ of a prism is a perpendicular segment that joins the planes of the

bases. The _____ h of a prism is the length of an altitude. A prism may either be

right or oblique.
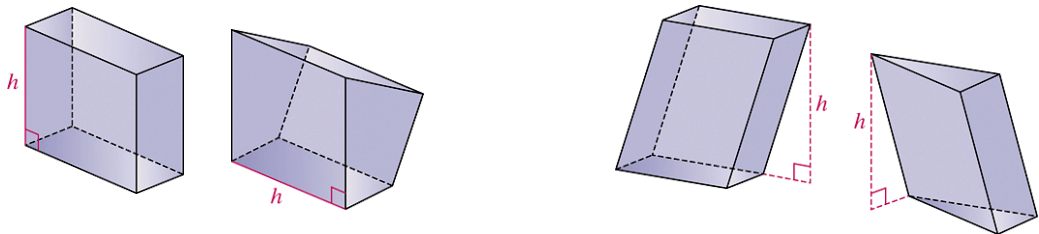
In a _____, the lateral faces are rectangles and a lateral edge is an altitude.

In an _____, some or all of the lateral faces are nonrectangular.

The _____ of a prism is the sum of the areas of the lateral faces.

The _____ is the sum of the lateral area and the area of the two bases.

Example Using a Net to Find the Surface Area of a Prism
What is the surface area of the prism at the right? Use a net.

5 cm

4 cm   3 cm

Theorem Surface Area of a Prism
The surface area SA of a right prism is

$$SA =$$

where *B* is _____ ,

P is _____ ,

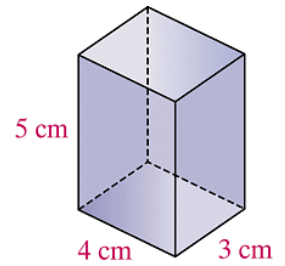and *h* is _____ .

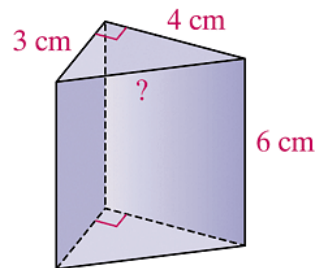**Example** Using Formulas to Find Surface Area of a Prism
Find the surface area of the prism by answering parts **a-d.**
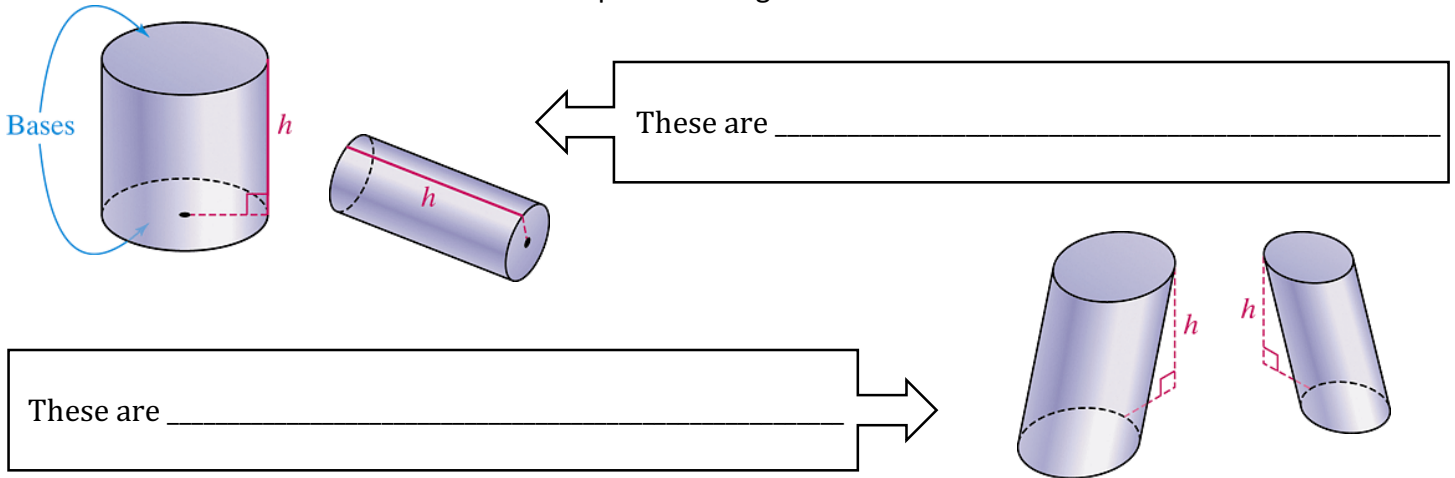
3 cm   4 cm
?
6 cm

a. What is the perimeter of a base?

b. What is the lateral area of the prism?

c. What is the area of a base in simplest radical form?

d. What is the surface area of the prism rounded to a whole number?

Bases h

These are _____

These are _____

A _____ is a solid that has two congruent parallel _____ that are circles.

An _____ of a cylinder is a perpendicular segment that joins the planes of the bases.

The _____ h of a cylinder is the length of an altitude.

To find the area of the curved surface of a cylinder, visualize "unrolling" it.

The circumference of a base is $2\pi r$.

$2\pi r$

h

B

The area B of a base is πr^2.
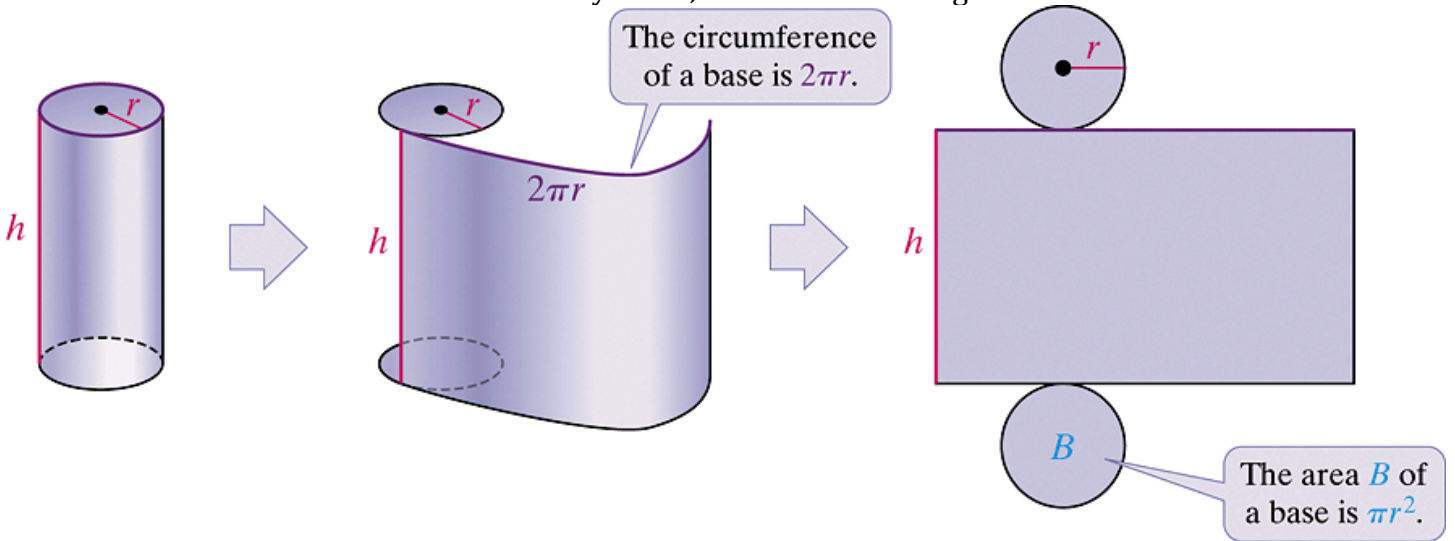
Theorem Surface Area of a Cylinder
The surface area of a right cylinder is

$SA =$

or $SA =$

where B is _____ ,

        r is _____ ,

and h is _____ .

Example Finding Surface Area of a Cylinder
Multiple Choice The radius of the base of a cylinder is 4 in. and its height is 6 in. What is the surface area of the cylinder in terms of π?

   a. 32π sq in.   b. 42π sq in.   c. 80π sq in.   d. 120π sq in.

Example Finding Surface Area Without One Base
Standing 82 ft tall with a radius of approximately 11 feet, the "AquaDom" is located in the Radisson Hotel in Berlin, Germany, and is titled the "World's Largest Cylindrical Fish Tank." Find the surface area of this tank without the area of the top base. Find the exact surface area and use $\pi \approx 3.14$ to approximate the surface area.

Section 11.3 Surface Areas of Pyramids and Cones

Objectives	Vocabulary
1. Find the Surface Area of a Pyramid. 2. Find the Surface Area of a Cone.	• pyramid (base, lateral face, vertex, altitude, height, slant height, lateral area, surface area) • regular pyramid • cone (base, altitude, vertex, height, slant height, lateral area, surface area) • right cone

A _____ is a polyhedron in which one face

(the _____) can be any polygon and the other faces (the

_____) are triangles that meet at a

common vertex (called the _____).
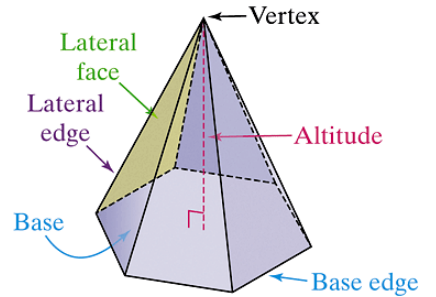
The _____ of a pyramid is the perpendicular segment from the vertex to the plane

of the base. The length of the altitude is h, the _____ of the pyramid.
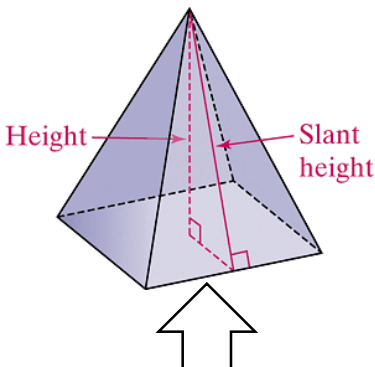
A _____ pyramid is a pyramid whose base is a regular

polygon and whose lateral faces are congruent isosceles triangles.

The _____ is the length of the

altitude of a lateral face of the pyramid.

Note the difference between **height** and **slant height**.

Just as with prisms and cylinders, the _____

of a pyramid is the sum of the areas of the lateral faces.

We can find a formula for the lateral area of a pyramid by looking at its net.

$LA =$

This, together with the area of the base, gives us a formula for the surface area
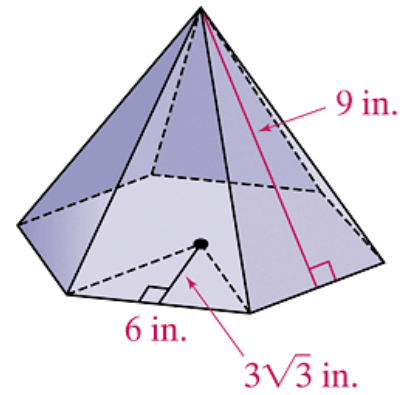of the pyramid.

Theorem Surface Area of a Pyramid

$SA =$

where B is _____ , P is _____ ,

and ℓ is _____ .

Example Finding the Surface Area of a Pyramid

What is the surface area of the hexagonal pyramid?

9 in.

6 in.

$3\sqrt{3}$ in.

Example Finding the Slant Height

The Great Pyramid in Egypt is surrounded by a complex of buildings among which are smaller pyramids including the Pyramid of Menkaure. Use the dimensions to find the surface area of this pyramid.
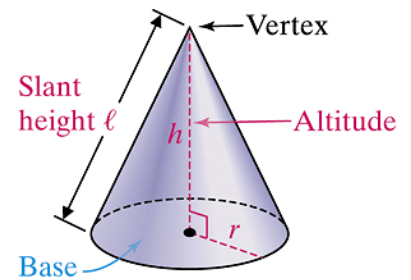
C

68.8 m

B

110 m

A
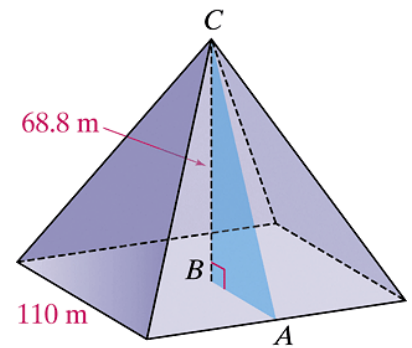
A _____ is a solid that has one base and a vertex that is not in the same plane as the base.

The base of a cone is a _____.

In a _____ cone, the altitude is a perpendicular segment from the vertex to the center of

the base.

The _____ is the length of the altitude.

The _____ is the distance from the

vertex to a point on the edge of the base.

← Vertex

Slant
height ℓ ← Altitude
                 h

                    r

Base

Theorem Surface Area of a Cone
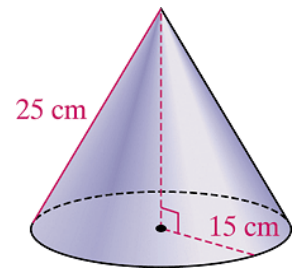
The surface area of a cone is
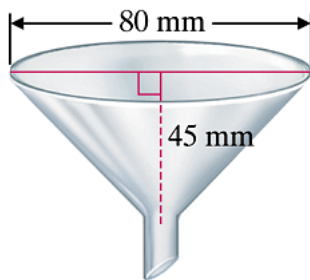
$$SA =$$

where B is the _____ , r is the _____ ,

and ℓ is _____.

Example Finding the Surface Area of a Cone
What is the surface area of the cone in terms of π?

25 cm

15 cm

Example Finding the Lateral Area of a Cone
In a chemistry lab experiment, we use the conical filter tunnel shown at the left. How much filter paper do we need to line the funnel?

80 mm

45 mm

Section 11.4 Volumes of Prisms and Cylinders and Cavalieri's Principle

Objectives	Vocabulary
1. Find the Volume of a Prism. 2. Find the Volume of a Cylinder. 3. Find the Volume of Composite Solids.	• volume • composite solid

_____ is the space that a figure occupies.

It is measured in **cubic** units such as: _____
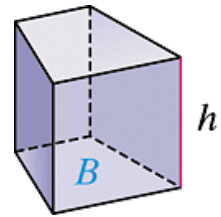_____

Theorem Cavalieri's Principle

If…

Then…

Theorem Volume of a Prism
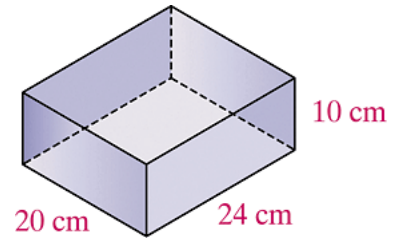The volume of a prism is

$$V =$$
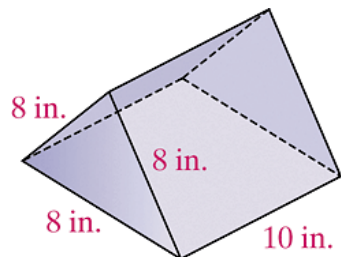
h

B

where B is the _____, and h is the _____.

Example Finding the Volume of a Rectangular Prism
What is the volume of the rectangular prism a the right?

10 cm

20 cm   24 cm

Example Finding the Volume of a Triangular Prism
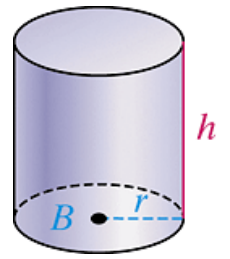**Multiple Choice** What is the approximate volume of the triangular prism?

a. 188 cu in.   b. 277 cu in.   c. 295 cu in.   d. 554 cu in.

8 in.

8 in.

8 in.

10 in.

Theorem Volume of a Cylinder
The volume of a cylinder is
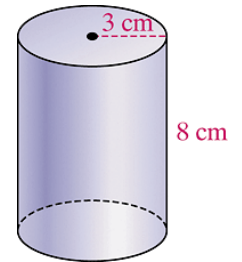
$V =$

where B is the _____ (so we know $B =$_____), and

h is the _____.

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Example Finding the Volume of a Cylinder
What is the volume of the cylinder in terms of π?

A _____ is a three-dimensional figure that is the combination
of two or more simpler figures. We can find the volume of a composite solid by adding the volumes of the
figures that are combined.

Example Finding the Volume of a Composite Solid
What is the approximate volume of the bullnose aquarium to the nearest cubic inch?
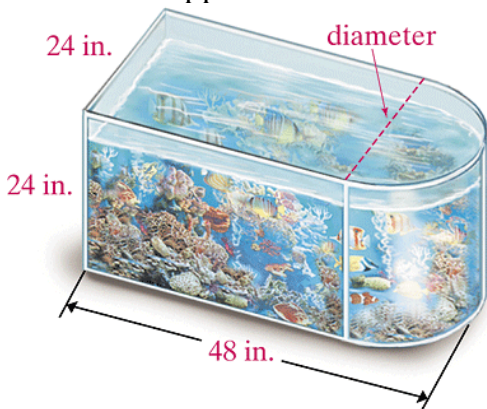
Section 11.5 Volumes of Pyramids and Cones

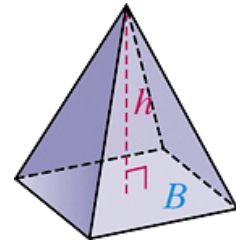| Objectives	Vocabulary
1. Find the Volume of a Pyramid. 2. Find the Volume of a Cone.	• No new vocabulary

Theorem Volume of a Pyramid
The volume of a pyramid is

$V =$

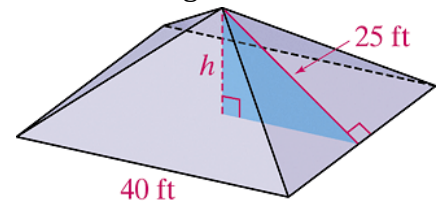where B is the _____, and h is the _____.

Example Finding Volume of a Pyramid
The entrance to the Louvre Museum in Paris, France, is a pyramid with a square base and a height of 21.64 m. What is the approximate volume of the Louvre Pyramid?

35.4 m
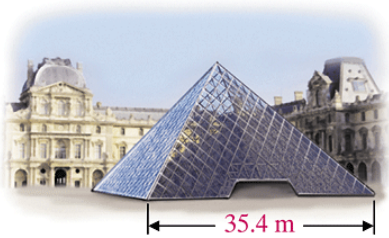
Example Finding Volume of a Pyramid
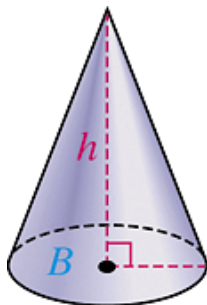What is the volume in cubic feet of a square pyramid with base edges 40 ft and slant height 25 ft?

25 ft

h

40 ft

Theorem Volume of a Cone
The volume of a cone is
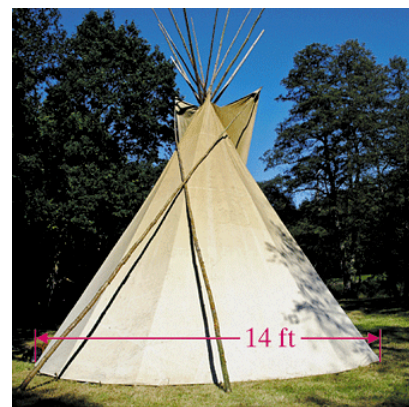
$V =$

h

where B is the _____ (so we know $B =$_____),

B

and h is the _____.

Example Finding the Volume of a Cone
The covering on a tepee rests on poles that come together like concurrent lines. The resulting structure approximates a cone. If the tepee pictured is 12 ft high with a base diameter of 14 ft, what is its approximate volume?

14 ft

Example Finding the Volume of an Oblique Cone
What is the volume of the oblique cone below at the left? Give your answer in terms of π and also rounded to the nearest cubic foot.

25 ft
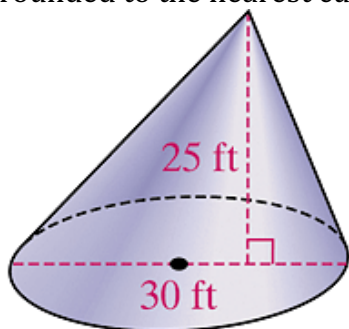
30 ft

$d = 30$ ft or $r = 15$ ft

Section 11.6 Surface Area and Volumes of Spheres

| Objectives	Vocabulary
1. Find the Surface Area and Volume of a Sphere.	• sphere • center of a sphere • radius of a sphere • diameter of a sphere • circumference of a sphere • great circle • hemisphere

A _____ is the set of all points in space equidistant from

a given point, called the _____.

A _____ is a segment that has one endpoint at the center and

the other endpoint on the sphere.

A _____ is a segment passing through the center with endpoints on the

sphere.
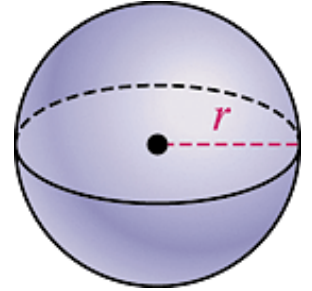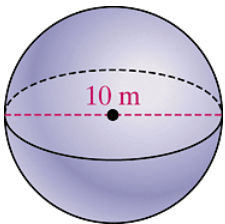

Theorem Surface Area of a Sphere
The surface area of a sphere is

    $SA =$

where r is the _____.

Example Finding the Surface Area of a Sphere
What is the surface area of the sphere in terms of π?

10 m

Example Finding Surface Area from Circumference
Earth's equator is about 24,902 mi long. What is the approximate surface area of Earth? Round to the nearest thousand square miles.
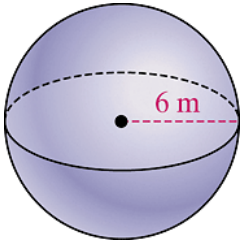
Theorem Volume of a Sphere
The volume of a sphere is

$V =$

where r is the _____.

Example Finding the Volume of a Sphere
What is the volume of the sphere in terms of π?

Example Using Volume to Find Surface Area
The volume of a sphere is 5000 cubic m. What is its surface area to the nearest square meter?