

# Surface Area

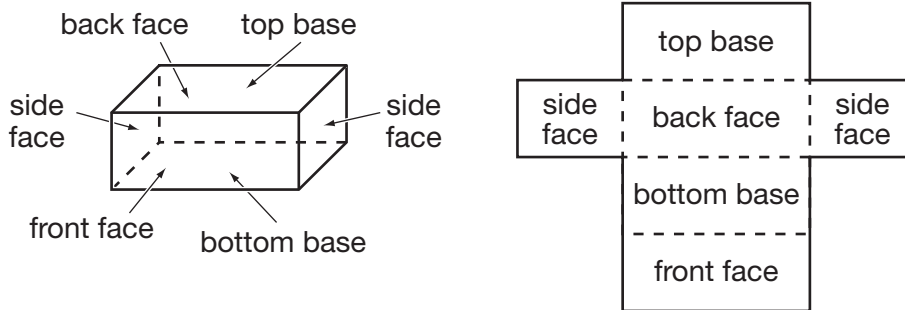


## Getting the Idea

The **surface area**, measured in square units, of a solid figure is the sum of the areas of all the surfaces of the figure. You can calculate the surface area of a figure, such as a cube, by finding the areas of all of its **faces** and then adding them.

Looking at a two-dimensional representation, called a **net**, of a solid figure may help you do this.

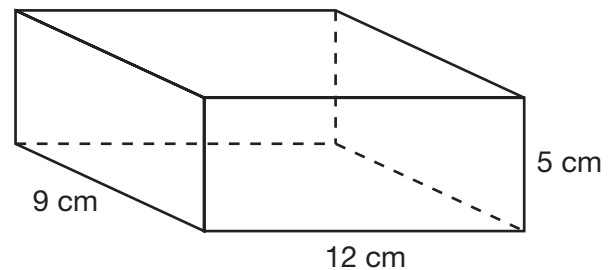
If the net below is folded along the dotted lines, a rectangular prism is formed.



The surface area of the rectangular prism is the total area of the 6 rectangular faces. The formula for the surface area of a rectangular prism is  $SA = 2lw + 2lh + 2wh$ , where  $l$  is length,  $w$  is width, and  $h$  is height.

### Example 1

What is the surface area of this rectangular prism?



#### Strategy

**Use the formula for the surface area of a rectangular prism.**

Substitute the values into the formula and simplify.

$$\text{Let } l = 12 \text{ cm, } w = 9 \text{ cm, and } h = 5 \text{ cm.}$$

$$SA = 2lw + 2lh + 2wh$$

$$SA = (2 \times 12 \text{ cm} \times 9 \text{ cm}) + (2 \times 12 \text{ cm} \times 5 \text{ cm}) + (2 \times 9 \text{ cm} \times 5 \text{ cm})$$

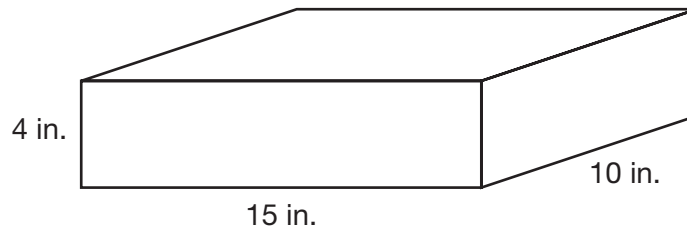
$$SA = 216 \text{ cm}^2 + 120 \text{ cm}^2 + 90 \text{ cm}^2 = 426 \text{ cm}^2$$

#### Solution

**The surface area of the rectangular prism is 426 square centimeters.**

## Example 2

Mary Jane is going to wrap this box with wrapping paper.



What is the minimum amount of wrapping paper she will need?

**Strategy** Find the surface area of a rectangular prism.

**Step 1**

Use the formula for the surface area of a rectangular prism.

$$SA = 2lw + 2lh + 2wh$$

**Step 2**

Substitute the values for the length, width, and height.

$$\text{Let } l = 15 \text{ in.}, w = 10 \text{ in.}, \text{ and } h = 4 \text{ in.}$$

$$SA = 2lw + 2lh + 2wh$$

$$SA = (2 \times 15 \text{ in.} \times 10 \text{ in.}) + (2 \times 15 \text{ in.} \times 4 \text{ in.}) + (2 \times 10 \text{ in.} \times 4 \text{ in.})$$

**Step 3**

Multiply and add to find the surface area.

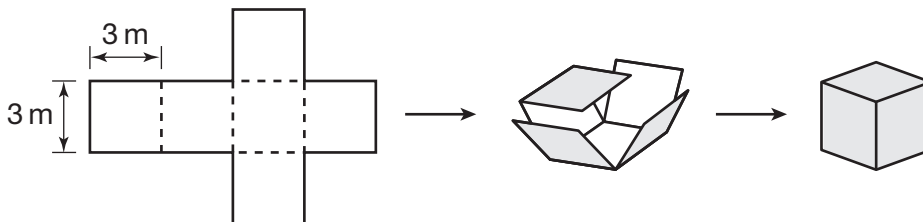
$$SA = 300 \text{ in.}^2 + 120 \text{ in.}^2 + 80 \text{ in.}^2$$

$$SA = 500 \text{ in.}^2$$

**Solution** The minimum amount of wrapping paper that Mary Jane will need is 500 square inches.

## Example 3

The net below can be folded to form a cube.



What is the surface area of the cube that it will form?

**Strategy** Think about the area of a square and the number of faces in a cube.

**Step 1**

Find the area of one square in the net.

The leftmost square has dimensions 3 m by 3 m.

$$A \text{ of square face} = s^2 = 3^2 = 9 \text{ square meters}$$

**Step 2**

Find the total surface area.

The net is made up of 6 congruent squares.

This must be true because a cube has 6 congruent square faces.

The total surface area is  $6 \times$  (area of one face).

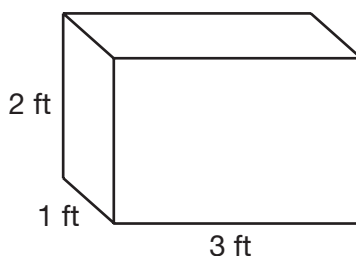
$$6 \times s^2 = 6 \times 9 \text{ square meters} = 54 \text{ square meters}$$

**Solution** The total surface area of the cube is 54 square meters.



### Coached Example

A toymaker will paint four sides of this toy chest. He will not paint the bottom or top surface. How many square feet of the chest will the toymaker paint?



You only need to find the areas of the surfaces that will be painted.

The front and back faces are rectangles that are 3 ft long and \_\_\_\_\_ ft high.

$$A \text{ of front face} = lw = 3 \times \underline{\hspace{1cm}} = \underline{\hspace{1cm}} \text{ ft}^2$$

The area of the back face is also \_\_\_\_\_  $\text{ft}^2$ .

The left and right side faces are rectangles that are 1 ft long and \_\_\_\_\_ ft high.

$$A \text{ of left side face} = lw = 1 \times \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$$

The area of the right side face is also \_\_\_\_\_  $\text{ft}^2$ .

Add the areas of all four faces: \_\_\_\_\_ + \_\_\_\_\_ + \_\_\_\_\_ + \_\_\_\_\_ = \_\_\_\_\_

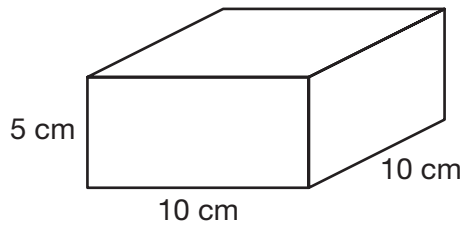
**The toymaker will paint \_\_\_\_\_ square feet of the toy chest.**



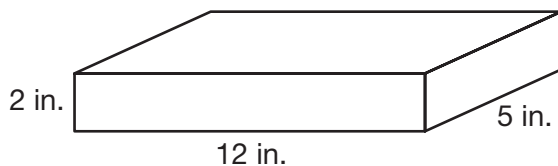
## Lesson Practice

Choose the correct answer.

1. Hermione made a jewelry box shaped like the rectangular prism below. What is the surface area of the jewelry box?

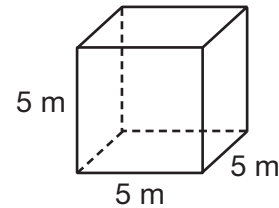


- A.  $400 \text{ cm}^2$   
B.  $300 \text{ cm}^2$   
C.  $200 \text{ cm}^2$   
D.  $100 \text{ cm}^2$
2. What is the surface area of a cube with 1-inch sides?
- A.  $36 \text{ in.}^2$   
B.  $24 \text{ in.}^2$   
C.  $6 \text{ in.}^2$   
D.  $4 \text{ in.}^2$
3. What is the surface area of the rectangular prism below?

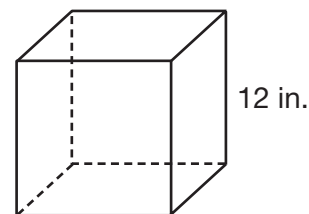


- A.  $68 \text{ in.}^2$   
B.  $94 \text{ in.}^2$   
C.  $188 \text{ in.}^2$   
D.  $376 \text{ in.}^2$

4. What is the surface area of the cube below?



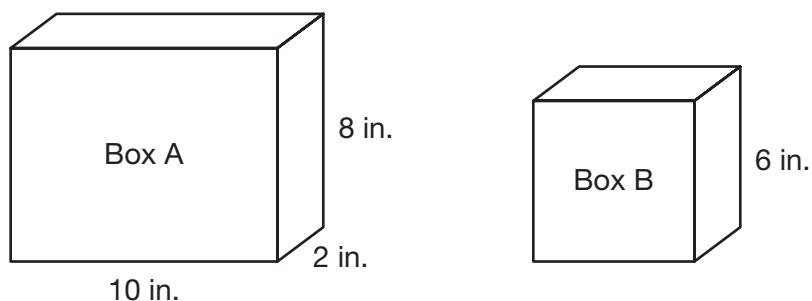
- A.  $30 \text{ m}^2$   
B.  $75 \text{ m}^2$   
C.  $125 \text{ m}^2$   
D.  $150 \text{ m}^2$
5. Alexis is designing a storage chest shaped like a rectangular prism. The storage chest is 6 feet long, 2 feet wide, and 3 feet high. What is the surface area of the storage chest?
- A.  $18 \text{ ft}^2$                       C.  $36 \text{ ft}^2$   
B.  $24 \text{ ft}^2$                       D.  $72 \text{ ft}^2$
6. What is the surface area of the cube below?



- A.  $144 \text{ in.}^2$   
B.  $288 \text{ in.}^2$   
C.  $864 \text{ in.}^2$   
D.  $1,200 \text{ in.}^2$

7. Davindra made a paper box that is 8 in. long, 5 in. wide, and 1 in. high. It is shaped like a rectangular prism. What is the surface area of the box?
- A.  $120 \text{ in.}^2$   
B.  $106 \text{ in.}^2$   
C.  $80 \text{ in.}^2$   
D.  $44 \text{ in.}^2$
8. A cube has a surface area of  $24 \text{ ft}^2$ . What is the length of one edge of the cube?
- A. 6 ft  
B. 4 ft  
C. 2 ft  
D. 1 ft

9. Ronnie wants to wrap the boxes below with wrapping paper.



- A. What is the surface area of Box A? Show your work.

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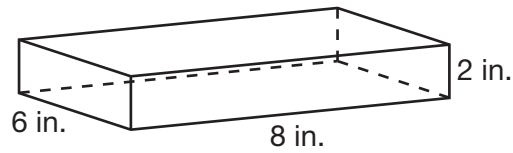
- B. What is the surface area of Box B, which is a cube? Show your work.

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10. Falak has a pencil box that is in the shape of a rectangular prism as shown below. Circle the number that makes the statement true.



The surface area of this pencil box is 

64
96
152

 square inches.

11. Compare the surface area of each rectangular prism to  $75 \text{ m}^2$ . Write the name of each rectangular prism in the correct box.

Prism A $l = 2 \text{ m}$ $w = 4 \text{ m}$ $h = 5 \text{ m}$	Prism B $l = 3 \text{ m}$ $w = 4 \text{ m}$ $h = 4 \text{ m}$	Prism C $l = 3 \text{ m}$ $w = 5 \text{ m}$ $h = 3 \text{ m}$	Prism D $l = 2 \text{ m}$ $w = 2 \text{ m}$ $h = 7 \text{ m}$	Prism E $l = 6 \text{ m}$ $w = 2 \text{ m}$ $h = 3 \text{ m}$
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Surface Area $< 75 \text{ m}^2$	Surface Area $> 75 \text{ m}^2$

12. Which figure has a surface area greater than 240 meters? Circle all that apply.
- A. cube with side 8 meters
  - B. rectangular prism with length 9 meters, width 3 meters, and height 8 meters
  - C. rectangular prism with length 9 meters, width 4 meters, and height 6 meters
  - D. cube with side 6 meters
  - E. rectangular prism with length 10 meters, width 3 meters, and height 7 meters

13. Look at each description of a rectangular prism and a cube. Is the surface area of the rectangular prism greater than the surface area of the cube? Select Yes or No.

A. rectangular prism:  $l = 5$  meters,  $w = 9$  meters,  $h = 8$  meters;  Yes  No  
cube:  $s = 7$  meters

B. rectangular prism:  $l = 7$  meters,  $w = 6$  meters,  $h = 5$  meters;  Yes  No  
cube:  $s = 6$  meters

C. rectangular prism:  $l = 4$  meters,  $w = 6$  meters,  $h = 4$  meters;  Yes  No  
cube:  $s = 5$  meters

D. rectangular prism:  $l = 3$  meters,  $w = 5$  meters,  $h = 6$  meters;  Yes  No  
cube:  $s = 4$  meters

14. Use numbers from the box to make each statement true.

The surface area of a rectangular prism with length 2 centimeters, width 2 centimeters, and height 1 centimeter is \_\_\_\_\_ square centimeters.

The surface area of a rectangular prism with length 2 centimeters, width 2 centimeters, and height 3 centimeters is \_\_\_\_\_ square centimeters.

The surface area of a rectangular prism with length 2 centimeters, width 2 centimeters, and height 6 centimeters is \_\_\_\_\_ square centimeters.

16	40
24	48
32	56