

Area of Circles

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7.8 Area of Circles

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[Figure 1]

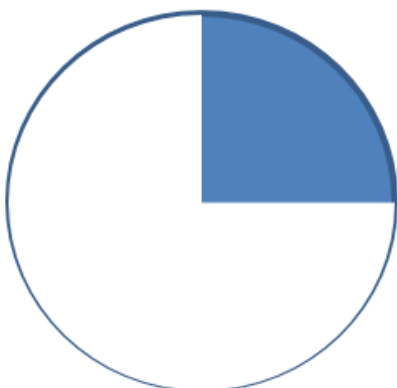
You have a recipe for an 8-in pizza but you want to make a pizza for your 16-in round pan. Will doubling your recipe be enough to fill the larger pan?

In this concept, you will learn to calculate the **area** of circles and the area of sectors of circles.

Area

Area is the amount of two-dimensional **space** a figure takes up. In other words, area is the space contained within a circle's **circumference**. The formula for the area of a **circle** is $A = \pi r^2$.

A **sector** is a part of a circle with radii for two sides and part of the curved circumference as another. Sectors look like pie slices. Look at the **diagram** below. The shaded area is the sector of the circle.

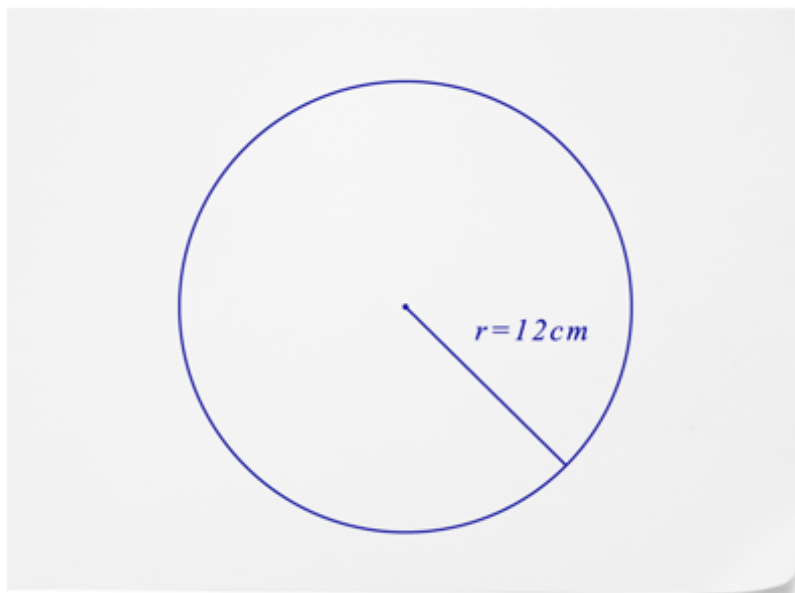


[Figure 2]

For now, the area of a sector can be found by finding the **proportion** of the circle. In the diagram above, the blue sector is $\frac{1}{4}$ of the entire circle.

Let's look at an example.

What is the area of the circle below?



[Figure 3]

First, substitute what you know into the formula for the area of a circle.

$$A = \pi r^2$$

$$A = \pi(12)^2$$

Next, solve for the area.

$$A = \pi(12)^2$$

$$A = \pi(144)$$

$$A = 452.4$$

The answer is 452.4.

The area of the circle is 452.4 cm².

Let's look at another example.

The area of a circle is 113.04 **square** inches. What is its **radius**?

First, substitute what you know into the formula for the area of a circle.

$$\begin{aligned} A &= \pi r^2 \\ 113.04 &= \pi r^2 \end{aligned}$$

Next, divide both sides by π .

$$\begin{aligned} 113.04 &= \pi r^2 \\ \frac{113.04}{\pi} &= \frac{\pi r^2}{\pi} \\ r^2 &= 35.98 \end{aligned}$$

Then, take the square root of both sides to solve for r .

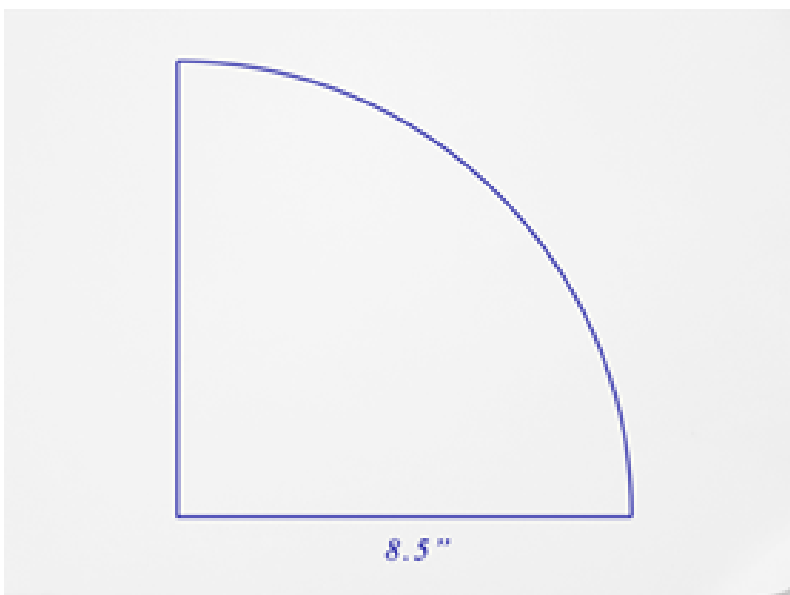
$$\begin{aligned} r^2 &= 35.98 \\ r &= \sqrt{35.98} \\ r &= 6 \end{aligned}$$

The answer is 6.

The radius of the circle is 6 in.

Let's look at an example of finding the area of a sector.

What is the area of the figure below?



[Figure 4]

First, substitute what you know into the formula for the area of a circle.

$$A = \pi r^2$$

$$A = \pi(8.5)^2$$

Next, solve for the area.

$$A = \pi(8.5)^2$$

$$A = \pi(72.25)$$

$$A = 226.98$$

Then, knowing the figure is one-quarter of a circle, divide this area by 4.

$$A_{\text{sector}} = \frac{226.98}{4}$$

$$A_{\text{sector}} = 56.7$$

The answer is 56.7.

The area of the sector is 56.7 in².

Examples

Example 1

Earlier, you were given a problem about the expanding pizza.

You want to know if you simply need to double the ingredients for your pizza if you want to use a 16-in round pan rather than an 8-in round pan.

First, find the radius of each pizza pan.

8 – in round pan	16 – in round pan
$r = \frac{d}{2}$	$r = \frac{d}{2}$
$r = \frac{8}{2}$	$r = \frac{16}{2}$
$r = 4$	$r = 8$

Next, find the area of each pizza pan.

8 – in round pan	16 – in round pan
$A = \pi r^2$	$A = \pi r^2$
$A = \pi(4)^2$	$A = \pi(8)^2$
$A = \pi \times 16$	$A = \pi \times 64$
$A = 50.3$	$A = 201.1$

Then, divide the area of the 16-in round pan by the area of the 8-in round pan.

$$\frac{A_{16\text{-in round pan}}}{A_{8\text{-in round pan}}} = \frac{201.1}{50.3}$$

$$\frac{A_{16\text{-in round pan}}}{A_{8\text{-in round pan}}} = 4$$

The answer is 4.

The 16-in pizza pan is four times the size of the 8-in pizza pan, so doubling the ingredients is not enough.

Example 2

What is the area of a circle with a **diameter** of 45 centimeters?

First, find the radius of the circle. Remember the radius is half the diameter.

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

$$r = \frac{45}{2}$$

$$r = 22.5$$

Next, substitute what you know into the formula for the area of a circle.

$$A = \pi r^2$$

$$A = \pi(22.5)^2$$

Then, solve for the area.

$$A = \pi(22.5)^2$$

$$A = \pi(506.25)$$

$$A = 1590.4$$

The answer is 1590.4.

The area of the circle is 1590 cm².

Find the area of each circle by using the given dimension.

Example 3

Find the area of each circle with a radius of 2.5 inches.

First, substitute what you know into the formula for the area of a circle.

$$A = \pi r^2$$

$$A = \pi(2.5)^2$$

Next, solve for the area.

$$A = \pi(2.5)^2$$

$$A = \pi(6.25)$$

$$A = 19.6$$

The answer is 19.6.

The area of the circle is 19.6 in².

Example 4

Find the area of each circle with a radius of 3 feet.

First, substitute what you know into the formula for the area of a circle.

$$A = \pi r^2$$

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

Next, solve for the area.

$$\begin{aligned}A &= \pi(3)^2 \\A &= \pi(9) \\A &= 28.3\end{aligned}$$

The answer is 28.3.

The area of the circle is 28.3 ft².

Example 5

Find the area of each circle with a diameter of 8 inches.

First, find the radius of the circle. Remember, the radius is half the diameter.

$$\begin{aligned}r &= \frac{d}{2} \\r &= \frac{8}{2} \\r &= 4\end{aligned}$$

Next, substitute what you know into the formula for the area of a circle.

$$\begin{aligned}A &= \pi r^2 \\A &= \pi(4)^2\end{aligned}$$

Then, solve for the area.

$$\begin{aligned}A &= \pi(4)^2 \\A &= \pi(16) \\A &= 50.3\end{aligned}$$

The answer is 50.3.

The area of the circle is 50.3 in².

Review

Find the area of each circle given the radius. Use 3.14 to approximate π and round to the nearest hundredths place if needed.

1. $r = 4 \text{ in}$
2. $r = 3 \text{ ft}$
3. $r = 2.5 \text{ in}$
4. $r = 5 \text{ cm}$
5. $r = 3.5 \text{ in}$
6. $r = 9 \text{ mm}$
7. $r = 11 \text{ cm}$
8. $r = 10 \text{ in}$
9. $r = 7 \text{ ft}$
10. $r = 8 \text{ in}$

Find the area of each sector given the radius and the angle measure. Use 3.14 to approximate π and round to the nearest hundredths place if needed.





11. 45° angle with a radius of 3 in.
12. 55° angle with a radius of 4 mm
13. 60° angle with a radius of 5 cm
14. 43° angle with a radius of 6 in
15. 70° angle with a radius of 2 in.

Review (Answers)

To see the review answers, return to the Table of Contents and select 'Other Versions' or 'Resources'.

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