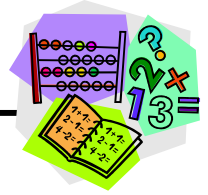
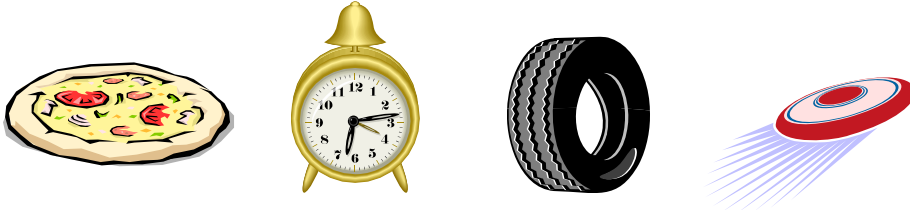


Circumference



What do a pizza, a clock, an automobile tire and a throwing disc have in common?



They are all **circular**!

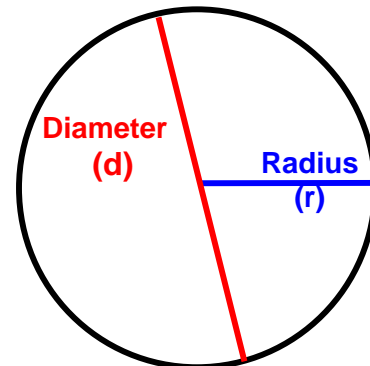
Circumference, **diameter** and **radius** can be measured and/or calculated for circles.

Circumference is the distance around the outside surface of a circle.

Diameter is the distance from a point along one edge of the circle, through the centre of the circle, to a point on the opposite side of the circle.

Radius is the distance from a point along the edge of the circle to the exact centre of the circle. Radius is half the value of the diameter.

Circumference (C)



Pi is a mathematical constant that demonstrates the relationship between the diameter and circumference of a circle. The symbol for pi is π



Early mathematicians who studied circles discovered that the circumference of circles divided by the diameter equals approximately **3.14**.

The value **3.14** is called **pi**, which is a mathematical constant common to all circles, no matter how big or small.

Calculating Circumference

The circumference of a circle can be calculated using two different formulas.

- If you know the diameter, use the formula:

$$C = \pi d \quad \text{Circumference equals pi times diameter}$$

- If you know the radius, use the formula:

$$C = \pi 2r \quad \text{Circumference equals pi times two times the radius}$$

The diameter is two times larger than the value of the radius as represented by the following:

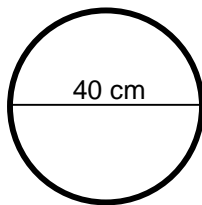
$$d = 2 \times r \quad \text{Diameter equals two times the radius}$$

Remember that πd is the same as $\pi \times d$ and $\pi 2r$ is the same as $\pi \times 2 \times r$.

Examples

Check out the following examples that show how to use both equations to calculate the circumference of circles.

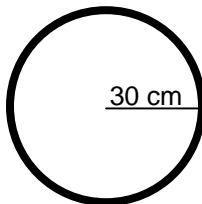
- A) A tire is 40 cm in diameter. What is the circumference of the tire?



$$\begin{aligned} C &= \pi \times d \\ &= 3.14 \times 40 \text{ cm} \\ &= 125.60 \text{ cm} \end{aligned}$$

The circumference of the tire is 125.60 cm.

- B) A bicycle tire has a radius of 30 cm. What is the circumference of the tire?



$$\begin{aligned} C &= \pi \times 2 \times r \\ &= 3.14 \times 2 \times 30 \text{ cm} \\ &= 188.40 \text{ cm} \end{aligned}$$

The circumference of the bicycle tire is 188.40 cm.

Do you notice that the units used for circumference, diameter and radius are the same?



Practice: Calculating Circumference

1. Locate and measure, using metric and imperial tools, the diameter and radius of a variety of circles in and around the school or community. With a partner, calculate the circumference of these circles.

2. Marcy cleaned out an old barrel to paint and decorate for her room. She painted the barrel and made a string of beads to glue to the barrel opening. If the diameter of the barrel was 56 centimetres, what was the length of string needed for the beads?

3. Brandon is helping paint the basketball circles on the floor of the gym. The circles must have a radius of 0.8 m. What will be the circumference of the circles Brandon will paint?

Calculating Diameter and Radius

The formulas for calculating the circumference of a circle can be rearranged to calculate the diameter and radius of a circle.

If you do not know the diameter, use [opposite operations](#) to isolate the diameter on one side of the equation.

$$C = \pi \times d$$

Divide each side of the equation by π to isolate d .

$$\frac{C}{\pi} = \frac{\pi \times d}{\pi}$$

Remember that $\frac{\pi}{\pi} = 1$.

Therefore, the diameter equals circumference divided by π .

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

If you do not know the radius, calculate diameter and divide by 2.

OR

Use [opposite operations](#) to isolate the radius on one side of the equation.

$$C = \pi \times 2 \times r$$

Divide by $\pi \times 2$

Remember that $\frac{\pi \times 2}{\pi \times 2} = 1$

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

Therefore, the radius is circumference divided by $\pi \times 2$, which can also be represented as 2π .

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

Examples

Check out the examples below that illustrate the use of equations to solve for diameter and radius.

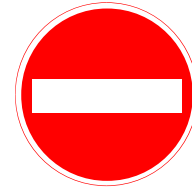
- A) Some tractors have tires with circumferences of 150 cm. What is the diameter of these tires, rounded to the nearest cm?



$$\begin{aligned}d &= C \div \pi \\ &= 150 \text{ cm} \div 3.14 \\ &= 48 \text{ cm}\end{aligned}$$

The diameter is 48 cm.

- B) A Do Not Enter traffic sign has a circumference of 60 cm. What is the radius of the sign?



$$\begin{aligned}r &= \frac{C}{\pi \times 2} \\ &= \frac{60 \text{ cm}}{3.14 \times 2} \\ &= \frac{60 \text{ cm}}{6.28} \\ &= 9.55, \text{ rounds to } 9.6 \text{ cm}\end{aligned}$$

The radius of the sign is approximately 9.6 cm.



Practice: Working with Circumference

1. Use a string, metre-stick, yardstick or other instruments to measure the circumference and diameter of several circular objects, such as a volleyball, pumpkin, dinner plate, basketball hoop, tire and steering wheel.
 - a) Divide the circumference by the diameter and record the answer in the column on the right.

Object	Circumference	$C \div d$	Diameter
1.			
2.			
3.			
4.			

- b) What value did you calculate in the right-hand column?
- c) Write a statement about the relationship between circumference and diameter.

2. Find the missing information. **Round** answers to the nearest tenth.

- a) A dime has a diameter of approximately 10 mm. Calculate its circumference.

- b) The minute hand of a clock is 20 cm long. Calculate how far the clock hand travels in one hour.

- c) Two circular car stereo speakers each have diameters of 8 inches. What is the size of the hole that must be cut for each speaker?

- d) The circumference of a round pond is 6.6 m. How long will the bridge be that goes from one side to the other and crosses at the middle of the pond?

- e) A farmer is building a circular shed for grain. If the circumference is $28\frac{1}{4}$ feet, what will the diameter be? What will the radius be?

- f) A person swings a ball attached to a rope in a circular motion. If the rope and ball are 1.5 m long, how far will the ball travel in a circular path with each swing?