# Circumference of Circles

I Can... find the circumferences of circles, given the radius or diameter, using the formulas for the circumference of a circle, and find the radius or diameter of a circle, given its circumference.

Learn Radius and Diameter

A **circle** is the set of all points in a plane that are the same distance from a point, called the **center**. 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.

Label the parts of the circle with the correct terms.

center   diameter   radius

diameter — radius — center
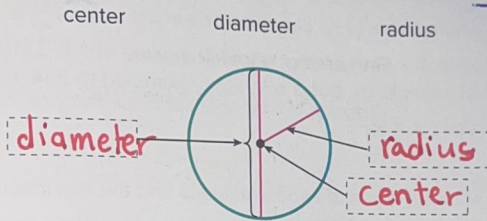
Because the radius of a circle is the distance from the center to any point on the circle, the length of the diameter is always twice the radius. It also means that the radius is half the diameter.

$d = 2r$
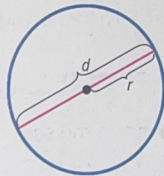
$r = \frac{1}{2}d$

What Vocabulary Will You Learn?

center
circle
circumference
diameter
pi (π)
radius

(handwritten, Arabic) اجابل المستقبل

Mrs / Aya

To find the ~~radius~~ circumfrence by Giving radius
$$C = 2\pi r$$
If he gives Diameter we use
$$C = \pi d$$

To find $r = \dfrac{C}{2\pi}$

$d = \dfrac{C}{\pi}$

Talk About It!

What equation can be used to find the diameter d of a circle given the radius r?

$d = 2r$

Talk About It!

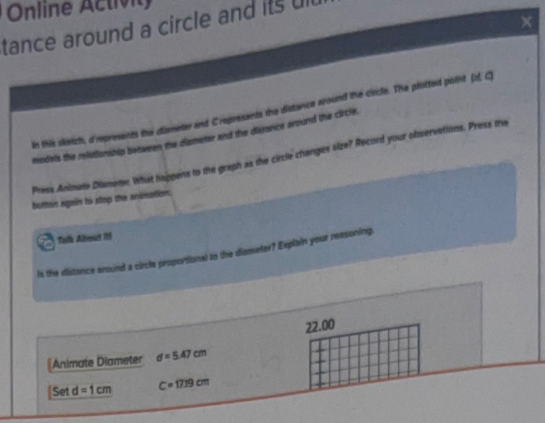What equation can be used to find the radius r of a circle given the diameter d?

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

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$d = 2r$

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

Explore The Distance Around a Circle

Online Activity You will explore the relationship between the distance around a circle and its diameter.

In this sketch, d represents the diameter and C represents the distance around the circle. The plotted point (d, C) models the relationship between the diameter and the distance around the circle.

Press Animate Diameter. What happens to the graph as the circle changes size? Record your observations. Press the button again to stop the animation.

Talk About It!
Is the distance around a circle proportional to the diameter? Explain your reasoning.

[Animate Diameter] d = 5.47 cm
[Set d = 1 cm] C = 17.19 cm

22.00

Learn Circumference of Circles

Circumference is the distance around a circle. The circumference of a circle is proportional to its diameter. The exact ratio of $\dfrac{C}{d}$ is represented by the Greek letter π **(pi)**. The value of π is 3.1415926... The decimal never ends, but is often approximated to **3.14**. Another approximation for π is $\dfrac{22}{7}$.

The table shows the use of two formulas to find the circumference of a circle.

Words	Model
To find the circumference C of a circle, multiply π by its diameter, d or π by two times its radius, r.	
Symbols	
$C = \pi d$ or $C = 2\pi r$	

Talk About It!
When you use 3.14 or $\dfrac{22}{7}$ to find the circumference of a circle, will it be the exact circumference or an approximation? Justify your response.

Because 3.14 or $\dfrac{22}{7}$ are approximate value for π, the circumference is an aproximation

Example 1 Find the Circumference Given the Diameter

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. Use 3.14 for π. Round to the nearest hundredth if necessary.

Because you are given the diameter, use the formula $C = \pi d$.

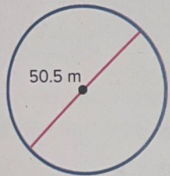|	
$C = \pi d$	Circumference of a circle
$C = \pi(23)$	Replace d with 23.
$C = 23\pi$	Simplify. This is the *exact* circumference.
$C \approx 23(3.14)$	Replace π with 3.14.
$C \approx 72.22$	Simplify. This is the *approximate* circumference.

So, the distance around the clock face is about __72.22__ feet.

(handwritten) $C = \pi d$
I am given diameter
$C = 2\pi r$
I am given Radius

Talk About It!
In the fourth line of the solution, why was the equal sign (=) changed to an approximately equal to symbol (≈)?

(handwritten) Because 3.14 we used for π. The circumfrance is an approximation and Not an exact value.

Check

The Niagara SkyWheel, which overlooks Niagara Falls, Canada, has a diameter of 50.5 meters. Find the circumference of the Niagara SkyWheel. Use 3.14 for π. Round to the nearest hundredth if necessary.

50.5 m

Show your work here

(handwritten)
$C = \pi d$
$C = 3.14 \times 50.5$
$C = 157.57\, m$

مسح اقل الوقت
Mrs / Aya

Go Online You can complete an Extra Example online.

Example 2 Find the Circumference Given the Radius

Find the circumference of a circle with a radius of 21.2 inches. Use 3.14 for π. Round to the nearest hundredth if necessary.

Think About It!

What formula can you use to find the circumference if you know the radius?

$$C = 2\pi r$$

Because you are given the radius, use the formula $C = 2\pi r$.

$C = 2\pi r$	Circumference of a circle
$C = 2\pi \boxed{21.2}$	Replace r with 21.2.
$C = \boxed{42.4\pi}$	Simplify. This is the *exact* circumference.
$C \approx 42.4 \boxed{3.14}$	Replace π with 3.14.
$C \approx \boxed{133.136}$	Simplify. This is the *approximate* circumference.

So, the circumference of a circle with a radius of 21.2 inches is about 133.14 inches.

Check

Find the circumference of a circle with a radius of 0.9 centimeter. Use 3.14 for π. Write your answer as a decimal rounded to the nearest hundredth.

Show your work here

$$C = 2\pi r$$
$$C = 2 \times 3.14 \times 0.9 \approx 5.65 \text{ cm}$$

▶ Go Online You can complete an Extra Example online.

Talk About It!

Why are the units of the circumference given as inches and not square inches or cubic inches?

Pause and Reflect

Compare and contrast the concepts of perimeter and circumference.

Record your observations here

[handwritten notes in left margin: Mrs/ Aya Hamed]

Learn Use Circumference to Find Missing Dimensions

You can use the formula for the circumference of a circle to find the diameter or radius, given the circumference. Rewrite the circumference formula in terms of d or r using the properties of equality.

$C = \pi d$

$C = 2\pi r$
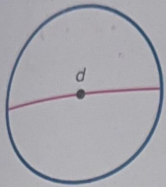
$C = \pi d$	Circumference of a circle
$\frac{C}{\pi} = \frac{\pi d}{\pi}$	Division Property of Equality
$\frac{C}{\pi} = d$	Simplify.
$d = \frac{C}{\pi}$	

$C = 2\pi r$	
$\frac{C}{2\pi} = \frac{2\pi r}{2\pi}$	
$\frac{C}{2\pi} = r$	
$r = \frac{C}{2\pi}$	

Talk About It!

Why is there a 2 in the denominator for the equation to find the radius, but not in the equation to find the diameter?

[Handwritten notes:]
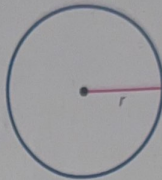
$C = 2\pi r$

To find the radius you divide each side by 2π

$\therefore$ there is a 2 in the denominator

$C = \pi d$ to find diameter you divid by π Not 2π

Example 3 Find the Diameter Given the Circumference

One of the largest water fountains in the world, Singapore's Fountain of Wealth, consists of a circular bronze ring that has a circumference of 66 meters.

Find the approximate diameter of the fountain's bronze ring. Use 3.14 for π. Round to the nearest hundredth.

Because you need to find the diameter, use the formula $d = \frac{C}{\pi}$.

$d = \frac{C}{\pi}$	Diameter of a circle
$d \approx \frac{66}{3.14}$	Replace π with 3.14 and C with 66.
$d \approx 21.02$	Simplify.

So, the approximate diameter of the fountain's bronze ring is about 21.02 meters.

Think About It!

What is a good estimate for the diameter? Explain how you calculate that estimate.

Talk About It!

How does the solution compare to your estimate?

Check

Find the approximate diameter of a basketball hoop that has a circumference of 56.52 inches. Use 3.14 for π. Round to the nearest hundredth if necessary.

Show your work here

$$C = \pi d$$

$$d = \frac{C}{\pi} = \frac{56.52}{\pi} = \boxed{18 \text{ in}}$$

Example 4 Find the Radius Given the Circumference

Find the approximate radius of a circle with a circumference of 70.82 inches. Use 3.14 for π. Round to the nearest hundredth.

Because you need to find the radius, use the formula $r = \frac{C}{2\pi}$.

$$r = \frac{C}{2\pi} \qquad \text{Radius of a circle}$$

$$r \approx \frac{70.82}{2(3.14)} \qquad \text{Replace } \pi \text{ with 3.14 and } C \text{ with 70.82.}$$

$$r \approx 11.28 \qquad \text{Simplify.}$$

So, the approximate length of the radius of a circle that has a 70.82-inch circumference is about __11·28__ inches.

I estimate that the radius of the circle was About $70 \div 2(3)$ Because $11.28 \approx$ 11.7 is reasnable

Check

Find the approximate radius of a circle with a circumference of 7.92 centimeters. Use 3.14 for π. Round to the nearest hundredt

Show your work here

$$r = \frac{C}{2\pi} \qquad r = \frac{7.92}{2 \times 3.14}$$

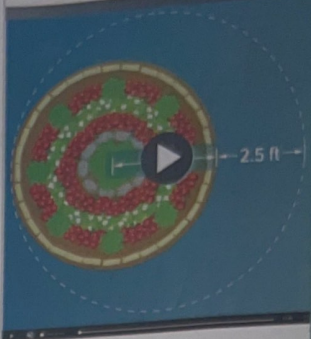$$\frac{7.92}{6.28} \qquad r \approx 1.2611$$

$$\boxed{r \approx 1.26}$$

Go Online You can complete an Extra Example online.

🅑 Apply Gardening

Kamma has a circular garden with a radius of 3 feet. The diameter of her neighbor's circular garden is 2.5 feet longer than the diameter of Kamma's garden. How much landscape edging does her neighbor need to border her garden? Use 3.14 for π. Round to the nearest hundredth.

—3 ft— —2.5 ft—

—2.5 ft—
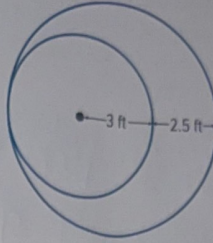
1 What is the task?

Make sure you understand exactly what question to answer or problem to solve. You may want to read the problem three times. Discuss these questions with a partner.

First Time Describe the context of the problem, in your own words.
Second Time What mathematics do you see in the problem?
Third Time What are you wondering about?

2 How can you approach the task? What strategies can you use?

Record your thoughts

                                          radius
Neighbor's diameter = 2.5 + 3 (2) → diameter
                    = 8.5

3 What is your solution?

Use your strategy to solve the problem.

Show your work here

neighbor circumfranc = πd

3.14 × 8.5

= 26.69 ft

Talk About It!
Is it possible to find the circumference of the neighbor's garden using only radius measurements rather than finding the diameters? Explain your reasoning.

yes, Becaus the diameter of neighbour's garden is 2.5 feet longer than the diameter of Kamma's garden

4 How can you show your solution is reasonable?

🖊 **Write About It!** Write an argument that can be used to defend your solution.

أجيال المستقبل التعليمية

Mrs / Aya hamed

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Check

A nickel has a diameter that is 2.16 millimeters longer than the diameter of a penny. If the radius of a penny is 9.525 millimeters, what is the circumference of a nickel? Use 3.14 for π. Round to the nearest tenth.

(handwritten in margin, Arabic) احسب محيط النيكل

(handwritten in margin) Mrs/Aya
0501717562

Show your work

$\text{Nickel}(d) = 2.16 + \text{penny dimeter}$

Penny radius = 9.525

$\text{Penny diameter} = 2(9.525)$
$\qquad = 19.05$

$\text{Nickel diameter} = 2.16 + 19.05$
$\qquad\qquad\qquad = 21.21$

$C = \pi d$

3.14×21.21

$C \approx 66.6 \, mm$

> **Go Online** You can complete an Extra Example online.

Pause and Reflect

Create a graphic organizer that will help you choose when to use the diameter or radius to find the circumference.
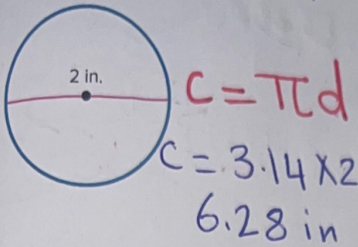
Record your observations here

Name _____ أجياب السقيفة _____ Period Ma)Ayq Date _____

Practice

1. Find the circumference of the watch face. Use 3.14 for π. Round to the nearest hundredth if necessary. (Example 1)

2 in.

$$C = \pi d$$
$$C = 3.14 \times 2$$
$$6.28 \text{ in}$$

2. A circular fence is being used to surround a dog house. How much fencing is needed to build the fence? Use 3.14 for π. Round to the nearest hundredth if necessary. (Example 1)

14.5 ft

$$C = \pi d$$
$$C = 3.14 \times 14.5$$
$$45.53 \text{ ft}$$
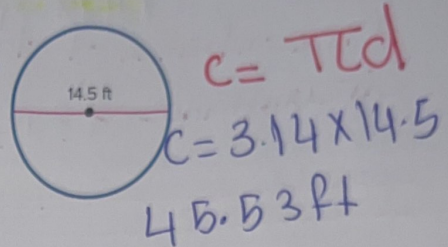
3. Find the circumference of a circle with a radius of $31\frac{1}{2}$ yards. Use 3.14 for π. Write your answer as a decimal rounded to the nearest hundredth. (Example 2)

$$C = 2\pi r$$
$$C = 2 \times 3.14 \times 31.5$$
$$= 197.82 \text{ yd}$$

4. Find the circumference of a circle with a radius of 4.4 inches. Use 3.14 for π. Round to the nearest hundredth if necessary. (Example 2)

$$C = 2\pi r$$
$$C = 2 \times 3.14 \times 4.4$$
$$= 27.632 \text{ in}$$

5. The world's largest flower, the Rafflesia, has a circumference of 286 centimeters. Find the approximate diameter of the flower. Use 3.14 for π. Round to the nearest hundredth if necessary. (Example 3)

$$d = \frac{c}{\pi} \quad d = \frac{286}{3.14}$$
$$91.082 \approx 91.08 \text{ cm}$$

6. A helicopter pad has a circumference of $47\frac{1}{2}$ yards. Find the approximate diameter of the helicopter pad. Use 3.14 for π. Write your answer as a decimal rounded to the nearest hundredth if necessary. (Example 3)

$$d = \frac{c}{\pi} \quad d = \frac{47.5}{3.14}$$
$$= 15.127 \quad 15.13$$

7. Find the approximate radius of a circle with a circumference of 34.48 inches. Use 3.14 for π. Round to the nearest hundredth. (Example 4)

$$r = \frac{C}{2\pi} \quad \frac{34.48}{2 \times 3.14}$$
$$= 5.49$$

8. Equation Editor Find the approximate radius of a circle with a circumference of 198 centimeters. Use 3.14 for π. Round to the nearest hundredth.
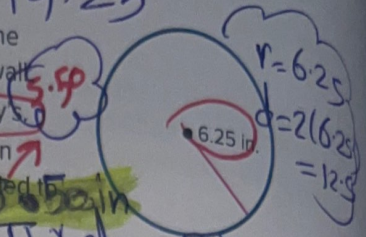
$$r = \frac{c}{2\pi} \quad \frac{198}{2(3.14)}$$

←	→	↑	↓	⊗
1	2	3
4	5	6
7	8	9
0	.	−

$$r = 31.528$$
$$r = 31.53$$

Lesson 12-1 • Circumference of Circles **765**

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Apply

[handwritten top] old sister diameter = $1\frac{3}{4}$ + poppy's diameter

$\frac{7}{4} + 2(6.25) = 14.25$

9. Poppy is using wire to make metal wall hangings that have the radius shown for her friends. Her older sister is making her wall hangings with a diameter that is $1\frac{3}{4}$ inches longer than Poppy's. How much more wire did her sister use per wall hanging than Poppy? Use 3.14 for π. Write your answer as a decimal rounded to the nearest hundredth.

[handwritten] $(14 + 14.5 - 39.25) = 5.59$ in

Circumfrance of old sister = $\pi \times d = 3.14 \times 14.25$
$= 44.745$

circumfrance of poppy = $\pi d = 3.14 \times 12.5 = 39.25$

[circle diagram handwritten] r = 6.25 d = 2(6.25) = 12.5 6.25 in.

10. Arun is making a bubble wand out of wire. The circular part of the wand has the radius shown. The diameter of his friend's wand is 4.5 millimeters shorter than the diameter of Arun's wand. How much wire did his friend need to make the circular part of his wand? Use 3.14 for π. Round to the nearest hundredth.
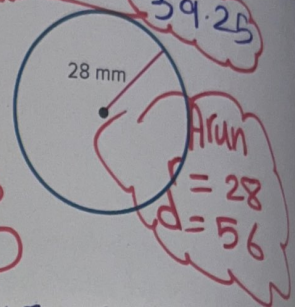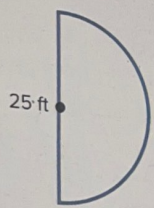
his friend diameter = Arun's diameter − 4.5
$d = 56 - 4.5 = 51.5$

his friend circumfrance = πd 3.14×51.5
$= 161.71$ mm

[circle diagram handwritten] 28 mm Arun = 28 d = 56

11. **MP Persevere with Problems** Find the distance around the figure. Use 3.14 for π.
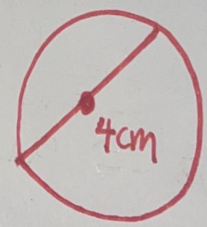
[figure: half-circle/D shape] 25 ft

$C = \frac{\pi d}{2} + d$

$\frac{3.14 \times 25}{2} + 25$

64.25 ft.

12. Draw and label a circle with a circumference between 10 and 15 centimeters. Label the length of the diameter.

[circle diagram handwritten] 4 cm

13. **MP Reason Abstractly** How would the circumference of a circle change if its radius was doubled? Provide an example to support your reasoning. The circumference would also double. ex a circle with a radius of 3 feet would have a circumfrance that is about 18 feet. When the radius is doubled to 6 feet, the circumfrance is about 36 feet.

14. **MP Justify Conclusions** Use mental math to determine if the circumference of a circle with a radius of 5 inches will be greater than or less than 30 inches. Write an argument that can be used to justify your solution. greater than, the radius of the circle is 5 inches, so the diameter is 5×2 or 10 inch since π is equal to a little more than 3 $18 \times 2 = 36$