9.2 Areas of Circles

Learning Target:Find the area of a circle.Success Criteria:I can estimate the area of a circle.

• I can use a formula to find the area of a circle.

EXPLORATION 1

Estimating the Area of a Circle

Work with a partner. Each grid contains a circle with a diameter of 4 centimeters. Use each grid to estimate the area of the circle. Which estimate should be closest to the actual area? Explain.



EXPLORATION 2

Writing a Formula for the Area of a Circle

Work with a partner. A student draws a circle with radius *r* and divides the circle into 24 equal sections. The student cuts out each section and arranges the sections to form a shape that resembles a parallelogram.





Math Practice

Interpret a Solution

Describe the relationship between the radius and the area of a circle.

- **a.** Use the diagram to write a formula for the area *A* of a circle in terms of the radius *r*. Explain your reasoning.
- **b.** Use the formula to check your estimates in Exploration 1.

9.2 Lesson



Area of a Circle

Words The area *A* of a circle is the product of π and the square of the radius *r*.

Algebra $A = \pi r^2$





Finding the Area of a Semicircle

Math Practice Find General Methods How can you find the

area of one-fourth of a circle? three-fourths of a circle?



Find the area of the semicircle.				
The area of the semicircle is one-half the area of a circle with a diameter of 30 feet. The radius of the circle is $30 \div 2 = 15$ feet.				
$\frac{A}{2} = \frac{\pi r^2}{2}$	Divide the area by 2.	30 ft		
$\approx \frac{3.14 \cdot 15^2}{2}$	Substitute 3.14 for π and 15 for r .			
$=\frac{3.14\bullet225}{2}$	Evaluate 15 ² .			
= 353.25	Simplify.			

So, the area of the semicircle is about 353.25 square feet.

Try It Find the area of the semicircle.





Self-Assessment for Concepts & Skills-

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



6. **ESTIMATING AN AREA** The grid contains a circle with a diameter of 2 centimeters. Use the grid to estimate the area of the circle. How can you change the grid to improve your estimate? Explain.

- 7. WRITING Explain the relationship between the circumference and area of a circle.
- 8. **DIFFERENT WORDS, SAME QUESTION** Which is different? Find "both" answers.

What is the area of a circle with a diameter of 1 m?	What is the area of a circle with a diameter of 100 cm?
What is the area of a circle with a radius of 100 cm?	What is the area of a circle with a radius of 500 mm?



Modeling Real Life

A tsunami warning siren can be heard up to 2.5 miles away in all directions. From how many square miles can the siren be heard?

You are given the description of a region in which a siren can be heard. You are asked to find the number of square miles within the range of the siren.



plan. Two and a half miles from the siren in all directions is a circular region with a radius of 2.5 miles. So, find the area of a circle with a radius of 2.5 miles.

$A = \pi r^2$	Write formula for area.
$\approx 3.14 \cdot 2.5^2$	Substitute 3.14 for π and 2.5 for r .
$= 3.14 \cdot 6.25$	Evaluate 2.5 ² .
= 19.625	Multiply.

So, the siren can be heard from about 20 square miles.

Check Reasonableness The number of square miles should be greater than $3 \cdot 2^2 = 12$, but less than $4 \cdot 3^2 = 36$.

Because 12 < 20 < 36, the answer is reasonable.



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



- **9.** A local event planner wants to cover a circular region with mud for an obstacle course. The region has a circumference of about 157 feet. The cost to cover 1 square foot with mud is \$1.50. Approximate the cost to cover the region with mud.
- **10. DIG DEEPER** A manufacturer recommends that you use a frying pan with a radius that is within 1 inch of the radius of your stovetop burner. The area of the bottom of your frying pan is 25π square inches. The circumference of your cooktop burner is 9π inches. Does your frying pan meet the manufacturer's recommendation?



Solve and check.

9.2 Practice



Review & Refresh

Find the circumference of the object. Use 3.14 or $\frac{22}{7}$ for π .



9 cm



You spin the spinner shown.

- 3. How many possible outcomes are there?
- 4. In how many ways can spinning an odd number occur?

Concepts, Skills, & Problem Solving

ESTIMATING AN AREA Use the grid to estimate the area of the circle. (See Exploration 1, p. 369.)

- 5. diameter of 3 centimeters
- 6. diameter of 1.6 inches





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FINDING AN AREA Find the area of the circle. Use 3.14 or $\frac{22}{7}$ for π .





- **13. WP YOU BE THE TEACHER** Your friend finds the area of a circle with a diameter of 7 meters. Is your friend correct? Explain.
- **14. (MP) MODELING REAL LIFE** The diameter of a flour tortilla is 12 inches. What is the total area of two tortillas?
- **15. WP MODELING REAL LIFE** The diameter of a coaster is 7 centimeters. What is the total area of five coasters?
- **16. WP PROBLEM SOLVING** The Hillsboro Inlet Lighthouse lights up how much more area than the Jupiter Inlet Lighthouse?



FINDING THE AREA OF A SEMICIRCLE Find the area of the semicircle.



- **20. MODELING REAL LIFE** The plate for a microscope has a circumference of 100π millimeters. What is the area of the plate?
 - **21. MODELING REAL LIFE** A dog is leashed to the corner of a house. How much running area does the dog have? Explain how you found your answer.
 - **22. (D) REASONING** Target A has a circumference of 20 feet. Target B has a diameter of 3 feet. Both targets are the same distance away. Which target is easier to hit? Explain your reasoning.
- **23. MODELING REAL LIFE** A circular oil spill has a radius of 2 miles. After a day, the radius of the oil spill increases by 3 miles. By how many square miles does the area of the oil spill increase?
- **24. FINDING AN AREA** Find the area of the circle in square yards.



- **25. WP REPEATED REASONING** What happens to the circumference and the area of a circle when you double the radius? triple the radius? Justify your answer.
- **26. CRITICAL THINKING** Is the area of a semicircle with a diameter of *x* greater than, *less than*, or *equal to* the area of a circle with a diameter of $\frac{1}{2}x$? Explain.