GEOMETRY   11

Name: _____Key_____   Date:_____   Period:_____

SECTION 11.6 THREE-DIMENSIONAL SHAPES

VOCABULARY

DEFINITION	EXAMPLE
Volume: the "inside" of a polyhedron (3 dimensional figure) - measured by number of unit cubes to fill it	
Prism: a polyhedron with two parallel & congruent faces. Prisms are named by their bases	triangular prism rectangular prism
Face: polygons which make up a polyhedron	
Edge: borders of faces, line segments joining vertices	
Vertices: (singular: vertex) vertices of polygons are the vertices of a polyhedron	
Base (of a prism or pyramid): → side opposite the apex ↳ parallel & congruent sides	
Height (of a prism or pyramid): perpendicular length from a base to the other base or the apex	
Lateral Surface: non-base polygon area	
Pyramid: 3 dimensional figure with a polygonal base and a point not in its plane	apex

Big Idea: How do we find volumes of prisms and pyramids?

PRISMS

EXAMPLE 1

Identify the 5 prisms below. Determine the number of vertices, faces, and edges for each.
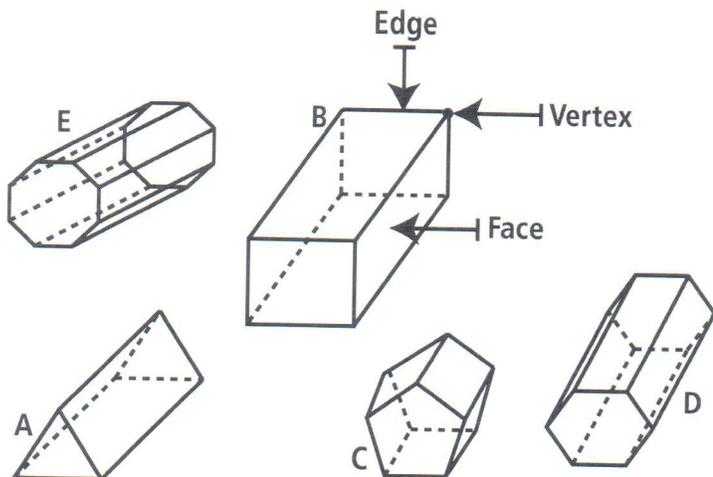
	Prism Name	# of Faces	# of Vertices	# of Edges
A	triangular prism	5	6	9
B	rectangular prism	6	8	12
C	pentagonal prism	7	10	15
D	hexagonal prism	8	12	18
E	octagonal prism	10	16	24

EXPLORATION 1

How many inch cubes (also called cubic inches) are there in a cube that is 2 inches long on each side? How many cubic inches are there in a cube that is 3 inches long on each side?
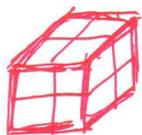
8 cubic inches
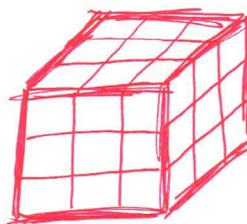
27 cubic inches

FORMULA: The volume of a cube is ___ $V = s^3$ ___

EXPLORATION 2

How many cubic inches are there in one cubic foot?

12 inches in 1 ft

$12^3 = 12 \cdot 12 \cdot 12 = \boxed{1728}$ cubic inches in 1 cubic foot

How many cubic feet are in a cubic yard?

3 feet in 1 yard

$3^3 = 3 \cdot 3 \cdot 3 = \boxed{27}$ cubic feet in 1 cubic yard

Make a rectangular prism with edges that are 2, 3 and 4 units long. Find its volume.
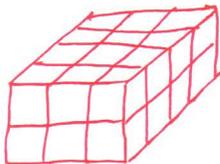
24 cubic units

FORMULA: The Volume of a Rectangular Prism is $\underline{V = Bh \ \text{or} \ V = lwh}$

where B is the area of the base.

EXAMPLE 3

Using the triangular prism below, which has a height of 7 units, a triangle base of 4 units and a height of 5 units, determine the volume of the prism.

$\frac{1}{2} \cdot 4 \cdot 5 = 10$

$10 \cdot 7 =$

$\boxed{70 \text{ cubic units}}$

= base of prism

"height of triangle

5 units

7 units = height of prism

4 units = base of triangle
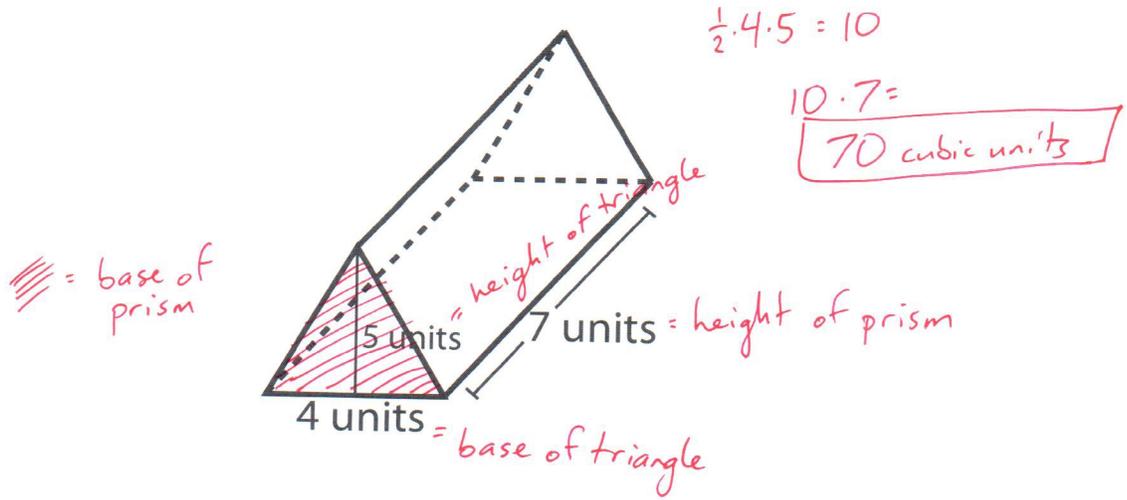
FORMULA: The volume of a triangular prism is $\underline{V = Bh}$

PROBLEM 2

Calculate the volume of the following prisms.

a.

8 cm
9 cm
3 cm

$V = Bh = \left(\frac{1}{2} \cdot 3 \cdot 8\right) 9$

$= 12 \cdot 9$

$= \boxed{108 \text{ cm}^3}$

b.

6 m
6 m
6 m

$V = S^3 = 6^3$

$= \boxed{216 \text{ m}^3}$

c.

2 in
4 in
8 in

$V = 2 \cdot 4 \cdot 8$

$= \boxed{64 \text{ in}^3}$

d.

1.5 ft
6 ft
7 ft

$V = 1.5 \cdot 6 \cdot 7$

$= \boxed{63 \text{ ft}^3}$
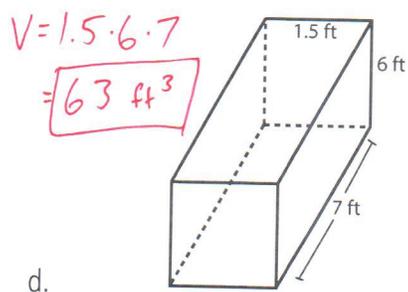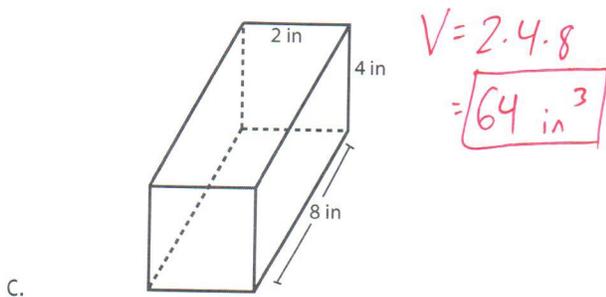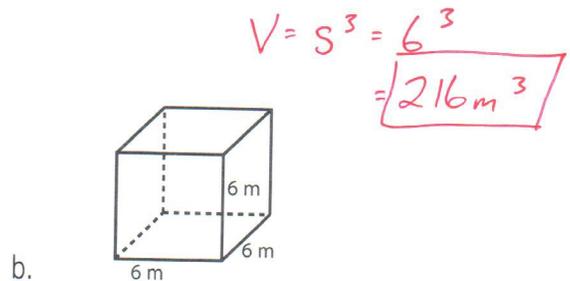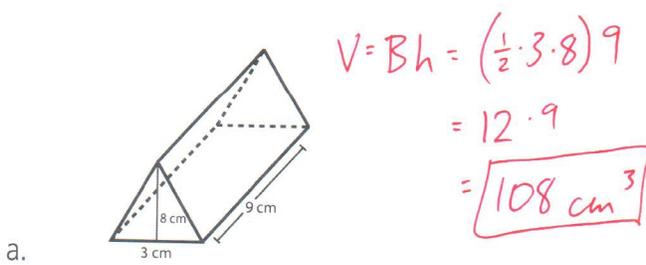
CYLINDER

EXAMPLE 4

Determine the volume of the cylinder below.

10 in.

7 in.
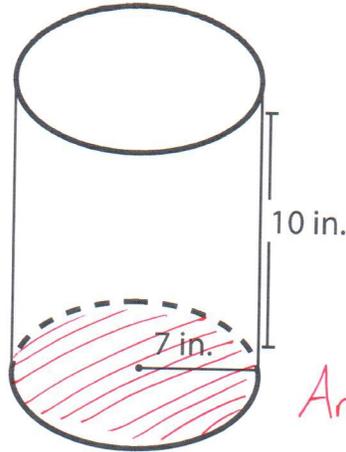
Area of Base = $\pi\, 7^2 = 49\pi\,in^2$

FORMULA: The volume of a cylinder is $\underline{V = Bh = \pi r^2 h}$

PYRAMIDS

EXAMPLE 5

Identify the 3 pyramids below. Determine the number of vertices, faces, and edges for each.

A. apex
face
base

B. apex
face
base

C. edge apex
face
base
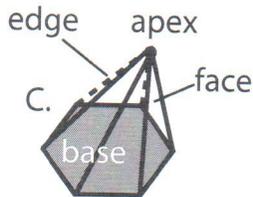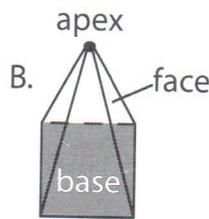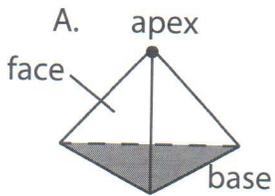
	Pyramid Name	# of Faces	# of Vertices	# of Edges
A	triangular pyramid	4	4	6
B	rectangular pyramid	5	5	8
C	hexagonal pyramid	7	7	12

PROBLEM 3

Calculate the volume of a triangular pyramid, in which the triangular base has area 10 square units and the height with 7 units.

$$V = \frac{1}{3} Bh$$

$$V = \frac{1}{3}(10)(7)$$

$$V = \boxed{\frac{70}{3} \text{ units}^3} = 23\frac{1}{3} \text{ units}^3 = 23.\overline{3} \text{ units}^3$$

SUMMARY (What I learned today)