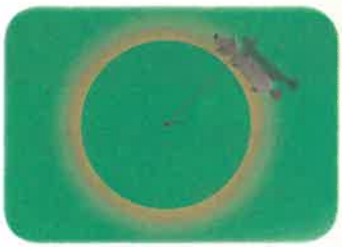
Lesson 2

Area of Circles

Real-World Link

Pets Adrienne bought an 8-foot leash for her dog.

1. Adrienne wants to find the distance the dog runs when it runs one circle with the leash fully extended. Should she calculate the circumference or area? Explain.



2. Suppose she wants to find the amount of running room the dog has with the leash fully extended. Should she calculate the circumference or area? Explain.

3. Describe a real-world situation that would involve finding the area of a circle.

4. Describe a real-world situation that would involve finding the circumference of a circle.

Essential Question

HOW do measurements help you describe real-world objects?

Vocabulary

semicircle

Common Core State Standards

Content Standards
7.G.4

Mathematical Practices
1, 3, 4

Which MP Mathematical Practices did you use? Shade the circle(s) that applies.

① Persevere with Problems	⑤ Use Math Tools
② Reason Abstractly	⑥ Attend to Precision
③ Construct an Argument	⑦ Make Use of Structure
④ Model with Mathematics	⑧ Use Repeated Reasoning

Key Concept

Find the Area of a Circle

Words The area A of a circle equals the product of π and the square of its radius r.

Symbols $A = \pi r^2$

Model

Work Zone

Examples

Tutor

1. **Find the area of the circle. Use 3.14 for π.**

Estimate $3 \times 2 \times 2 = 12$

$A = \pi r^2$ Area of a circle

$A \approx 3.14 \cdot 2^2$ Replace r with 2.

$A \approx 3.14 \cdot 4$ $2^2 = 2 \cdot 2$ or 4

$A \approx 12.56$ Multiply.

Check for Reasonableness $12.56 \approx 12$ ✓

The area of the circle is approximately 12.56 square inches.

2. **Find the area of a circle with a radius of 14 centimeters. Use $\frac{22}{7}$ for π.**

Estimate $3 \times 14 \times 14 = 588$

$A = \pi r^2$ Area of a circle

$A \approx \frac{22}{7} \cdot 14^2$ Replace π with $\frac{22}{7}$ and r with 14.

$A \approx \frac{22}{7} \cdot 196$ $14^2 = 14 \cdot 14$ or 196

$A \approx \frac{22}{\cancel{7}_{1}} \cdot \cancel{196}^{28}$ Divide by the GCF, 7.

$A \approx 616$ Multiply.

Check for Reasonableness $616 \approx 588$ ✓

The area of the circle is approximately 616 square centimeters.

STOP and Reflect

Cross out the formula that is not used for finding the area of a circle.

$A = \pi r^2$ $A = 3.14r^2$

$A = \frac{22}{7}r^2$ $A = \frac{1}{2}bh$

Got it? **Do this problem to find out.**

Show your work.

a. Find the area of a circle with a radius of 3.2 centimeters. Round to the nearest tenth.

a. _____

Example

Tutor

3. **Find the area of the face of the Virginia quarter with a diameter of 24 millimeters. Use 3.14 for π. Round to the nearest tenth if necessary.**

The radius is $\frac{1}{2}(24)$ or 12 millimeters.

$A = \pi r^2$ Area of a circle

$A \approx 3.14 \cdot 12^2$ Replace r with 12.

$A \approx 452.16$ Multiply.

The area is approximately 452.2 square millimeters.

Got it? **Do this problem to find out.**

b. The bottom of a circular swimming pool with a diameter of 30 feet is painted blue. How many square feet are blue?

Show your work.

b. _____

Calculating with π

When evaluating expressions involving π, using the π key on a calculator will result in a different approximation.

Area of Semicircles

A **semicircle** is half of a circle. The formula for the area of a semicircle is $A = \frac{1}{2}\pi r^2$.

Example

Tutor

4. **Find the area of the semicircle. Use 3.14 for π. Round to the nearest tenth.**

$A = \frac{1}{2}\pi r^2$ Area of a semicircle

$A \approx \frac{1}{2}(3.14)8^2$ Replace r with 8.

$A \approx 0.5(3.14)(64)$ $8^2 = 8 \cdot 8$ or 64

$A \approx 100.5$ Simplify.

The area of the semicircle is approximately 100.5 square inches.

Got it? **Do this problem to find out.**

c. Find the approximate area of a semicircle with a radius of 6 centimeters.

c. _____

Example

5. **On a basketball court, there is a semicircle above the free-throw line that has a radius of 6 feet. Find the area of the semicircle. Use 3.14 for π. Round to the nearest tenth.**

$A = \frac{1}{2}\pi r^2$ Area of a semicircle

$A \approx 0.5(3.14)(6^2)$ Replace π with 3.14 and r with 6.

$A \approx 0.5(3.14)(36)$ $6^2 = 6 \cdot 6$ or 36

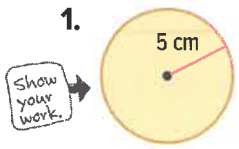
$A \approx 56.5$ Multiply.

So, the area of the semicircle is approximately 56.5 square feet.

Guided Practice

Find the area of each circle. Round to the nearest tenth. Use 3.14 or $\frac{22}{7}$ for π. (Examples 1–3)

1.



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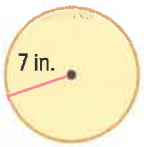
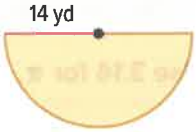


3. diameter = 16 m

4. Rondell draws the semicircle shown at the right. What is the area of the semicircle?

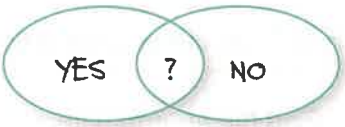
Use 3.14 for π. (Examples 4 and 5)



5. **Building on the Essential Question** Name one way the circumference and area of a circle are the same and one way they are different.

Rate Yourself!

Are you ready to move on? Shade the section that applies.



For more help, go online to access a Personal Tutor.

Name _____ My Homework _____

Independent Practice

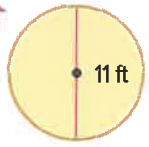
Go online for Step-by-Step Solutions eHelp

Find the area of each circle. Round to the nearest tenth. Use 3.14 or $\frac{22}{7}$ for π. (Examples 1–3)

1. Show your work.

2.

3



4. diameter = 10.5 in.

5. radius = 6.3 mm

6. radius = $3\frac{1}{4}$ yd

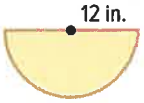
7. Refer to the pets problem at the beginning of this lesson. Find the area, to the nearest tenth, of grass that Adrianne's dog may run in if the leash is 9 feet long. (Example 3) _____

8. A rotating sprinkler that sprays water at a radius of 11 feet is used to water a lawn. Find the area of the lawn that is watered. Use 3.14 for π.

(Example 3) _____

Find the area of each semicircle. Round to the nearest tenth. Use 3.14 for π. (Example 4)

9



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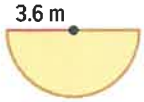

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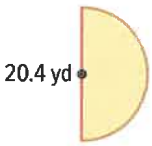


12. The tunnel opening shown is a semicircle. Find the area, to the nearest tenth, of the opening of the tunnel enclosed by the semicircle. (Example 5)

13. **Justify Conclusions** Harry's Pizzeria is having a sale on medium and large pizzas. Medium pizzas are 10 inches in diameter and cost $7.99. Large pizzas are 14 inches in diameter and cost $14.99. Which size pizza is the better deal? Explain. (*Hint*: Find the cost per square inch of each pizza.)

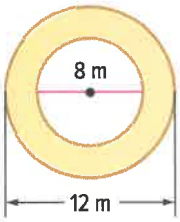
H.O.T. Problems Higher Order Thinking

14. **Model with Mathematics** Write a real-world problem that involves finding the area of two circles. Then solve your problem.

15. **Reason Inductively** If the length of the radius of a circle is doubled, how does that affect the circumference and area? Explain.

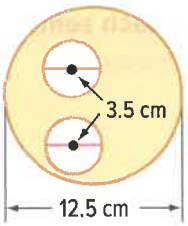
Persevere with Problems Find the area of the shaded region in each figure. Round to the nearest tenth.

16.

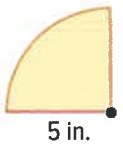


17.

18.



19. **Persevere with Problems** Explain how you could find the area of the quarter circle shown at the right. Then write a formula that could be used to find the area of a quarter circle and use the formula to find the area to the nearest tenth.



Name _____ My Homework _____

Extra Practice

Find the area of each circle. Round to the nearest tenth. Use 3.14 or $\frac{22}{7}$ for π.

20.

$A = \pi r^2$

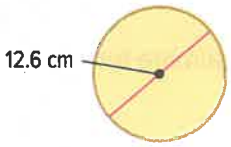
$A = 3.14 \cdot 4.2^2$

$A = 55.4 \text{ m}^2$

Homework Help

$3.14 \times 4.2 \times 4.2 = 55.4 \text{ m}^2$

21.



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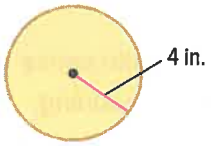


23. diameter = 10.8 yd

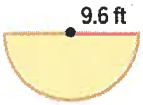
24. radius = $3\frac{4}{5}$ ft

25. radius = 9.3 mm

26. Find the area of the Girl Scout patch shown if the diameter is 1.25 inches. Round to the nearest tenth.

Find the area of each semicircle. Round to the nearest tenth. Use 3.14 for π.

27.



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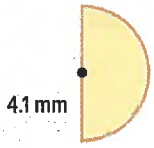


29.

30. A window that is in the shape of a semicircle has a diameter of 28 inches. Find the area of the window. Round to the nearest tenth.

31. MP **Justify Conclusions** Which has a greater area, a triangle with a base of 100 feet and a height of 100 feet or a circle with diameter of 100 feet? Justify your selection.

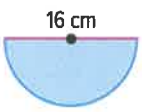
32. A radio station sends a signal in a circular area with an 80-mile radius. Find the approximate area in square kilometers that receives the signal. (*Hint*: 1 square mile ≈ 2.6 square kilometers)

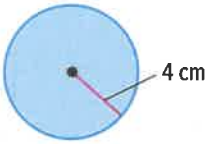
Power Up! Common Core Test Practice

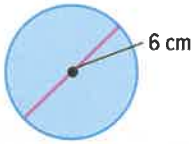
33. A large pizza at a restaurant has the dimensions shown. Find the area of the pizza. Use $\frac{22}{7}$ for π.

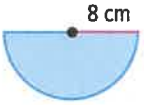
Why does it make sense to use $\frac{22}{7}$ as the estimate for π? Explain your reasoning.

34. Refer to the figures shown below. Which figures have the same area? Select all that apply.

☐ 

☐ 

☑ 

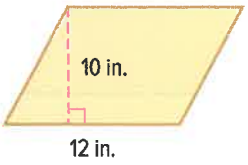
☑ 

Common Core Spiral Review

35. A frame for a collage of pictures is in the shape of a trapezoid. The two bases are 15 inches and 20 inches. The height of the trapezoid is 12 inches. What is the area enclosed by the frame? 6.G.1 _____

Find the area of each parallelogram. Round to the nearest tenth if necessary. 6.G.1

36.



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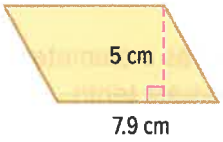

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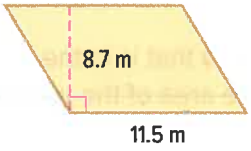

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