Topic 9: Surface Area
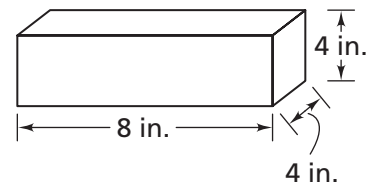
Jillian is wrapping a box of model cars for her brother's birthday. Jillian needs to measure the box to see if she has enough paper to wrap it.
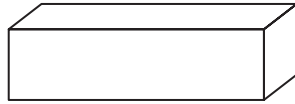
The **surface area** is the amount of area around the outside of an object.

Problem 9.1

Jillian measures each side of the box and labels the dimensions.

A. 1. How many shapes make the sides of Jillian's box?

2. Draw a picture of each side. Label the dimensions.

3. Do all of the sides have the same area?

4. Jillian has 80 in.^{2} of wrapping paper. Can she cover the box?

5. Jillian has more boxes to wrap. What formula, can you give her to make the job easier?

B. 1. Patrick also has to wrap a present. The container for his present is shown. What is different about the parts that make up this container?

2. Draw a picture of each shape that makes up the surface area this container.

3. What areas do you need to find for this total surface area?

4. Use what you know about the total area of the parts to find the total surface area of this container. Explain the formula you used to find your answer.

5. How does the formula that you wrote for the box compare to the formula for this container?
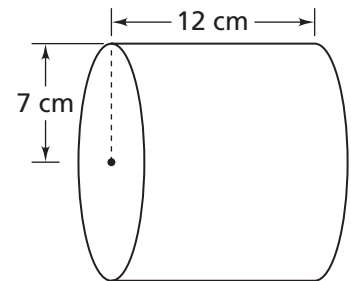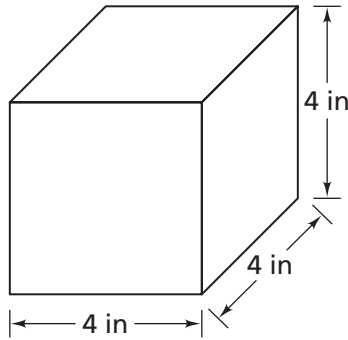
C. Jillian finds two more sheets of paper. She gives one sheet that measures 1,000 cm^2 to Patrick and keeps the other 200 in.^{2} sheet for herself.

1. Can Jillian cover her brother's birthday present now?

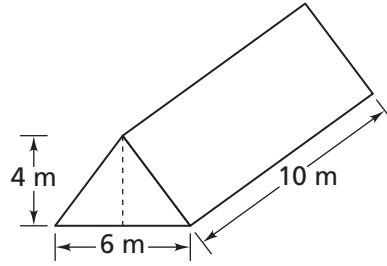**2.** Can Patrick cover his cylinder–shaped package?

Exercises

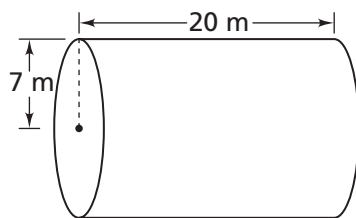**Use your formula to find the surface area of each container.**

1.

4 in

4 in

4 in

2.

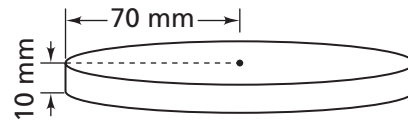
4 m

10 m

6 m

3.

20 m

7 m

4.

70 mm

10 mm

5. A container has two rectangular ends that measure 4 ft by 6 ft., and another side that has a length that is 12 ft long.

a. What are the measurements for all of the sides of the container?

b. What are the areas for all of the sides of the container?

c. What is the total surface area of the container?

6. Keira has 45 square inches of wrapping paper. Her package is 15 inches long, 12 inches wide, and 8 inches high. Does she have enough paper to cover her package? Explain.

7. The pyramid at the right has four sides that are congruent triangles.

a. What shape is the bottom of the pyramid?

b. If you know the length of a side of the base, do you have enough information to find the surface area of the pyramid? Explain.
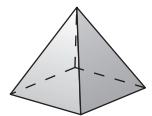
Topic 9: Surface Area

Mathematical Goals

- Explore strategies to find the surface area of prisms and cylinders.
- Solve real-world problems to find surface areas.

Guided Instruction

Before beginning Topic 9, show students a box. Rotate the box to several positions. Review the shape on each side of the box. Ask students to explain how to find the area of one side. Review the formula for area of a rectangle with the class. Show the class a sheet of wrapping paper. Ask the class if they believe there is enough paper to cover the box. Let the students explain how they can find this information. Then develop a definition for surface area using the faces of the box to show the total area that must be covered by the wrapping paper.

For Problem 9.1 A, ask:

- *How many sides does the box have?* (6 sides)
- *How many of these sides are the same shape?* (4 sides are the same rectangle and 2 sides are the same square.)
- *What do you multiply to find the area of each rectangle or square?* (length × width; side squared)
- *What is the total surface area of the box?* (160 in.^{2})
- *How did you find the total surface area?* (Add the area of all of the sides.)
- *How can you write what you did as a formula?* (2 times the area of the squares plus 4 times the area of the rectangles)

Use a can of soup (or similar can with a label). Remove the label so that students can see the shape of the side of the can. Ask:

- *If you remove the label from a can, what shape is the label?* (rectangle)
- *What area formulas do you need to find the surface area of the can (or cylinder)?* (area of a circle and area of a rectangle)
- *What part of the circle is equal to the length of the rectangle?* (the circumference)

For Problem 9.1 C, ask:

- *What do you need to determine if there is enough paper to cover a container?* (area of the paper and total surface area of the container)

Students can further explore surface area by wrapping various sized containers. If the same size paper is used each time, students can predict first whether there is enough paper to cover the container. Encourage students to measure the surface area of the container if they predict that there is not enough paper.

You will find additional work on surface area in the grade 7 unit *Filling and Wrapping.*

Vocabulary

- surface area

Materials

- Labsheet 9.1

ACE Assignment Guide
for Topic 9

Core 1–7

Answers to Topic 9

Problem 9.1

A. 1. There are six shapes total. Four equal sized rectangles and two equal sized squares.

2. Check student drawings. Students should have four rectangles labeled 4 in. by 8 in., and two squares labeled 4 in. by 4 in.

3. No, the areas are all different. They are 32 in.^{2}, 32 in.^{2}, 32 in.^{2}, 32 in.^{2}, 16 in.^{2}, 16 in.^{2}.

4. No, Jillian can not cover his box. She needs more paper.

5. Answers may vary. Students should have a formula similar to
SA $= 2(\ell \times w) + 2(w \times h) + 2(\ell \times h)$.

B. 1. Two ends of the container are circles.

2. Check student drawings. The shapes are 2 circles and 1 rectangle.

3. You need to find the area of the 2 circles and the rectangle.

4. The surface area of the container is 836 cm^2. The formula is 2 × the area of the circle $(2\pi\, r^2)$ + the area of the rectangle $(2\pi r \times 12)$.

5. Answers may vary. Sample: The formula for a cylinder uses the formulas for circles and that the circumference of the circular base is actually one side of the rectangle.

C. 1. Yes. Jillian now has enough paper to cover her gift.

2. Yes. Patrick has enough paper to cover his cylinder shaped package.

Exercises

1. $2(4 \times 4) + 2(4 \times 4) + 2(4 \times 4) = 96$ in.^{2}

2. $2(10 \times 5) + 1(10 \times 6) + 2(\frac{1}{2}(6 \times 4)) = 184$ m^2

3. $(2\pi\, 7^2) + (2\pi 7 \times 20) \approx 1188$ cm^2

4. $(2\pi\, 70^2) + (2\pi 70 \times 10) \approx 35{,}168$ mm^2

5. a. Two sides are 4 by 6, two sides are 12 × 6, and two sides are 12 × 4.

b. 24 ft^2, 24 ft^2, 72 ft^2, 72 ft^2 48 ft^2, 48 ft^2

c. 288 ft^2

6. No. One side of Keira's package is 12 × 15 which equals 180 by itself. Keira needs many more pieces of wrapping paper.

7. a. A square.

b. No there is not enough information. You need the height of the triangle.

Labsheet 9.1

Surface Area

A.

8 in.

4 in.

4 in.

B.

12 cm

7 cm