

7.5 Surface Areas of Prisms

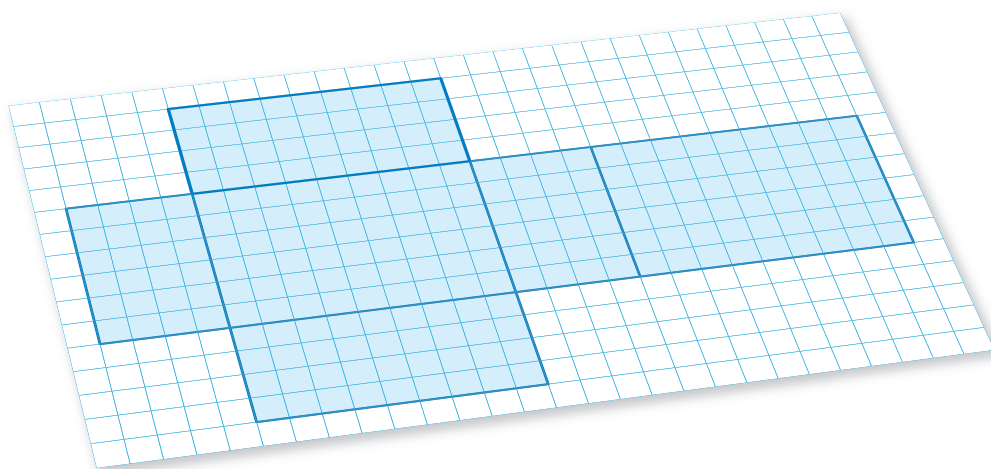
Learning Target: Represent prisms using nets and use nets to find surface areas of prisms.

- Success Criteria:**
- I can draw nets to represent prisms.
 - I can use nets to find surface areas of prisms.
 - I can use a formula to find the surface area of a cube.
 - I can apply surface areas of prisms to solve real-life problems.

EXPLORATION 1

Using Grid Paper to Construct a Solid

Work with a partner. Copy the figure shown below onto grid paper.



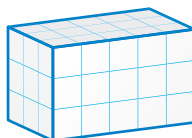
- Cut out and fold the figure to form a solid. What type of solid does the figure form?
- What is the area of the entire surface of the solid?

EXPLORATION 2

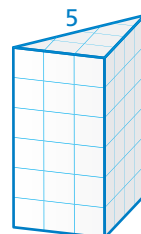
Finding the Area of the Entire Surface

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

a.



b.



Math Practice

Repeat Calculations

When finding the area of the entire surface, what calculations do you repeat?

7.5 Lesson

Key Vocabulary

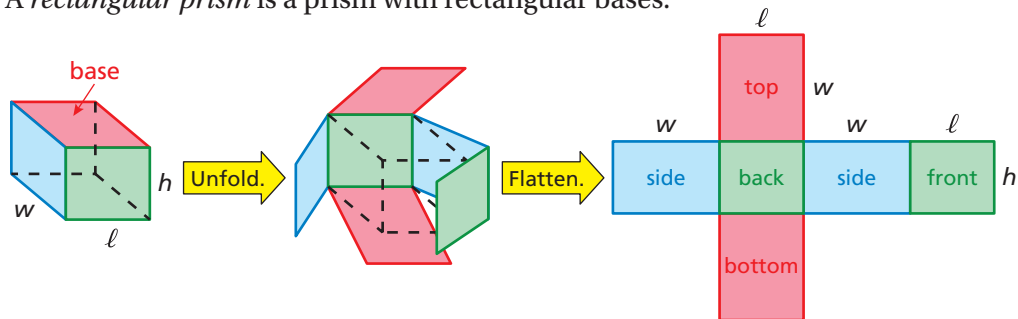
surface area, p. 312
net, p. 312

The **surface area** of a solid is the sum of the areas of all of its faces. You can use a two-dimensional representation of a solid, called a **net**, to find the surface area of the solid. Surface area is measured in *square units*.

Key Idea

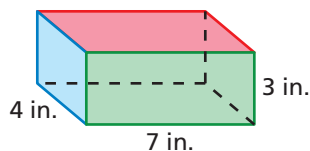
Net of a Rectangular Prism

A *rectangular prism* is a prism with rectangular bases.



EXAMPLE 1

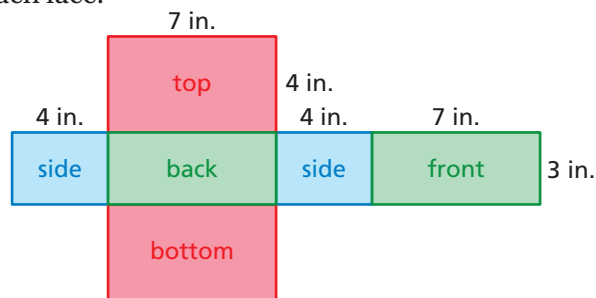
Finding the Surface Area of a Rectangular Prism



Find the surface area of the rectangular prism.

Use a net to find the area of each face.

$$\begin{aligned}\text{Top: } & 7 \cdot 4 = 28 \\ \text{Bottom: } & 7 \cdot 4 = 28 \\ \text{Front: } & 7 \cdot 3 = 21 \\ \text{Back: } & 7 \cdot 3 = 21 \\ \text{Side: } & 4 \cdot 3 = 12 \\ \text{Side: } & 4 \cdot 3 = 12\end{aligned}$$

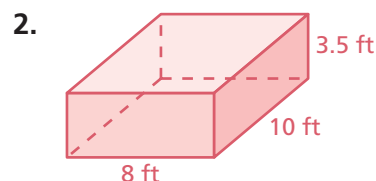
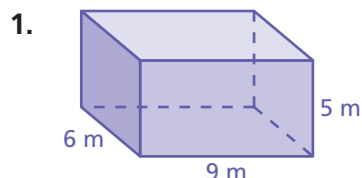


Find the sum of the areas of the faces.

$$\begin{aligned}\text{Surface Area} &= \text{Area of top} + \text{Area of bottom} + \text{Area of front} + \text{Area of back} + \text{Area of a side} + \text{Area of a side} \\ S &= 28 + 28 + 21 + 21 + 12 + 12 = 122\end{aligned}$$

So, the surface area is 122 square inches.

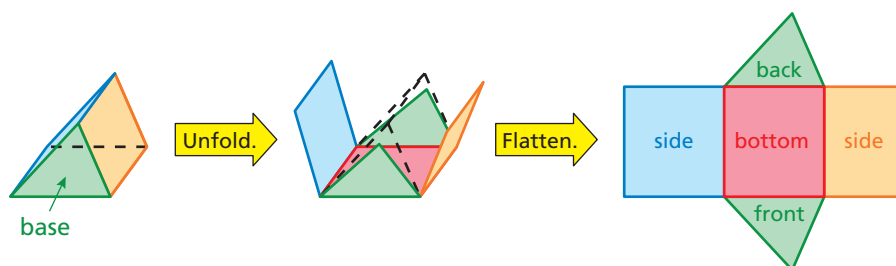
Try It Find the surface area of the rectangular prism.



Key Idea

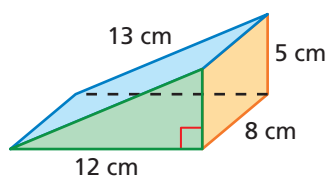
Net of a Triangular Prism

A *triangular prism* is a prism with triangular bases.



EXAMPLE 2

Finding the Surface Area of a Triangular Prism



Find the surface area of the triangular prism.

Use a net to find the area of each face.

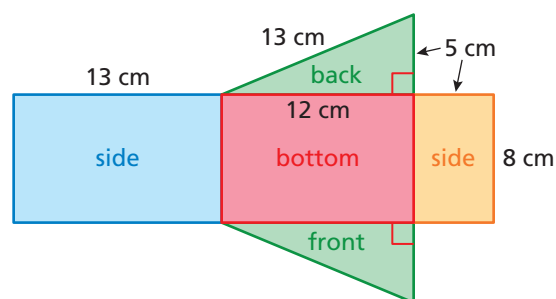
$$\text{Bottom: } 12 \cdot 8 = 96$$

$$\text{Front: } \frac{1}{2} \cdot 12 \cdot 5 = 30$$

$$\text{Back: } \frac{1}{2} \cdot 12 \cdot 5 = 30$$

$$\text{Side: } 13 \cdot 8 = 104$$

$$\text{Side: } 8 \cdot 5 = 40$$



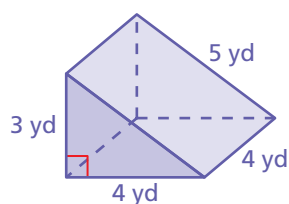
Find the sum of the areas of the faces.

$$\begin{aligned} \text{Surface Area} &= \text{Area of bottom} + \text{Area of front} + \text{Area of back} + \text{Area of a side} + \text{Area of a side} \\ S &= 96 + 30 + 30 + 104 + 40 \\ &= 300 \end{aligned}$$

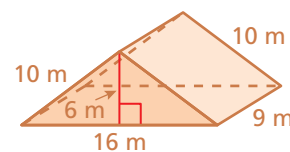
So, the surface area is 300 square centimeters.

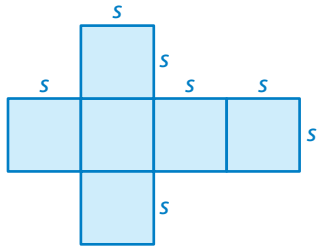
Try It Find the surface area of the triangular prism.

3.



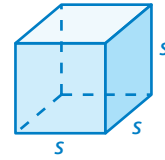
4.



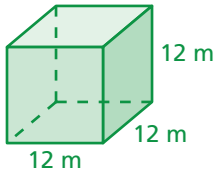


When all the edges of a rectangular prism have the same length s , the rectangular prism is a cube. The net of a cube shows that each of the 6 identical square faces has an area of s^2 . So, a formula for the surface area of a cube is

$$S = 6s^2. \quad \text{Formula for surface area of a cube}$$



EXAMPLE 3 Finding the Surface Area of a Cube

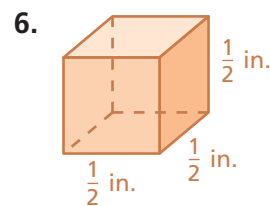
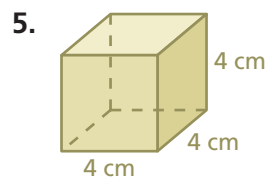


Find the surface area of the cube.

$$\begin{aligned} S &= 6s^2 && \text{Write formula for surface area of a cube.} \\ &= 6(12)^2 && \text{Substitute 12 for } s. \\ &= 6(144) && \text{Evaluate power.} \\ &= 864 && \text{Multiply.} \end{aligned}$$

▶ The surface area of the cube is 864 square meters.

Try It Find the surface area of the cube.



Self-Assessment for Concepts & Skills

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

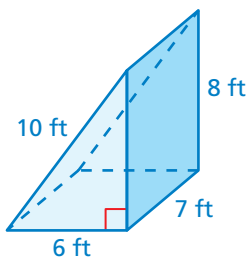
7. **FINDING SURFACE AREA** Find the surface area of a cube with edge lengths of 9 centimeters.
8. **DIFFERENT WORDS, SAME QUESTION** Which is different? Find “both” answers.

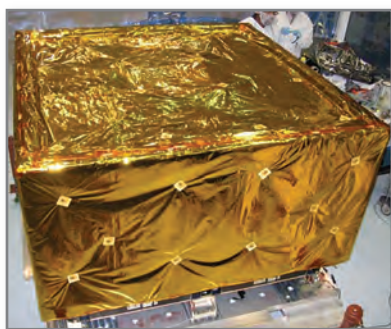
What is the sum of the areas of all of the faces of the prism?

What is the area of the entire surface of the prism?

What is the combined area of the triangular faces of the prism?

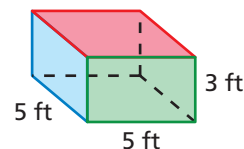
What is the surface area of the prism?



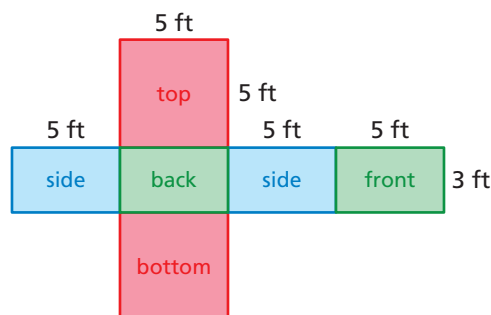
EXAMPLE 4**Modeling Real Life**

Space instruments are often wrapped in gold-colored multi-layer insulation (MLI) to reflect radiation from the Sun. What is the least amount of MLI needed to wrap an instrument in the shape of a rectangular prism with a length of 5 feet, a width of 5 feet, and a height of 3 feet?

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



$$\begin{aligned}\text{Top: } & 5 \cdot 5 = 25 \\ \text{Bottom: } & 5 \cdot 5 = 25 \\ \text{Front: } & 5 \cdot 3 = 15 \\ \text{Back: } & 5 \cdot 3 = 15 \\ \text{Side: } & 5 \cdot 3 = 15 \\ \text{Side: } & 5 \cdot 3 = 15\end{aligned}$$



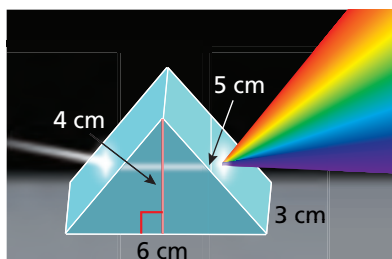
$$S = 25 + 25 + 15 + 15 + 15 + 15 = 110$$

So, the least amount of MLI needed is 110 square feet.

Check Reasonableness The surface area of a $5 \text{ ft} \times 5 \text{ ft} \times 3 \text{ ft}$ prism should be less than the surface area of a $5 \text{ ft} \times 5 \text{ ft} \times 5 \text{ ft}$ cube. The cube has a surface area of $6(5)^2 = 150$ square feet. Because $110 \text{ ft}^2 < 150 \text{ ft}^2$, the answer is reasonable. ✓

**Self-Assessment for Problem Solving**

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



9. Light shines through a glass prism and forms a rainbow. What is the surface area of the prism?
10. One pint of chalkboard paint covers 60 square feet. What is the least number of pints of paint needed to paint the walls of a room in the shape of a rectangular prism with a length of 15 feet, a width of 13 feet, and a height of 10 feet? Explain.
11. **DIG DEEPER!** A flexible *metamaterial* is developed for use in robotics and prosthetics. A block of metamaterial is in the shape of a cube with a surface area of 600 square centimeters. What is the edge length of the block of metamaterial?

7.5 Practice

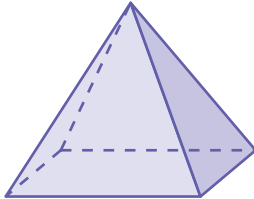


Go to BigIdeasMath.com to get HELP with solving the exercises.

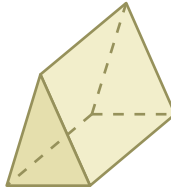
► Review & Refresh

Draw the front, side, and top views of the solid.

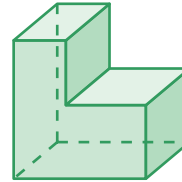
1.



2.



3.



Find the GCF of the numbers.

4. 18, 72

5. 44, 110

6. 78, 93

7. 60, 96, 156

Solve the equation.

8. $s - 5 = 12$

9. $x + 9 = 20$

10. $48 = 6r$

11. $\frac{m}{5} = 13$

Divide.

12. $496 \div 16$

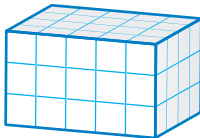
13. $765 \div 45$

14. $1173 \div 23$

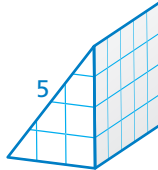
► Concepts, Skills, & Problem Solving

USING TOOLS Use a net to find the area of the entire surface of the solid. Explain your reasoning. (See Exploration 2, p. 311.)

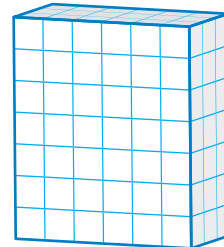
15.



16.

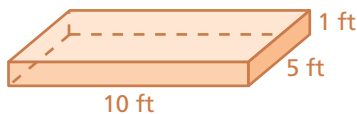


17.

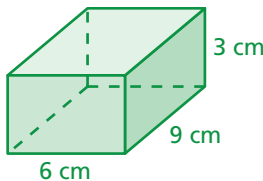


FINDING SURFACE AREA Find the surface area of the rectangular prism.

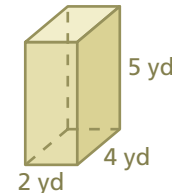
18.



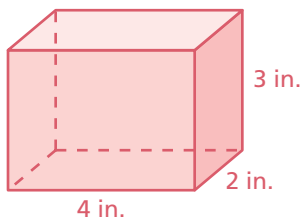
19.



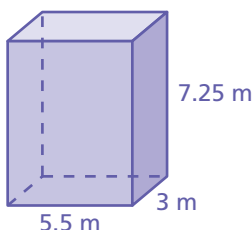
20.



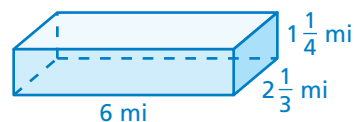
21.



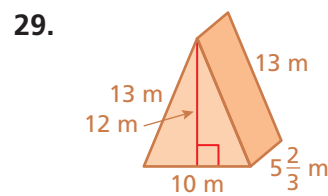
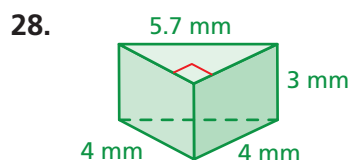
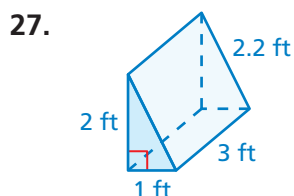
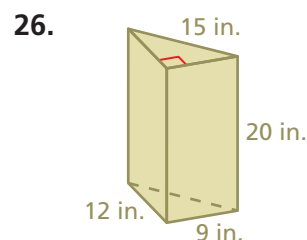
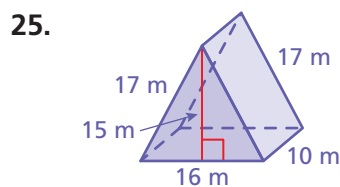
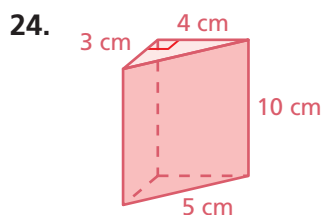
22.



23.



FINDING SURFACE AREA Find the surface area of the triangular prism.

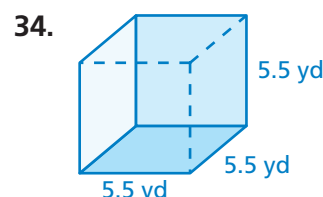
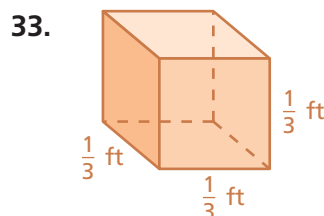
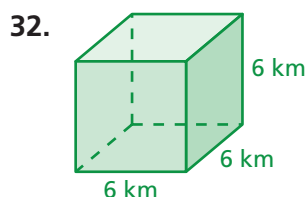


30. **MODELING REAL LIFE** A gift box in the shape of a rectangular prism measures 8 inches by 8 inches by 10 inches. What is the least amount of wrapping paper needed to wrap the gift box? Explain.

31. **MODELING REAL LIFE** What is the least amount of fabric needed to make the tent?



FINDING SURFACE AREA Find the surface area of the cube.



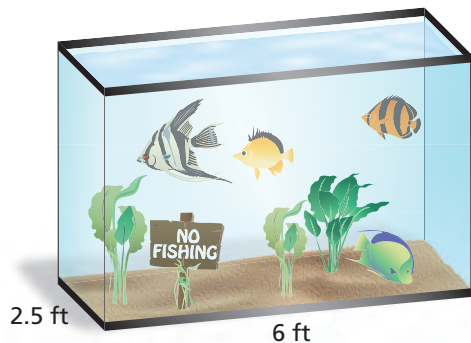
35. **MODELING REAL LIFE** A piece of dry ice is in the shape of a cube with edge lengths of 7 centimeters. Find the surface area of the dry ice.
36. **YOU BE THE TEACHER** Your friend finds the surface area of the prism. Is your friend correct? Explain your reasoning.

$$S = 6s^2$$

$$= 6(3)^2$$

$$= 54$$

The surface area of the prism is 54 square inches.



37. **CRITICAL THINKING** A public library has the aquarium shown. The front piece of glass has an area of 24 square feet. How many square feet of glass were used to build the aquarium? (The top of the aquarium is open and the bottom is glass.)

38. **MP PROBLEM SOLVING** A cereal box has the dimensions shown.

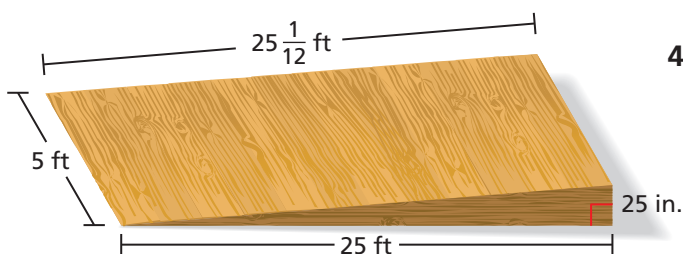
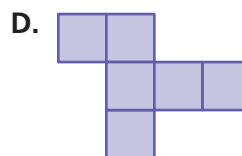
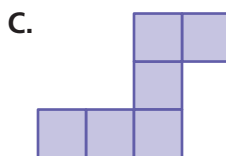
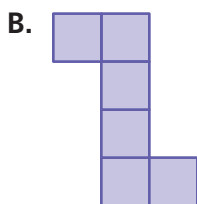
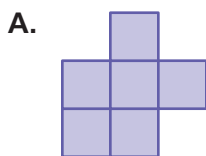
- Find the surface area of the cereal box.
- The manufacturer decides to decrease the size of the box by reducing each of the dimensions by 1 inch. Find the decrease in surface area.



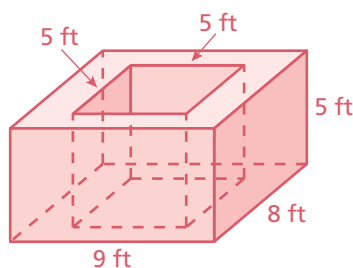
39. **MP REASONING** The material used to make a storage box costs \$1.25 per square foot. The boxes have the same volume. Which box might a company prefer to make? Explain your reasoning.

| | Length | Width | Height |
|-------|--------|-------|--------|
| Box 1 | 20 in. | 6 in. | 4 in. |
| Box 2 | 15 in. | 4 in. | 8 in. |

40. **MP LOGIC** Which of the following are nets of a cube? Select all that apply.



41. **MODELING REAL LIFE** A quart of stain covers 100 square feet. How many quarts should you buy to stain the wheelchair ramp? (Assume you do not have to stain the bottom of the ramp.)



42. **DIG DEEPER!** A cube is removed from a rectangular prism. Find the surface area of the figure after removing the cube.