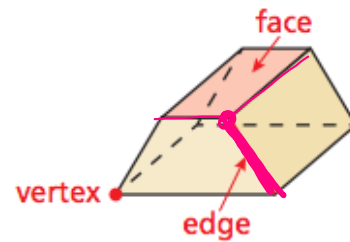# 11.4 Three Dimensional Figures

Essential Question
What is the relationship between the numbers of vertices V, edges E, and faces F of a polyhedron?
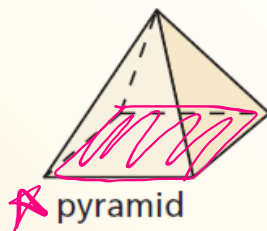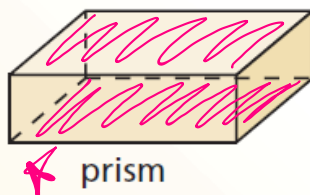
Classifying Solids

A three-dimensional figure, or solid, is bounded by flat or curved surfaces that enclose a single region of space. A **polyhedron** is a solid that is bounded by polygons, called **faces**. 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. The plural of polyhedron is *polyhedra* or *polyhedrons*.
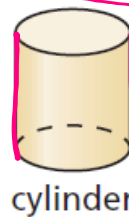
face

vertex

edge

Core Concept

Types of Solids

Polyhedra

prism

pyramid

Not Polyhedra

slant height

cylinder

cone

sphere

Mar 7-7:12 AM

1

To name a prism or a pyramid, use the shape of the *base*. The two bases of a prism are congruent polygons in parallel planes. For example, the bases of a pentagonal prism are pentagons. The base of pyramid is a polygon. For example, the base of a triangular pyramid is a triangle.
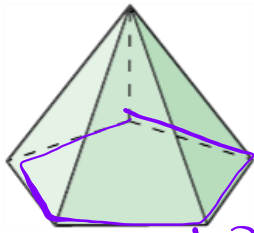
Pentagonal prism

Bases are pentagons.
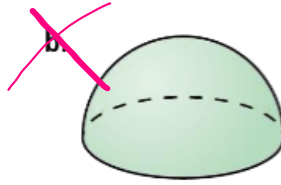
Triangular pyramid

Base is a triangle.
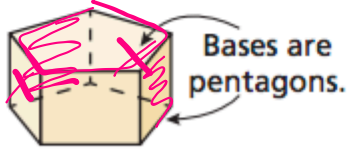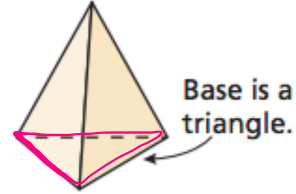
Example 1:

Tell whether each solid is a polyhedron.
If it is, name the polyhedron.

a.

Pentagonal Pyramid

b.

c.

hexagonal Prism
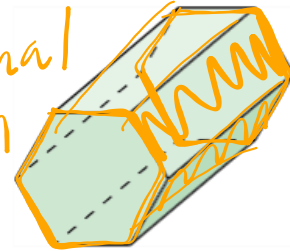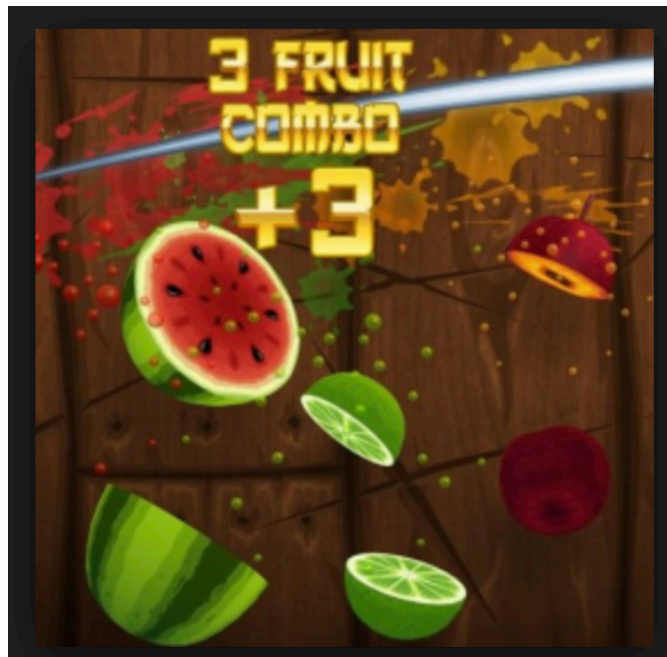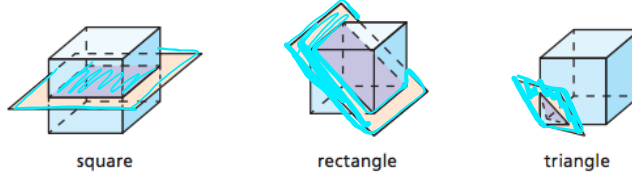
May 1-2:37 PM

Fruit Ninja - - - - - - → cross sections
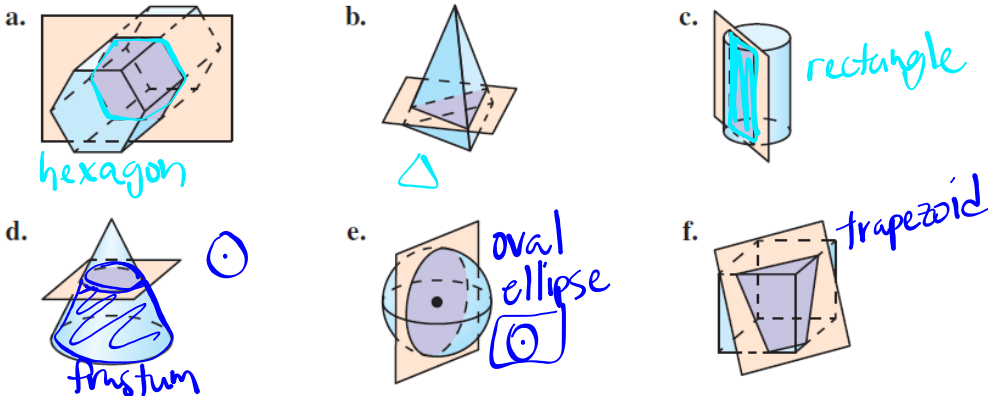
3 FRUIT COMBO +3

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Describing Cross Sections

Imagine a plane slicing through a solid. The intersection of the plane and the solid is called a **cross section**. For example, three different cross sections of a cube are shown below.

square   rectangle   triangle

Example 2:

Describe the shape formed by the intersection of the plane and the solid.

a.

hexagon

b.

△

c.

rectangle

d.

⊙

frustum

e.

oval
ellipse
⟨⊙⟩

f.

trapezoid

May 1-2:42 PM

Sketching and Describing Solids of Revolution

A **solid of revolution** is a three-dimensional figure that is formed by rotating a two-dimensional shape around an axis. The line around which the shape is rotated is called the **axis of revolution**.

For example, when you rotate a rectangle around a line that contains one of its sides, the solid of revolution that is produced is a cylinder.

1   2   3   cylinder

Example 3:

Sketch the solid produced by rotating the figure around the given axis. Then identify and describe the solid.

a.

6
4

△ cone!

Base 8
height 6

b.
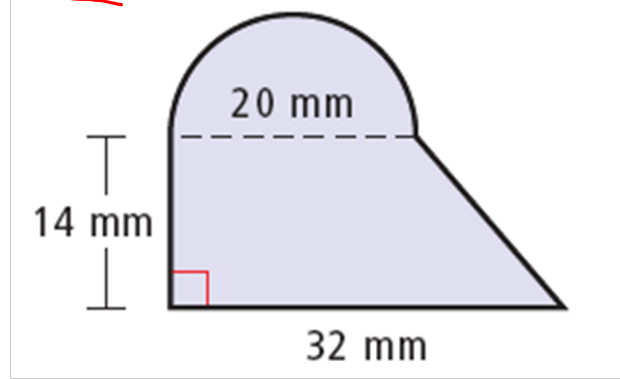
⊙

5
5

sphere
radius
5u
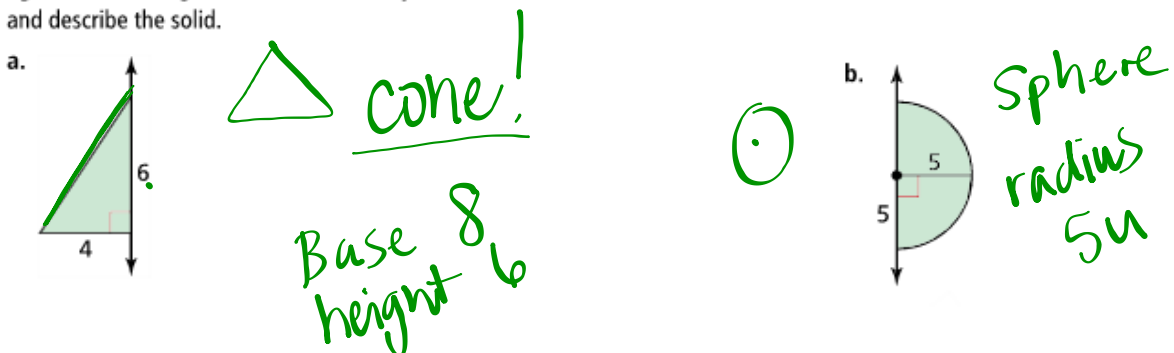
Example 3

Composite Shapes

Find the area of each shape and then add or subtract the parts. Break it down in the way you see first. It may be different than your neighbor.

Example 4: Find the shaded area.
Give exact answers AND approximations.

$$\frac{1}{2}(\pi r^2) + \frac{1}{2}h(b_1 + b_2)$$

$$\frac{1}{2}(\pi(10)^2) + \frac{1}{2}(14)(20 + 32)$$

$$\boxed{50\pi + 364 \text{ mm}^2}$$

$$\approx \boxed{521.080 \text{ mm}^2}$$

20 mm

14 mm

32 mm
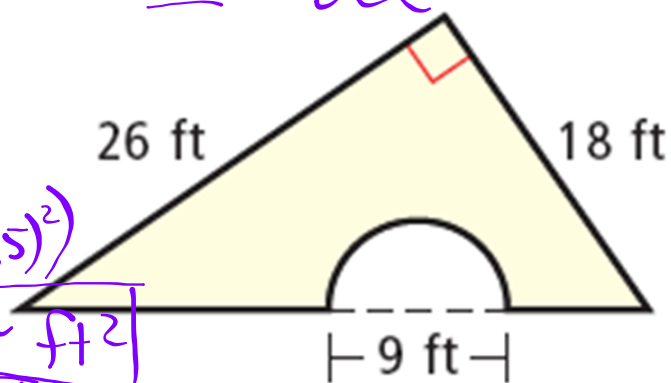
Answer: $50\pi + 280 + 84 = 364\pi$ mm² ≈ 521.1 mm²

Feb 15-1:40 PM

Practice: Find the shaded area.
Give exact answers AND approximations.

$$\frac{1}{2}bh - \frac{1}{2}(\pi r^2)$$

$$\frac{1}{2}(18)(26) - \frac{1}{2}(\pi(4.5)^2)$$

$$= \boxed{234 - 10.125\pi \text{ ft}^2}$$

$$\boxed{\approx 202.191 \text{ ft}^2}$$

26 ft

18 ft

9 ft

Feb 15-1:40 PM

HW: pg. 621

A: 19, 25, 27, 33, 35, 37 - 39

B: 1, 5, 9, 13, 17, 19, 25, 27, 37 - 39

C: 1 - 25 (o), 37 - 39

ANSWERS:

38. yes; SAS ≅ Thm

Mar 7-8:41 AM