Circumference

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CHAPTER 1 Circumference

Learning Objectives

Here you'll learn how to calculate the circumference of a circle.

What if you wanted to find the "length" of the crust for an entire pizza? A typical large pizza has a diameter of 14 inches and is cut into 8 or 10 pieces. Think of the crust as the circumference of the pizza. Find the circumference.

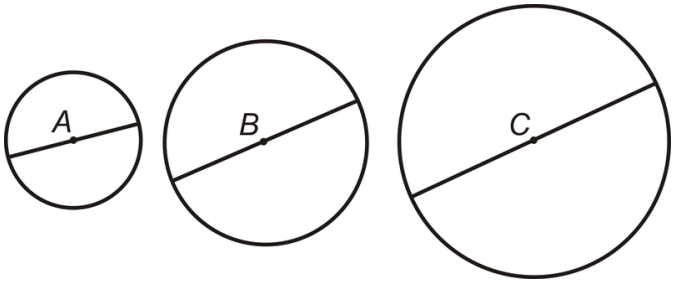
Circumference

Circumference is the distance around a circle. The circumference can also be called the perimeter of a circle. However, we use the term circumference for circles because they are round. The term perimeter is reserved for figures with straight sides. In order to find the formula for the circumference of a circle, we first need to determine the ratio between the circumference and diameter of a circle.

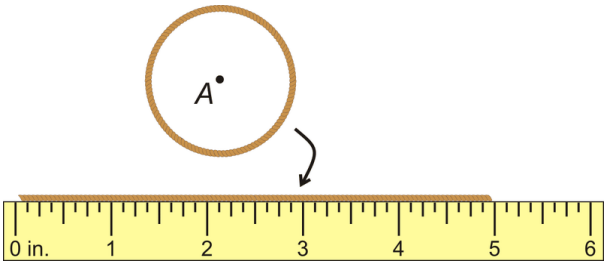
Investigation: Finding π (pi)

Tools Needed: paper, pencil, compass, ruler, string, and scissors

1. Draw three circles with radii of 2 in, 3 in, and 4 in. Label the centers of each A, B, and C.
2. Draw in the diameters and determine their lengths. Are all the diameter lengths the same in $\odot A$? $\odot B$? $\odot C$?



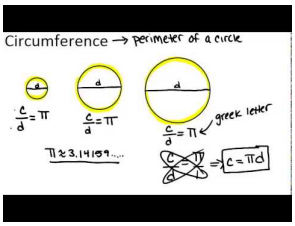
3. Take the string and outline each circle with it. The string represents the circumference of the circle. Cut the string so that it perfectly outlines the circle. Then, lay it out straight and measure, in inches. Round your answer to the nearest $\frac{1}{8}$-inch. Repeat this for the other two circles.



4. Find $\frac{circumference}{diameter}$ for each circle. Record your answers to the nearest thousandth. What do you notice?

From this investigation, you should see that $\frac{circumference}{diameter}$ approaches 3.14159... The bigger the diameter, the closer the ratio was to this number. We call this number π, the Greek letter "pi." It is an irrational number because the decimal never repeats itself. Pi has been calculated out to the millionth place and there is still no pattern in the sequence of numbers. When finding the circumference and area of circles, we must use π. π, or **"pi"** is the ratio of the circumference of a circle to its diameter. It is approximately equal to 3.14159265358979323846...

From this Investigation, we found that $\frac{circumference}{diameter} = \pi$. In other words, $C = \pi d$. We can also say $C = 2\pi r$ because $d = 2r$.



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Find the circumference of a circle with a radius of 7 cm.

Plug the radius into the formula.

$$C = 2\pi(7) = 14\pi \approx 44\ cm$$

Depending on the directions in a given problem, you can either leave the answer in terms of π or multiply it out and get an approximation. Make sure you read the directions.

Finding the Diameter

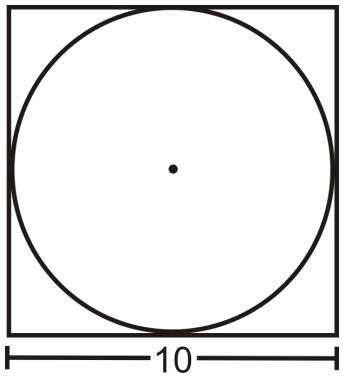
The circumference of a circle is 64π. Find the diameter.

Again, you can plug in what you know into the circumference formula and solve for d.

$$64\pi = \pi d$$
$$\frac{64\cancel{\pi}}{\cancel{\pi}} = \frac{\cancel{\pi} d}{\cancel{\pi}}$$
$$64 = d$$

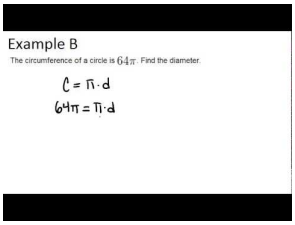
Finding the Circumference in Terms of Pi

A circle is inscribed in a square with 10 in. sides. What is the circumference of the circle? Leave your answer in terms of π.



From the picture, we can see that the diameter of the circle is equal to the length of a side. Use the circumference formula.

$$C = 10\pi \ in.$$



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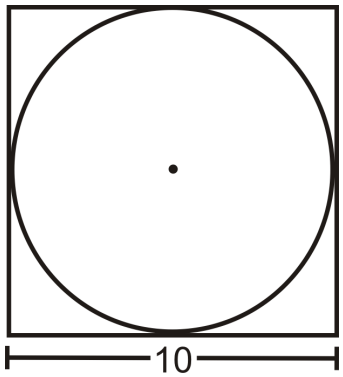
Pizza Problem Revisited

The entire length of the crust, or the circumference of the pizza is $14\pi \approx 44 \ in.$

Examples

Example 1

Find the perimeter of the square. Is it more or less than the circumference of the circle? Why?



The perimeter is $P = 4(10) = 40$ *in*. In order to compare the perimeter with the circumference we should change the circumference into a decimal.

$C = 10\pi \approx 31.42$ *in*. This is less than the perimeter of the square, which makes sense because the circle is smaller than the square.

Example 2

The tires on a compact car are 18 inches in diameter. How far does the car travel after the tires turn once? How far does the car travel after 2500 rotations of the tires?

One turn of the tire is the circumference. This would be $C = 18\pi \approx 56.55$ *in*. 2500 rotations would be $2500 \cdot 56.55in \approx 141,375$ *in*, 11,781 ft, or 2.23 miles.

Example 3

Find the radius of circle with circumference 88 in.

Use the formula for circumference and solve for the radius.

$$C = 2\pi r$$
$$88 = 2\pi r$$
$$\frac{44}{\pi} = r$$
$$r \approx 14 \text{ in}$$

Review

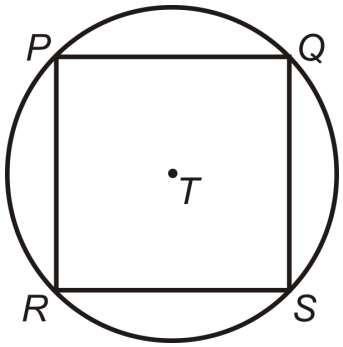
Fill in the following table. Leave all answers in terms of π.

TABLE 1.1:

	diameter	*radius*	*circumference*
1.	15		
2.		4	
3.	6		
4.			84π
5.		9	
6.			25π
7.			2π
8.	36		

9. Find the radius of circle with circumference 88 in.
10. Find the circumference of a circle with $d = \frac{20}{\pi} cm$.

Square $PQSR$ is inscribed in $\odot T$. $RS = 8\sqrt{2}$.



11. Find the length of the diameter of $\odot T$.
12. How does the diameter relate to $PQSR$?
13. Find the perimeter of $PQSR$.
14. Find the circumference of $\odot T$.

15. A truck has tires with a 26 in diameter.
    a. How far does the truck travel every time a tire turns exactly once?
    b. How many times will the tire turn after the truck travels 1 mile? (1 mile = 5280 feet)
16. Jay is decorating a cake for a friend's birthday. They want to put gumdrops around the edge of the cake which has a 12 in diameter. Each gumdrop is has a diameter of 1.25 cm. To the nearest gumdrop, how many will they need?
17. Bob wants to put new weather stripping around a semicircular window above his door. The base of the window (diameter) is 36 inches. How much weather stripping does he need?
18. Each car on a Ferris wheel travels 942.5 ft during the 10 rotations of each ride. How high is each car at the highest point of each rotation?

Review (Answers)

To view the Review answers, open this PDF file and look for section 10.8.