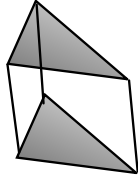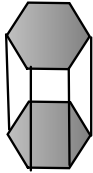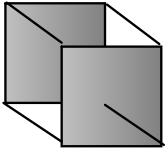What shapes do you see?

Do they have anything
in common?

Properties of 3D Shapes

Polyhedron

- A polyhedron is a solid that is bounded by polygons called faces, that enclose a single region of space.
- An edge of a polyhedron is a line segment formed by the intersection of two faces.
- A vertex of a polyhedron is a point where three or more edges meet.

Edge

Face

bases are
parallel

Vertex
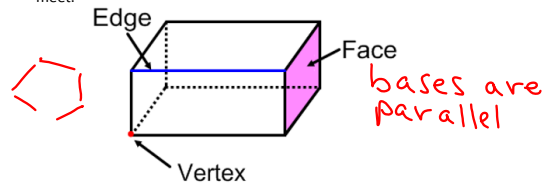
Surface Area

- The surface area of a polyhedron is the sum of the areas of its faces.
- The lateral area is the sum of the lateral faces (all faces that
- are not bases)

Prisms

- A prism is a polyhedron with two congruent faces, called bases that are parallel to each other. *side*
- The other faces, called (lateral) faces, are parallelograms formed by connecting the corresponding vertices of the bases.
- The segments connecting the vertices are called lateral edges.
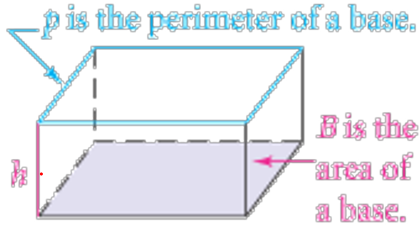- Prisms are classified by the shape of their bases.

base

lateral
face
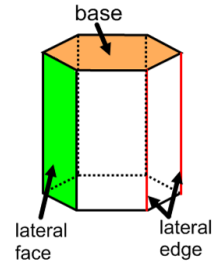
lateral
edge

Classify the prism:

a)

b)

c)

d)

e)
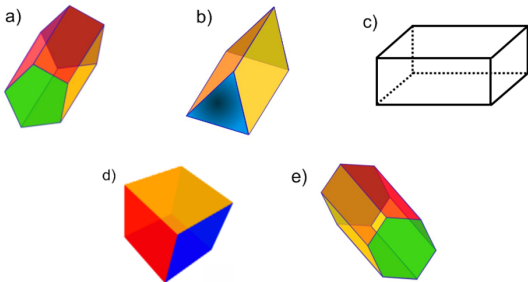
Surface Area of a Right Prism

$$SA = 2\underline{B} + Ph$$

Perimeter of the Base
Base
height

B= area of the base (parallel sides)
P = Perimeter of the Base
h = height

$$SA = 2\ell w + 2hw + 2h\ell$$

Lateral Area of a Prisim

p is the perimeter of a base.

h

B is the area of a base.

L.A. (prism) = *ph*

Example

$SA = 2B + \boxed{P \cdot h}$

$2(3 \cdot 5) + (5+3+5+3)$

$30 + 16 \cdot 2$

$30 + \underline{32} = 62 \, m^2$

$SA = 2(3 \cdot 5) + 2(5 \cdot 2) + 2(3 \cdot 2)$

$\quad 30 + 20 + 12 = 62 \, m^2$

$LA = P \cdot h$
$= (5+3+5+3)2$
$32 \, m^2$

2 m = h

5 m = w

3 m = l

Example

What shape is the polyhedron?

What is the lateral area?

What is the surface area?

2

6
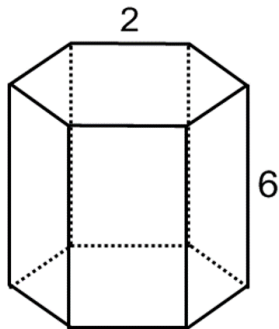
A **cylinder** is a solid with congruent circular bases that are parallel to each other.
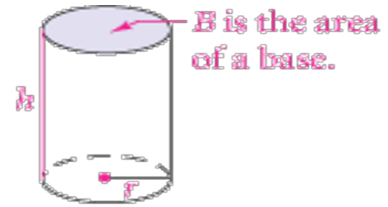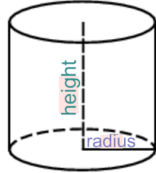
Net:

circular base
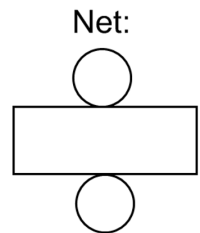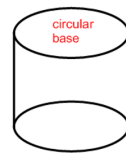
Surface Area of a Right Cylinder

$$\text{LA}$$

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

$$+ \text{ P} \cdot \text{h} \quad 2 \text{ B}$$
$$\text{c} \cdot \text{h}$$

h = height
r = radius of circle

B is the area of a base.

L.A. (cylinder) $= 2\pi rh$ or πdh

Example

What is the lateral area of the cylinder?
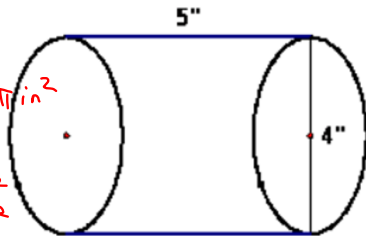
What is the surface are

5"

4"

$$L = d \cdot \pi \cdot h$$
$$4 \cdot \pi \cdot 5 = 20\pi \, \text{in}^2$$

$$SA = LA + 2B$$
$$2 \cdot \pi \cdot r^2$$
$$28\pi \, \text{in}^2 = 20\pi + \frac{2 \cdot \pi \cdot 2^2}{}$$

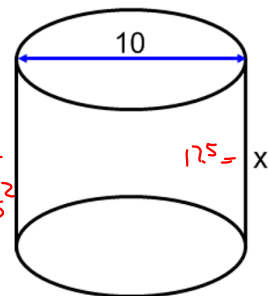## Example

SA = 225π

Solve for x

$$SA = 2\pi rh + 2\pi r^2$$
$$225\pi = 2\pi 5 \cdot h + 2\pi \cdot 5^2$$
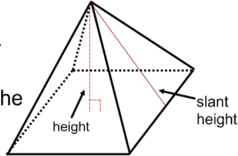$$225 = 10h + 50$$
$$175 = 10h$$
$$17.5 = h$$

10

$$17.5 = x$$

Pyramids

A **pyramid** is a polyhedron in which the base is polygon and the lateral faces are triangles with a common vertex, called the vertex of the pyramid.

A **regular pyramid** has a regular base. The **height** is the perpendicular distance between the vertex and the base.
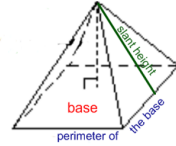
The **slant height** is the height of a lateral face.

height

slant height

Surface Area of a Regular Pyramid
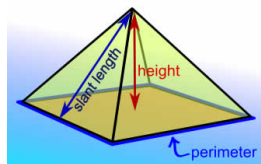
L.A.

$$SA = B + \frac{1}{2} Pl$$

slant height

base

perimeter of the base

B = area of the base
P = Perimeter of the Base
l = slant height

Lateral Area of Pyramid

$$LA = \frac{1}{2} Pl$$

ℓ

slant length

height

perimeter

A **cone** has a circular base and a vertex that is not in the same plane.

Net:

circular base
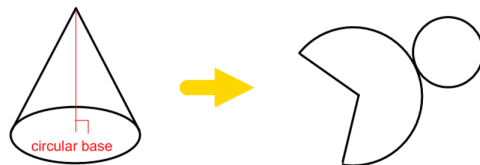
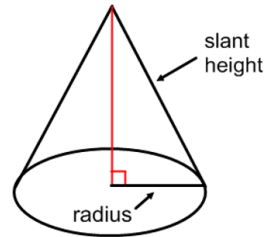Surface Area of a Right Cone

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

$\overset{LA}{}$
$\overset{}{P \cdot l} \quad \overset{B}{}$
$c \cdot l + B$

l = slant height
r = radius of circle

slant height

radius
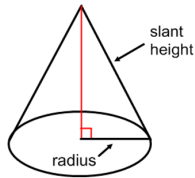
Lateral Area of a Cone

$$L = \pi r l$$

slant height

radius

Example

Find the lateral and surface area:

10
6
12
12

$$SA = B + \frac{P \cdot l}{2}$$
$$= 384 \text{ un}^2$$
$$LA = 240 \text{ un}^2$$

8   8.602
3

$$LA = \pi \cdot r \cdot l$$
$$\pi \cdot 3 \cdot 8.602 \approx 25.806\pi$$
$$\pi \cdot r^2 = 9\pi$$
$$SA = 25.806\pi + 9\pi$$
$$\approx 34.806\pi \text{ un}$$

Find the surface and lateral area
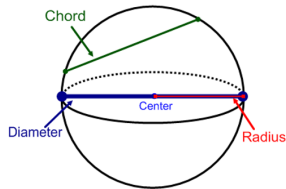
$$LA = 15\pi \text{ un}^2$$
$$SA = 24\pi \text{ un}^2$$
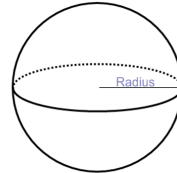$$SA = \pi r l + \pi r^2$$
$$15\pi + 9\pi$$

5
3

Spheres

- A sphere is the set of all points in space equidistant from a given point. This point is called the center of the sphere.
- A radius is a segment from the center to a point on the sphere.
- A chord is a segment whose endpoints are on the sphere.
- A diameter is a chord that contains the center.

Chord

Center

Diameter

Radius
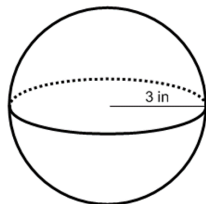
Surface Area of a Sphere

$$SA = 4\pi r^2$$

Radius

r = radius of sphere

Example

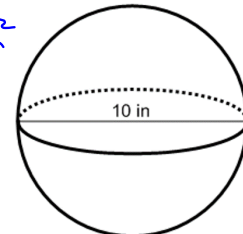What is the surface area of the sphere?

$36\pi \, in^2$

$4(\pi)(3)^2$

3 in

Example

What is the surface area of the sphere?

$4\pi \, 5^2 = 100\pi \, in^2$

10 in

hemisphere

LA

$\frac{1}{2}(4\pi r^2) = 2\pi r^2 + +\pi r^2 = 3\pi r^2$

SA

$3\pi(3)^2 = 27\pi \, cm^2$