7.6 Surface Areas of Pyramids

Learning Target: Represent pyramids using nets and use nets to find surface areas of pyramids.

Success Criteria:
- I can draw nets to represent pyramids.
- I can use nets to find surface areas of pyramids.
- I can apply surface areas of pyramids to solve real-life problems.

EXPLORATION 1

Using a Net to Construct a Solid

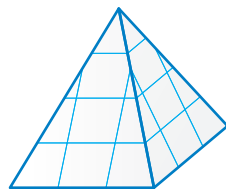**Work with a partner. Copy the net shown below onto grid paper.**
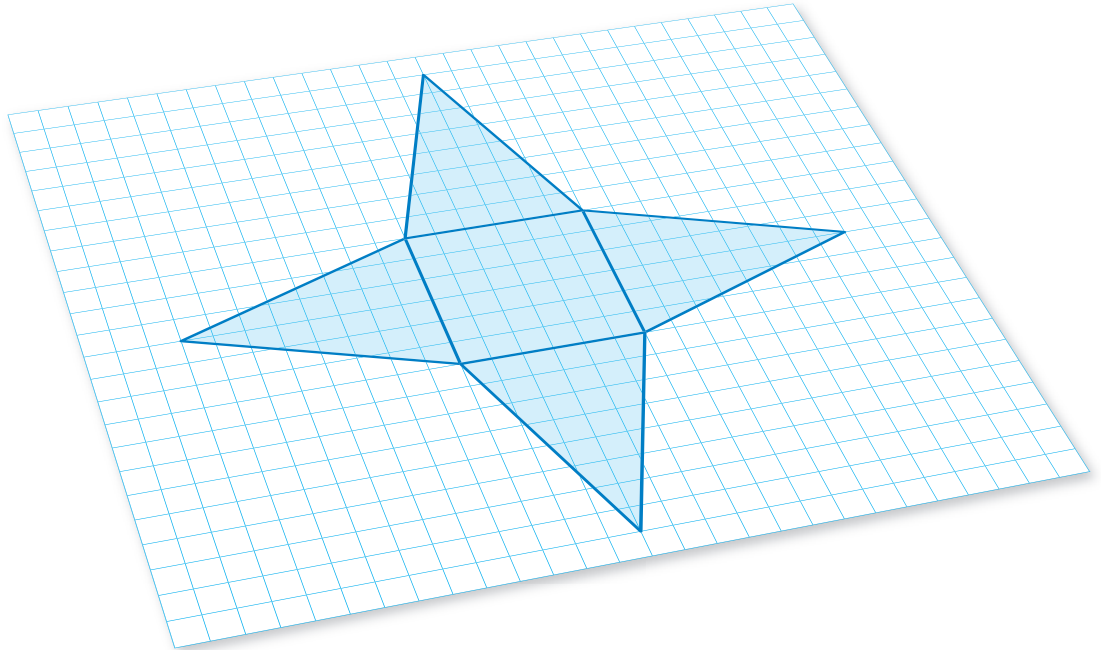
a. Cut out and fold the net to form a solid. What type of solid does the net form?

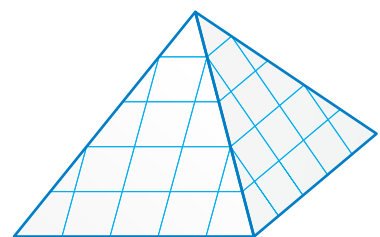**b.** What is the surface area of the solid?

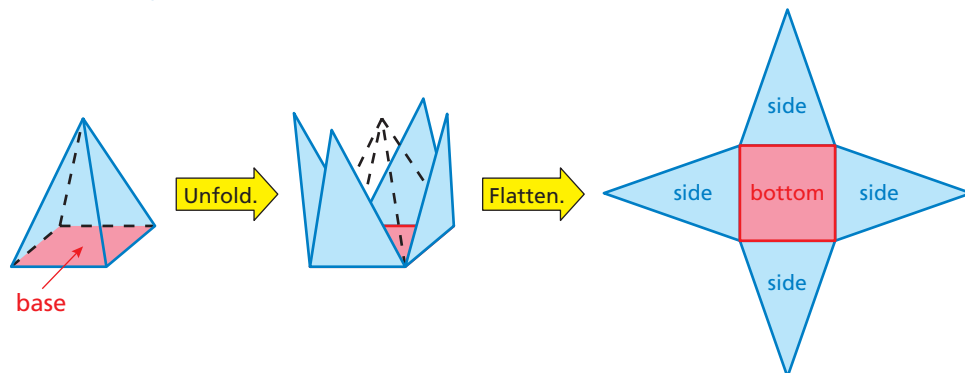## EXPLORATION 2

Finding Surface Areas of Solids

Math Practice

Analyze Givens
What information can you determine from the diagram? How does this help you find the surface area of the solid?

Work with a partner. Find the surface area of each solid. Explain your reasoning.

a.

b.

7.6 Lesson

Key Idea

Net of a Pyramid

Remember

A *square pyramid* is a pyramid with a square base. A *triangular pyramid* is a pyramid with a triangular base.
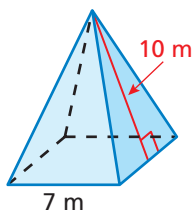
Unfold. → Flatten. →

side, side, bottom, side, side

base

In this book, the base of every pyramid is either a square or an equilateral triangle. So, the lateral faces are identical triangles.
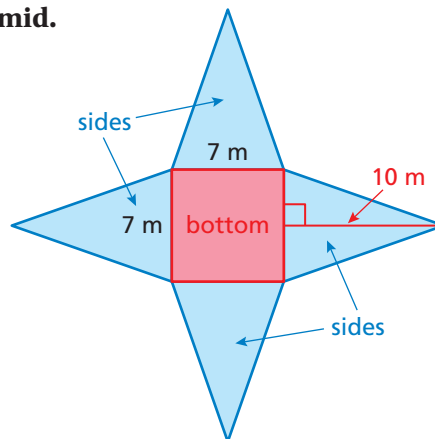
EXAMPLE 1 Finding the Surface Area of a Square Pyramid

Find the surface area of the square pyramid.

10 m
7 m

Use a net to find the area of each face.

Bottom: $7 \cdot 7 = 49$

Side: $\dfrac{1}{2} \cdot 7 \cdot 10 = 35$

Side: $\dfrac{1}{2} \cdot 7 \cdot 10 = 35$

Side: $\dfrac{1}{2} \cdot 7 \cdot 10 = 35$

Side: $\dfrac{1}{2} \cdot 7 \cdot 10 = 35$

sides
7 m
7 m bottom
10 m
sides

Find the sum of the areas of the faces.

$$\text{Surface Area} = \boxed{\text{Area of bottom}} + \boxed{\text{Area of a side}} + \boxed{\text{Area of a side}} + \boxed{\text{Area of a side}} + \boxed{\text{Area of a side}}$$

$$S = 49 + 35 + 35 + 35 + 35 = 189$$

▶ So, the surface area is 189 square meters.

Try It **Find the surface area of the square pyramid.**

1.
3 ft
2 ft

2.
5 cm
5 cm
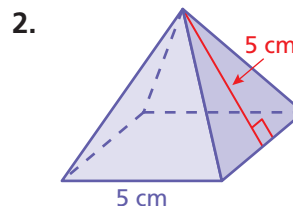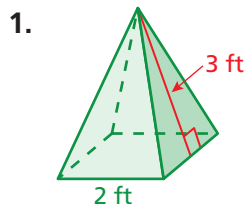
EXAMPLE 2 **Finding the Surface Area of a Triangular Pyramid**
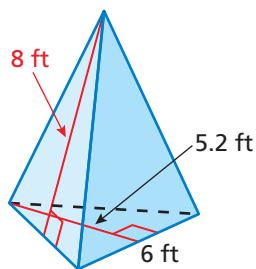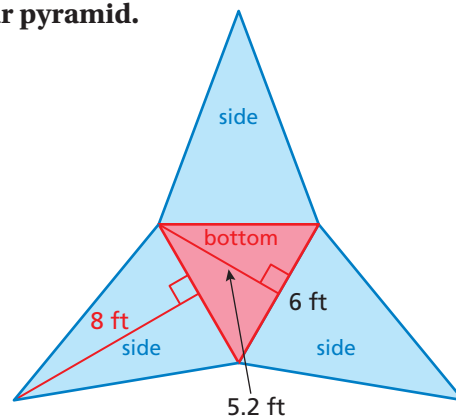
Find the surface area of the triangular pyramid.

Use a net to find the area of each face.

Bottom: $\dfrac{1}{2} \cdot 6 \cdot 5.2 = 15.6$

Side: $\dfrac{1}{2} \cdot 6 \cdot 8 = 24$

Side: $\dfrac{1}{2} \cdot 6 \cdot 8 = 24$
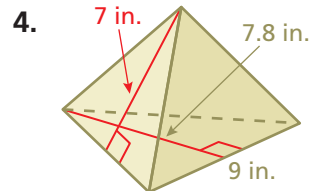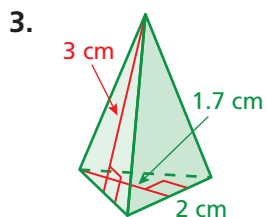
Side: $\dfrac{1}{2} \cdot 6 \cdot 8 = 24$

Find the sum of the areas of the faces.

Surface Area	=	Area of bottom	+	Area of a side	+	Area of a side	+	Area of a side
S	=	15.6	+	24	+	24	+	24

$\qquad = 87.6$

▶ So, the surface area is 87.6 square feet.

Try It Find the surface area of the triangular pyramid.

3.

3 cm
1.7 cm
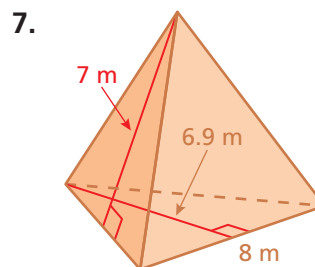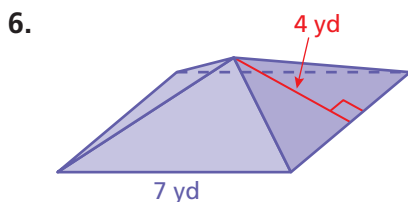2 cm

4.

7 in.
7.8 in.
9 in.

Self-Assessment *for Concepts & Skills*

Solve each exercise. Then rate your understanding of the success criteria in your journal.

5. **MP** **PRECISION** Explain how to find the surface area of a pyramid.

FINDING SURFACE AREA Find the surface area of the pyramid.

6.

4 yd
7 yd

7.

7 m
6.9 m
8 m

EXAMPLE 3   Modeling Real Life

The uppermost piece of an ancient Egyptian pyramid is called a pyramidion. These square pyramid-shaped pieces were sometimes covered with gold. What is the least amount of gold needed to cover a pyramidion in which each triangular face has a height of 1.2 meters and a base of 1.5 meters?

Draw the pyramid. The least amount of gold needed is represented by the surface area of the pyramid. Use a net to find the surface area.

Bottom: $1.5 \cdot 1.5 = 2.25$

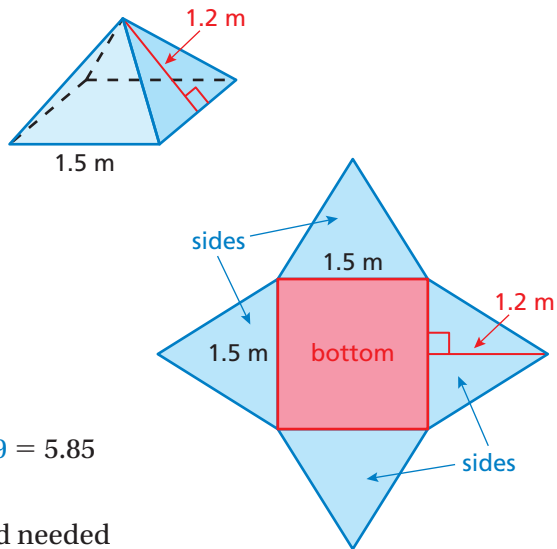Side: $\frac{1}{2} \cdot 1.5 \cdot 1.2 = 0.9$

Side: $\frac{1}{2} \cdot 1.5 \cdot 1.2 = 0.9$

Side: $\frac{1}{2} \cdot 1.5 \cdot 1.2 = 0.9$

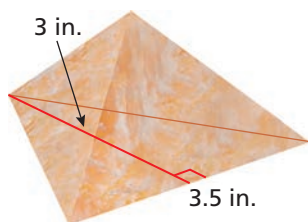Side: $\frac{1}{2} \cdot 1.5 \cdot 1.2 = 0.9$

$S = 2.25 + 0.9 + 0.9 + 0.9 + 0.9 = 5.85$

▶ So, the least amount of gold needed is 5.85 square meters.

Self-Assessment for Problem Solving

Solve each exercise. Then rate your understanding of the success criteria in your journal.

3 in.

3.5 in.

Surface Area = 15.75 in.^{2}

8. A salt lamp is shaped like a triangular pyramid. Find the area of each triangular face.

9. **DIG DEEPER!**   Originally, each triangular face of the Great Pyramid of Giza had a height of 612 feet and a base of 756 feet. Today, the height of each triangular face of the square pyramid is 592 feet. Find the change in the total surface area of the four triangular faces of the Great Pyramid of Giza.
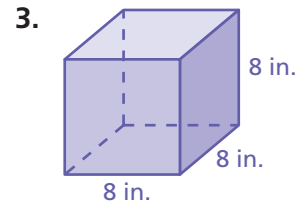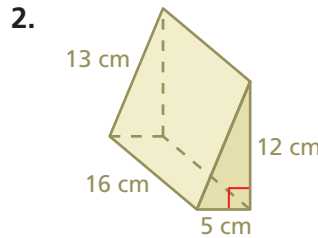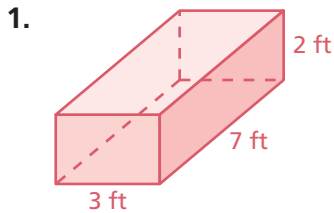
7.6 Practice

Go to *BigIdeasMath.com* to get
HELP with solving the exercises.

▶ Review & Refresh

Find the surface area of the prism.

1.

2 ft
7 ft
3 ft

2.

13 cm
16 cm
12 cm
5 cm

3.

8 in.
8 in.
8 in.

Match the expression with an equivalent expression.

4. $3(4n + 2)$

5. $6(2n + 3)$

6. $4(3n + 4)$

7. $12(n + 1)$

A. $2(6n + 6)$

B. $12n + 18$

C. $2(6n + 3)$

D. $12n + 16$
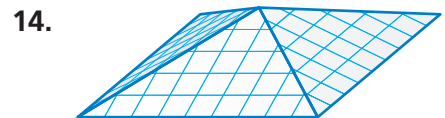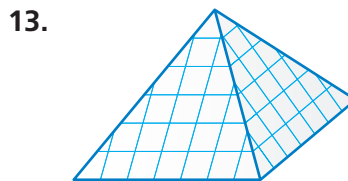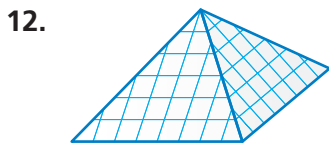
Write the fraction or mixed number as a percent.

8. $\dfrac{17}{25}$

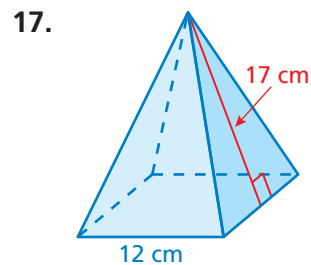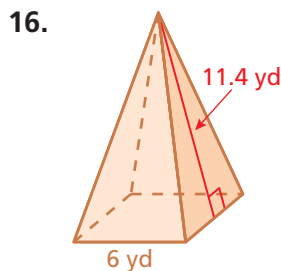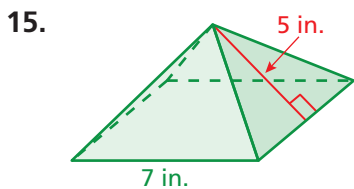**9.** $\dfrac{19}{20}$

**10.** $6\dfrac{7}{8}$

11. $\dfrac{3}{400}$

▶▶ Concepts, Skills, & Problem Solving

USING TOOLS Use a net to find the surface area of the solid. Explain your
reasoning. (See Exploration 2, p. 319.)

12.

13.

14.

FINDING SURFACE AREA Find the surface area of the pyramid.

15.

5 in.
7 in.

16.

11.4 yd
6 yd

17.

17 cm
12 cm

18.

9 ft
10.4 ft
12 ft

19.

14 in.
6.9 in.
8 in.

20.

8 m
3.5 m
4 m
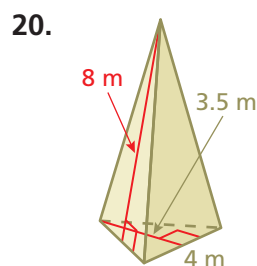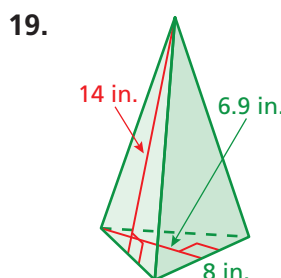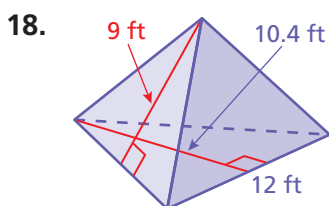
21. **MODELING REAL LIFE** A paperweight is shaped like a triangular pyramid. Find the surface area of the paperweight.

2.2 in.

2 in.
1.7 in.
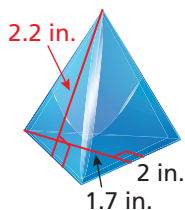
22. **MP PROBLEM SOLVING** The entrance to the Louvre Museum in Paris, France, is a square pyramid. The side length of the base is 116 feet, and the height of one of the triangular faces is 91.7 feet. Find the surface area of the four triangular faces of the entrance to the Louvre Museum.
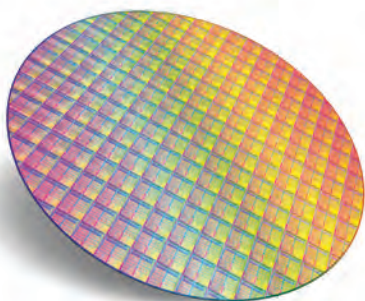
23. **MODELING REAL LIFE** A silicon wafer is textured to minimize light reflection. This results in a surface made up of square pyramids. Each triangular face of one of the pyramids has a base of 5 micrometers and a height of 5.6 micrometers. Find the surface area of the pyramid, including the base.

24. **MP REASONING** A hanging light cover made of glass is shaped like a square pyramid. The cover does not have a bottom. One square foot of the glass weighs 2.45 pounds. The chain can support 35 pounds. Will the chain support the light cover? Explain.

2 ft

2 ft

x in.

6 in.
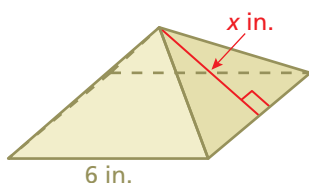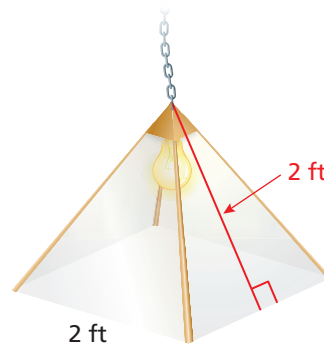
25. **GEOMETRY** The surface area of the square pyramid shown is 84 square inches. What is the value of *x*?

Base

26. **MP STRUCTURE** In the diagram of the base of the hexagonal pyramid, all the triangles are the same. Find the surface area of the hexagonal pyramid.

13 cm

8 cm

6.93 cm

8 cm

7 in.
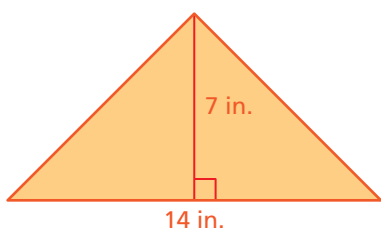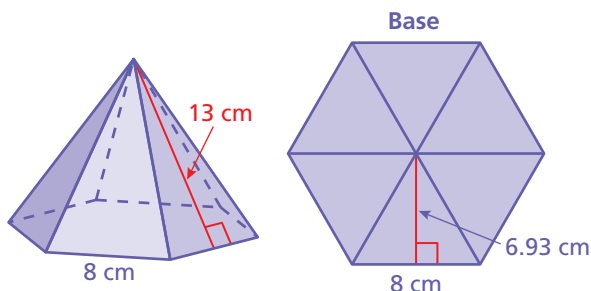
14 in.

27. **CRITICAL THINKING** Can you form a square pyramid using a square with side lengths of 14 inches and four of the triangles shown? Explain your reasoning.