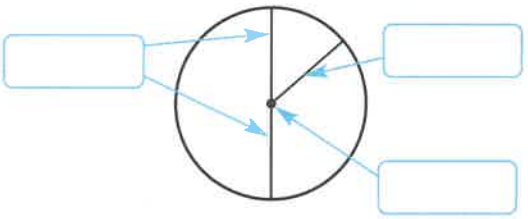
Lesson 1

Circumference

Vocabulary Start-Up

A **circle** is the set of all points in a plane that are the same distance from a point, called the **center**. The **circumference** is the distance around a circle. The **diameter** is the distance across a circle through its center. The **radius** is the distance from the center to any point on the circle.

Fill in each box with one of the following terms: *center*, *diameter*, and *radius*.



Real-World Link

1. The table shows the approximate measurements of two sizes of hula hoops.

Size	Radius (in.)	Diameter (in.)	Circumference (in.)
child	14	28	88
adult	20	40	126

   a. Describe the relationship between the diameter and radius of each hula hoop. _____

   b. Describe the relationship between the circumference and diameter of each hula hoop. _____

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

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

Essential Question

HOW do measurements help you describe real-world objects?

Vocabulary

circle
center
circumference
diameter
radius
pi π

Common Core State Standards

Content Standards
7.G.4

MP Mathematical Practices
1, 3, 4, 6, 8

Key Concept

Radius and Diameter

Words The diameter d of a circle is twice its radius r. The radius r of a circle is half of its diameter d.

Symbols $d = 2r$ $r = \frac{d}{2}$

Work Zone

Examples

Tutor

1. **The diameter of a circle is 14 inches. Find the radius.**

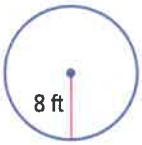
$r = \frac{d}{2}$ Radius of circle

$r = \frac{14}{2}$ Replace d with 14.

$r = 7$ Divide.

The radius is 7 inches.

2. **The radius of a circle is 8 feet. Find the diameter.**



$d = 2r$ Diameter of circle

$d = 2 \cdot 8$ Replace r with 8.

$d = 16$ Multiply.

The diameter is 16 feet.

Got it? **Do these problems to find out.**

Find the radius or diameter of each circle with the given dimension.

a. $d = 23$ cm

b. $r = 3$ in.

c. $d = 16$ yd

d. $r = 5.2$

STOP and Reflect

The diameter of a circle is 36 inches. Circle the radius.

72 in. 18 in.

Show your work.

a. _____

b. _____

c. _____

d. _____

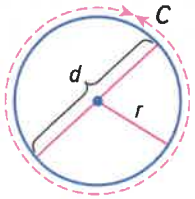
Circumference

Key Concept

Words The circumference of a circle is equal to π times its diameter or π times twice its radius.

Symbols $C = \pi d$ or $C = 2\pi r$

Model



In the Inquiry Lab, you learned that $\frac{C}{d} \approx 3$. The exact ratio is represented by the Greek letter **π (pi)**. The value of π is 3.1415926... . The decimal never ends, but it is often approximated as 3.14.

Another approximation for π is $\frac{22}{7}$. Use this value when the radius or diameter is a multiple of 7 or has a multiple of 7 in its numerator if the radius is a fraction.

Estimation
To estimate the circumference of a circle, you can use 3 for π since $\pi \approx 3$.

Example

Tutor

3. **Find the circumference of a circle with a radius of 21 inches.**

Since 21 is a multiple of 7, use $\frac{22}{7}$ for π.

$C = 2\pi r$ Circumference of a circle

$C \approx 2 \cdot \frac{22}{7} \cdot 21$ Replace π with $\frac{22}{7}$ and r with 21.

$C \approx 2 \cdot \frac{22}{\cancel{7}_{1}} \cdot \frac{\cancel{21}^{3}}{1}$ Divide by the GCF, 7.

$C \approx 132$ Simplify.

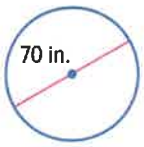
The circumference of the circle is about 132 inches.

Got it? **Do these problems to find out.**

Show your work.

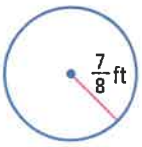
Find the circumference of each circle. Use $\frac{22}{7}$ for π.

e.



e. _____

f.



f. _____

Example

4. **Big Ben is a famous clock tower in London, England. The diameter of the clock face is 23 feet. Find the circumference of the clock face. Round to the nearest tenth.**

$C = \pi d$ Circumference of a circle

$C \approx 3.14(23)$ Replace π with 3.14 and d with 23.

$C \approx 72.2$ Multiply.

So, the distance around the clock is about 72.2 feet.

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

g. A circular fence is being placed to surround a tree. The diameter of the fence is 4 feet. How much fencing is used? Use 3.14 for π. Round to the nearest tenth if necessary.

Show your work.

g. _____

Guided Practice

Find the radius or diameter of each circle with the given dimension.
(Examples 1 and 2)

1. $d = 3$ m _____

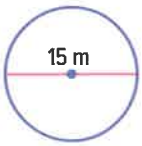
Show your work.

2. $r = 14$ ft _____

3. $d = 20$ in. _____

Find the circumference of each circle. Use 3.14 or $\frac{22}{7}$ for π. Round to the nearest tenth if necessary. (Examples 3 and 4)

4.



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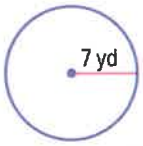
5.



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6. **Building on the Essential Question** A circle has a circumference of about 16.3 meters and a diameter of about 5.2 meters. What is the relationship between the circumference and diameter of this circle?

_____

_____

_____

Rate Yourself!

How confident are you about finding the circumference? Check the box 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 radius or diameter of each circle with the given dimensions.
(Examples 1 and 2)

1. $d = 5$ mm _____

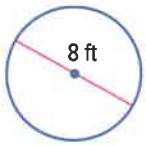
2. $d = 24$ ft _____

3. $r = 17$ cm _____

Show your work.

Find the circumference of each circle. Use 3.14 or $\frac{22}{7}$ for π. Round to the nearest tenth if necessary. (Example 3)

4.



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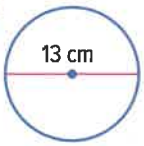
5.



_____

6.

_____

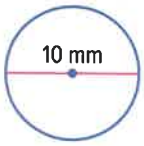
7. The largest tree in the world by volume is in Sequoia National Park. The diameter at the base is 36 feet. If a person with outstretched arms can reach 6 feet, how many people would it take to reach around the base of the tree? (Example 4)

_____

8. The Belknap shield volcano is located in the Cascade Range in Oregon. The volcano is circular and has a diameter of 5 miles. What is the circumference of this volcano. Round your answer to the nearest tenth? (Example 4)

_____

9. MP **Be Precise** Refer to the circle at the right.



a. Find the circumference of the circle. Use 3 as the estimate of π.

_____

b. Find the circumference of the circle using 3.14 for π.

_____

c. Another estimate of π is 3.14159. Find the circumference using this estimate.

_____

d. What do you notice about the estimate used for π and the circumference of the circle?

_____

_____

Copy and Solve **For Exercises 10–14, show your work on a separate piece of paper.**

Find the diameter given each circumference. Use 3.14 for π.

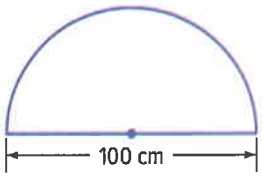
10. a satellite dish with a circumference of 957.7 meters

11. a basketball hoop with a circumference of 56.52 inches

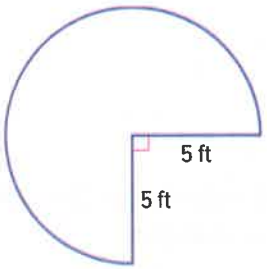
12. a nickel with a circumference of about 65.94 millimeters

Find the distance around each figure. Use 3.14 for π.

13.



14.



H.O.T. Problems Higher Order Thinking

15. MP **Justify Conclusions** Determine if the circumference of a circle with a radius of 4 feet will be greater or less than 24 feet. Explain.

16. MP **Model with Mathematics** Draw and label a circle that has a diameter more than 5 inches, but less than 10 inches. Estimate its circumference and then find its circumference using a calculator. Compare your results.

17. MP **Persevere with Problems** Analyze how the circumference of a circle would change if the diameter was doubled. Provide an example to support your explanation.

18. MP **Justify Conclusions** Determine whether the relationship between the circumference of a circle and its diameter is a direct variation. If so, identify the constant of proportionality. Justify your response.

Name _____ My Homework _____

Extra Practice

Find the radius or diameter of each circle with the given dimensions.

19. $d = 7$ in. 3.5 in.

Homework Help

$r = \frac{d}{2}$

$r = \frac{7}{2}$ or 3.5

20. $d = 30$ m _____

21. $r = 36$ ft _____

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

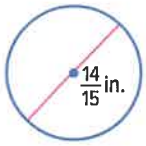
22.

_____

23.

_____

24.



_____

25. a button with a radius of 21 millimeters

_____

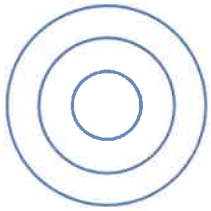
26. a dunk tank with a radius of 36 inches

_____

27. The diameter of a music CD is 12 centimeters. Find the circumference of a CD to the nearest tenth. _____

28. At a local park, Sara can choose between two circular paths to walk. One path has a diameter of 120 yards, and the other has a radius of 45 yards. How much farther can Sara walk on the longer path than the shorter path if she walks around the path once? _____

29. MP **Identify Repeated Reasoning** The diagram at the right is made up of circles with the same center. The innermost circle has a diameter of 1 unit. Each circle moving outward has a diameter one more unit than the previous. Without calculating, how much longer is the circumference of each circle? _____



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Power Up! Common Core Test Practice

30. A bicycle tire has a radius of 12.5 inches. Select values to complete the equation below to find the circumference of the wheel. Use 3.14 for π.

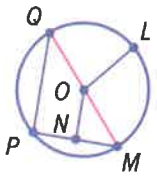
0.5	4
2	12.5
3.14	25

$C \approx$ [ ] $\times$ [ ] $\times$ [ ]

How far does the tire roll in one complete revolution?

[ ]

31. A circle with center at point O is shown. Determine if each statement is true or false.

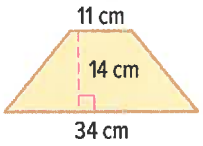


a. $\overline{ON}$ is a radius of the circle.	☐ True	☐ False
b. $\overline{QM}$ is a diameter of the circle.	☑ True	☐ False
c. To find the circumference, multiply the length of $\overline{OL}$ by π.	☐ True	☐ False

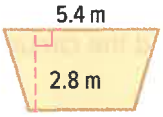
Common Core Spiral Review

Find the area of each trapezoid. 6.G.1

32.



33.



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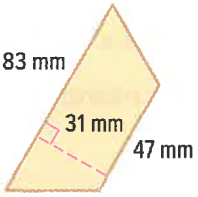

35. Find the area of glass used on the side of the parallelogram-shaped building shown. 6.G.1

36. Find the area of a triangle with a base of 25 inches and a height of 30 inches. 6.G.1