

# That's a Spicy Pizza!

# 2

## Area of Circles

### WARM UP

Determine a unit rate for each situation.

1. \$38.40 for 16 gallons of gas
2. 15 miles jogged in 3.75 hours
3. \$26.99 for 15 pounds

### LEARNING GOALS

- Describe the relationship between the circumference and area of a circle and use the area formula to solve problems.
- Decide whether circumference or area is an appropriate measure for a problem situation.
- Calculate unit rates associated with circle areas.

### KEY TERM

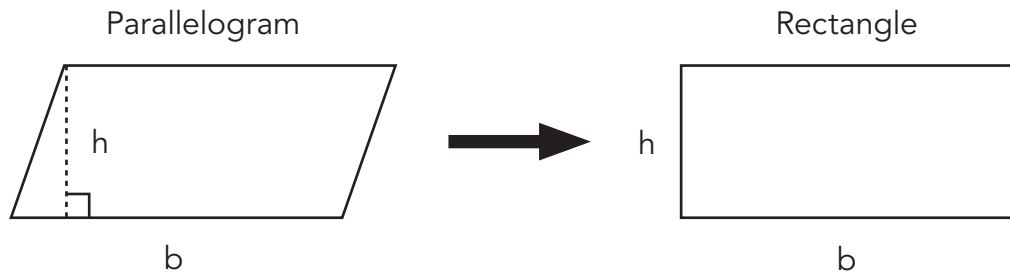
- unit rate

You have learned about the different parts and measures of a circle, including radius, diameter, and circumference. How can you use the parts of a circle to determine the area of a circle?

# Getting Started

## What Changed? What Stayed the Same?

The length of the base and height are the same in the parallelogram and rectangle shown.



1. How could you rearrange the parallelogram to create the rectangle?

2. What is the area of each figure?



In the last lesson you derived formulas for the distance around a circle. In this lesson, you will investigate the space within a circle. Use the circle at the end of the lesson that is divided into 4, 8, and 16 equal parts.

**1. Follow the steps to decompose the circle and then compose it into a new figure.**

a. First, cut the circle into fourths and arrange the parts side by side so that they form a shape that looks like a parallelogram.

b. Then cut the circle into eighths and then sixteenths. Each time, arrange the parts to form a parallelogram.

**2. Analyze the parallelogram you made each time.**

a. How did the parallelogram change as you arranged it with the smaller equal parts of the same circle?

b. What would be the result if you built the parallelogram out of 40 equal circle sections? What about 100 equal circle sections?

c. Represent the approximate base length and height of the parallelogram in terms of the radius and circumference of the circle.

d. Use your answers to part (c) to determine the formula for the area of the parallelogram.

e. How does the area of the parallelogram compare to the area of the circle?

f. Write a formula for the area of a circle.

3. Use different representations for  $\pi$  to calculate the area of a circle.

a. Calculate the area of each circle with the given radius. Round your answers to the nearest ten-thousandths, if necessary.

Value for $\pi$	$r = 6$ units	$r = 1.5$ units	$r = \frac{1}{2}$ unit
$\pi$			
Use the $\pi$ key on a calculator			
Use 3.14 for $\pi$			
Use $\frac{22}{7}$ for $\pi$			

b. Compare your area calculations for each circle. How do the different values of  $\pi$  affect your calculations?

4. Suppose the ratio of radius lengths of two circles is 1 unit to 2 units.

a. What is the ratio of areas of the circles? Experiment with various radius lengths to make a conclusion.

b. If the length of the radius of a circle is doubled, what effect will this have on the area?



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Circle Formulas

$$C = \pi d, \text{ or } 2\pi r$$

$$A = \pi r^2$$

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The circumference of a circle is the distance around the circle, while the area of a circle is the amount of space contained inside the circle. When solving problems involving circles, it is important to think about what you are trying to determine.

**1. A city park has a large circular garden with a path around it. The diameter of the garden is 60 feet.**

**a. Gina likes to walk along the circular path during her lunch breaks. How far does Gina walk if she completes one rotation around the path?**

**b. Jason works for the City Park Department. He needs to spread plant food all over the garden. What is the area of the park he will cover with plant food?**

2. Samantha is making a vegetable pizza. First, she presses the dough so that it fills a circular pan with a 16-inch diameter and covers it with sauce. What is the area of the pizza Samantha will cover with sauce?

3. Members of a community center have decided to paint a large circular mural in the middle of the parking lot. The radius of the mural is to be 11 yards. Before they begin painting the mural, they use rope to form the outline. How much rope will they need?

ACTIVITY  
**2.3**

## Unit Rates and Circle Area



Talarico's Pizza has a large variety of pizza sizes.

	Small	Medium	Large	X-Large	Enorme	Ginorme	Colossale
Diameter	10 in.	13 in.	16 in.	18 in.	24 in.	28 in.	36 in.
Slices	6	8	10	12	20	30	40
Cost	\$6.99	\$9.99	\$12.99	\$14.99	\$22.99	\$28.99	\$54.99

Lina and Michael are trying to decide whether to get two pizzas or one Ginorme pizza. They ask themselves, "Which choice is the better buy?"

They each calculated a unit rate for the Ginorme pizza.

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Recall that a **unit rate** is a ratio of two different measures in which either the numerator or denominator is 1.

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Lina



$$1 \text{ Ginorme: } \frac{\pi(14)^2}{28.99} = \frac{196\pi}{28.99} \approx 21.24 \text{ square inches per dollar}$$

The Ginorme gives you approximately 21.24 square inches of pizza per dollar.



Michael



1 Ginorme:  $\frac{28.99}{14^2 \pi} = \frac{28.99}{196\pi} \approx \$0.05$  per square inch

The Ginorme costs approximately \$0.05 for each square inch of pizza.

1. Consider Lina's and Michael's work.

a. Explain why Lina's and Michael's unit rates are different but still both correct.

b. How would you decide which pizza was the better buy if you calculated the unit rate for each pizza using Lina's method versus Michael's method.

2. Which of the seven sizes of pizza from Talarico's Pizza is the best buy? Explain your answer.

## TALK the TALK

### Go With the Flow

1. Residents of a community are trying to determine which configuration would allow more water to flow through the pipe(s), one pipe with a radius of 8 cm or two pipes that each have a radius of 4 cm. Which configuration allows the most water to flow through the pipe(s), and what is the difference between the two configurations? Show your work and explain your reasoning.

# Circle Area Cutouts

