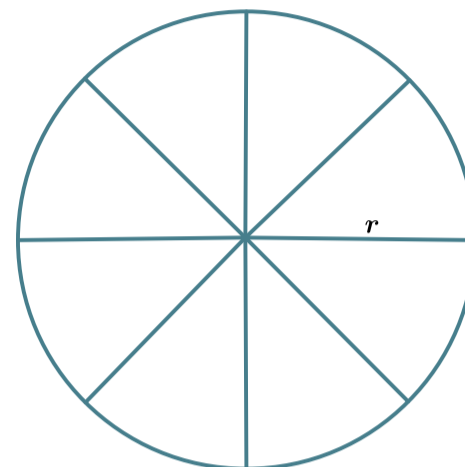# The Relationship Between Circumference and Area

You have learned how to find the distance around, or circumference, of a circle. Now, what happens if you wanted to determine the amount of square units inside a circle, or its **area**? Well, the formula is actually related to circumference! Keep reading to learn more.
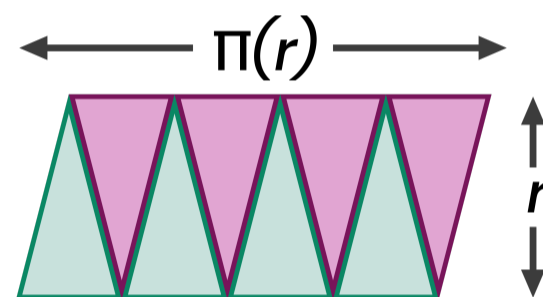
You are given a circle with a radius of r.

If you take the circle and fold it in half, then half again, and half once more, and then unfold it, there will be crease lines that show 8 wedges or pie slices of equal size.

If the wedges were cut out and arranged as shown, they will create a rectangle. It looks more like a parallelogram now, but if the circle was sliced into a much larger number of wedges, and they were fit together in this manner, it would look more like a rectangle.

The length of the rectangle is equal to half of the circumference of the circle, or $\frac{2\pi r}{2} = \pi r$. The width of the rectangle is equal to the radius, r, of the circle.

You can find the area of this rectangle by simply multiplying the length and the width.

$$A = (\text{length})(\text{width})$$

$$A = (\pi r)(r)$$

$$A = \pi r^2$$

You just discovered the formula for the area of a circle!

Area of a Circle

To calculate the area, A, of any circle:

$A = \pi r^2$, where r is the radius

Using the formula, you can calculate the area or the amount of square units inside any given circle.

Find the area of the given circle in terms of π.
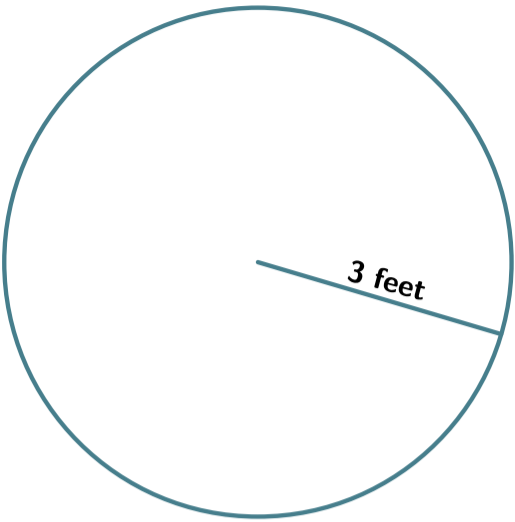
The radius of the circle is 3 feet, so substitute $r = 3$ into the formula, $A = \pi r^2$.

$$A = \pi r^2$$

$$A = \pi(3)^2$$

$$A = 9\pi$$

The area of the circle is 9π square feet.

Write Like a Mathematician

Just like with circumference, the area of a circle can be written in terms of π or be approximated using $\pi = 3.14$, $\pi = \frac{22}{7}$, or $\pi = \frac{355}{113}$.

The area of the circle with a radius of of 3 feet can be calculated using each of the approximations of π.

$$A = 9\pi = 9\,(3.14) = 28.26$$

$$A = 28.26 \text{ ft}^2$$

$$A = 9\pi = 9\left(\tfrac{22}{7}\right) = \tfrac{198}{7}$$

$$A = \tfrac{198}{7} \text{ ft}^2$$

$$A = 9\pi = 9\left(\tfrac{355}{113}\right) = \tfrac{3{,}195}{113}$$

$$A = \tfrac{3{,}195}{113} \text{ ft}^2$$

Learn More About Finding Area of a Circle

Find the area of a circle with a diameter of 2.6 meters. Use $\pi = 3.14$.

To use the formula $A = \pi r^2$, the radius must be calculated. Recall that $d = 2r$, or $r = \frac{1}{2}d$.

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

$$r = \tfrac{1}{2}(2.6)$$

$$r = 1.3$$

Now that the radius is found, substitute $r = 1.3$ and $\pi = 3.14$ into the formula.

$$A = \pi r^2$$

$$A = (3.14)(1.3)^2$$

$$A = (3.14)\,(1.69) \quad \text{Simplify the exponent first.}$$

$$A = 5.3066$$

The area of the circle is approximately 5.3066 square meters.

Sometimes, you'll be asked for part of the circle's area. Find the area using the formula, and multiply it by the fraction of the area you are looking for.

A circle with a radius of 4 centimeters is cut into 8 equal pieces. How many square centimeters are 3 of the pieces?

The radius of the circle is 4 cm, so substitute $r = 4$ into the formula, $A = \pi r^2$.

$$A = \pi r^2$$

$$A = \pi (4)^2$$

$$A = 16\pi$$

The area of the circle is $16\pi \ cm^2$.

Divide the area by 8 to find the area of each piece.

$$\frac{16\pi}{8} = 2\pi \ cm^2$$

If each piece has an area of 2π, then 3 pieces have an area of $(3)2\pi = 6\pi$