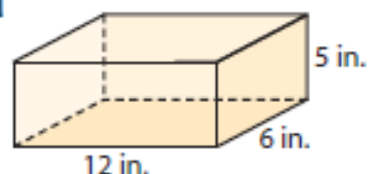


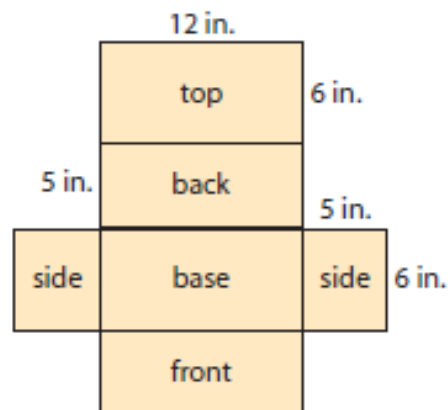
Surface Area of Rectangular and Triangular Prisms

Modeling the Surface Area of a Prism

The **surface area** of a three-dimensional figure is the sum of the areas of all of its surfaces. You can use a net to help you explore formulas related to the surface area of a prism.



A net for a CD storage box made of balsa wood is shown.



- A** The front and _____ have the same area.

$$A = lh = \underline{\quad} \cdot \underline{\quad} = \underline{\quad} \text{ square inches}$$

- B** The left side and _____ have the same area.

$$A = wh = \underline{\quad} \cdot \underline{\quad} = \underline{\quad} \text{ square inches}$$

- C** The *lateral faces* of a prism are parallelograms that connect the bases. The *lateral area* (L) of a prism is the sum of the areas of its lateral faces. Find the lateral area of the box.

$$L = 2 \cdot \underline{\quad} + 2 \cdot \underline{\quad} = \underline{\quad} \text{ square inches}$$

- D** Find the perimeter (P) of the base of the box.

$$P = \underline{\quad} + \underline{\quad} + \underline{\quad} + \underline{\quad} = \underline{\quad} \text{ inches}$$

- E** Multiply the perimeter of the base by the height.

$$Ph = \underline{\quad} \cdot \underline{\quad} = \underline{\quad} \text{ square inches}$$

- F** What do you notice about your answers in parts C and E?
- _____

- G** The top and _____ have the same base area (B).

$$B = lw = \underline{\quad} \cdot \underline{\quad} = \underline{\quad} \text{ square inches}$$

- H** Add the lateral area to the area of the two bases to find the total surface area (S).

$$S = 2B + L = 2 \cdot \underline{\quad} + \underline{\quad} = \underline{\quad} \text{ square inches}$$

Math Talk
Mathematical Processes

Write a formula for total surface area S in terms of l , w , and h .

Surface Area of a Rectangular Prism

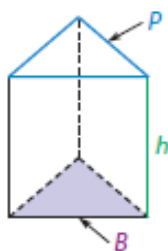
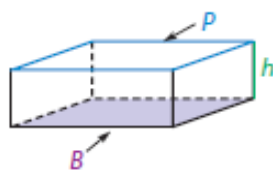
Lateral and Total Surface Area of a Prism

The lateral area L of a prism is the perimeter P of the base times the height h of the prism.

$$L = Ph$$

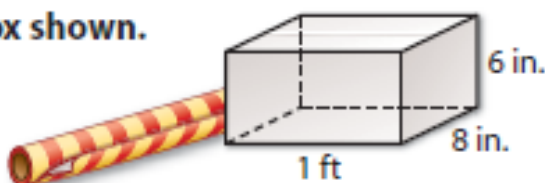
The total surface area S of a prism is twice the area of a base B plus the lateral area L .

$$S = 2B + L \quad \text{or} \quad S = 2B + Ph$$



EXAMPLE 1

Joanna is wrapping a present in the box shown. Find the amount of wrapping paper in square inches that Joanna needs, not counting overlap.



Analyze Information

What are you asked to find?

You need to find the total surface area of the box.

List the **Important Information**.

The length of the box is 1 foot. The width of the box is 8 inches.

The height of the box is 6 inches.



Formulate a Plan

Change 1 foot to 12 inches. Then find the area and perimeter of a base of the box, and substitute into the formula for the surface area of a prism.



Solve

$$\text{Area of Base: } B = l \cdot w = 12 \cdot 8 = 96$$

$$\text{Perimeter of Base: } P = 2l + 2w = 2(12) + 2(8) = 40$$

$$S = 2B + Ph$$

Total surface area of a prism

$$S = 2(96) + (40)(6)$$

Substitute: $B = 96$, $P = 40$, and $h = 6$.

$$S = 192 + 240 = 432$$

Simplify.

The total surface area of the box is 432 square inches.

YOUR TURN

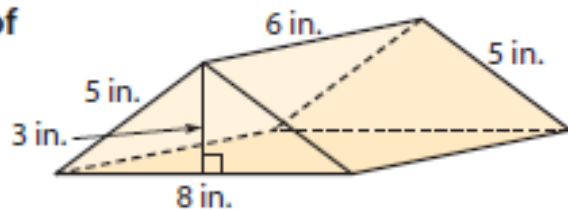
1. Sara is lining the bottom and lateral faces of a drawer with liner paper. The dimensions of the inside of the drawer are 1 yard, 20 inches, and 9 inches. What is the total area in square inches being covered?

Surface Area of a Triangular Prism

When you find the total surface area of a triangular prism, don't confuse the base and height of the triangular base with the base and height of the prism.

EXAMPLE 2

Kevin is painting a block in the shape of a triangular prism. What is the surface area of the block?



STEP 1 Find the area of a base.

$$B = \frac{1}{2}bh \quad \text{Area of a triangle}$$

$$B = \frac{1}{2}(8)(3) = 12 \quad \text{Substitute.}$$

STEP 2 Find the perimeter of a base.

$$P = 8 + 5 + 5 = 18 \quad \text{Perimeter of a triangle}$$

STEP 3 Use the formula for surface area.

$$S = 2B + Ph$$

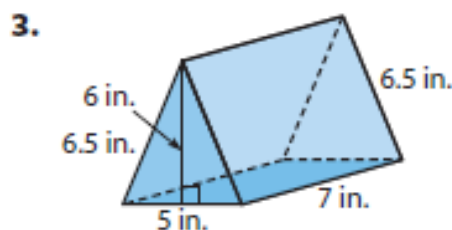
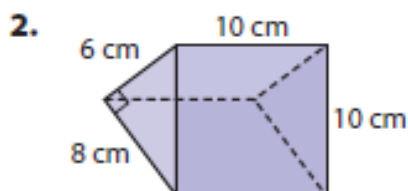
$$S = 2(12) + (18)(6) \quad \text{Substitute: } B = 12, P = 18, \text{ and } h = 6$$

$$S = 24 + 108 = 132$$

The surface area of the triangular prism is 132 in^2 .

YOUR TURN

Find the lateral area and total surface area of each prism.

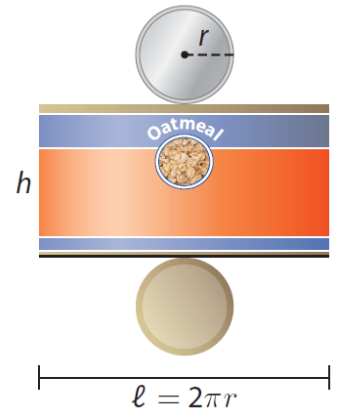


Surface Area of Cylinders

Modeling the Surface Area of a Cylinder

Just as you did with a prism, you can use a net to help you find a formula for the surface area of a cylinder.

The lateral area of a cylinder is the area of the curved surface that connects the two bases. The net shows that the lateral surface is a rectangle.



Finding the Surface Area of a Cylinder

The total surface area of a cylinder is the area of the bases plus the lateral area.

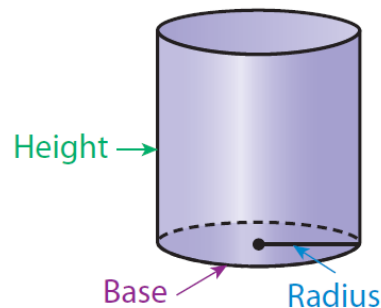
Lateral and Total Surface Area of a Cylinder

The lateral area L of a cylinder with height h and radius r is the circumference of the base times the height.

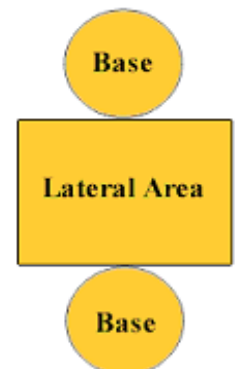
$$L = Ch \quad \text{or} \quad L = 2\pi rh$$

The total surface area S of a cylinder with height h and radius r is twice the area of a base B plus the lateral area L .

$$S = 2B + L \quad \text{or} \quad S = 2\pi r^2 + 2\pi rh$$



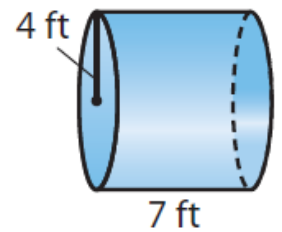
A **net** is a two-dimensional figure that can be cut out and folded up to make a three-dimensional solid.



Lateral = any face or surface that is not a base.

EXAMPLE 1

Find the lateral and total surface area of the cylinder to the nearest tenth. Use 3.14 for π .



STEP 1 Find the lateral area.

$$L = 2\pi rh$$

Use the formula for the lateral area of a cylinder.

$$\approx 2(3.14)(4)(7) \quad \text{Substitute.}$$

$$\approx 175.84 \quad \text{Simplify.}$$

The lateral area is about 175.8 square feet.

STEP 2 Find the total surface area.

$$S = 2\pi r^2 + L$$

Use the formula for the total surface area of a cylinder.

$$\approx 2(3.14)(4^2) + 175.84 \quad \text{Substitute.}$$

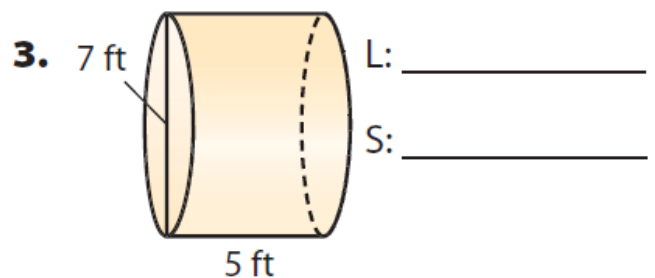
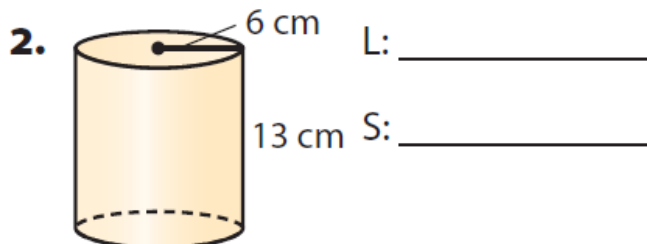
$$\approx 100.48 + 175.84 \quad \text{Simplify.}$$

$$\approx 276.32 \quad \text{Add.}$$

The total surface area of the cylinder is about 276.3 square feet.

YOUR TURN

Find the lateral and total surface area of each cylinder. Round your answers to the nearest tenth. Use 3.14 for π .



EXAMPLE 2

The can shown is 11 inches high and has a diameter of 9 inches. How many square inches of paper are needed for the label? How many square inches of metal are needed to make the entire can? Round your answers to the nearest whole number. Use 3.14 for π .



STEP 1 Find the radius of the base.

$$d = 9 \text{ in.}, \text{ so } r = 4.5 \text{ in.}$$

The radius is half of the diameter.

STEP 2 To find the area of the label, find the lateral area.

$$L = 2\pi rh$$

Use the formula for the lateral area of a cylinder.

$$\approx 2(3.14)(4.5)(11)$$

Substitute.

$$\approx 310.86$$

Multiply.

It takes about 311 square inches of paper to make the label.

STEP 3 To find the amount of metal, find the total surface area.

$$S = 2\pi r^2 + 2\pi rh$$

Use the formula for the total surface area of a cylinder.

$$\approx 2(3.14)(4.5^2) + 2(3.14)(4.5)(11)$$

Substitute.

$$\approx 127.17 + 310.86$$

Simplify.

$$\approx 438.03$$

Add.

It takes about 438 square inches of metal to make the can.

YOUR TURN

4. How many square inches of cardboard are needed for the lateral area of the raisin container shown? What is the total surface area of the container? Round your answers to the nearest tenth. Use 3.14 for π .

