

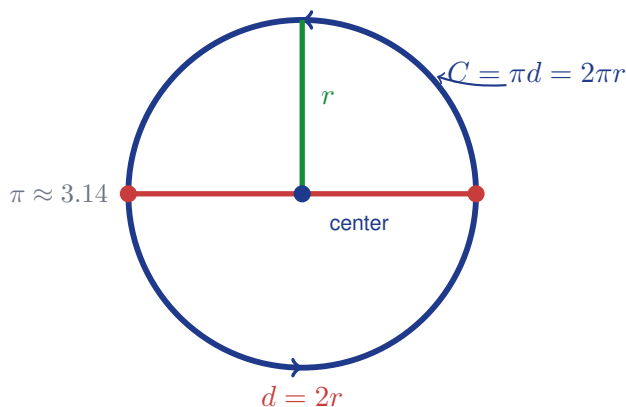
# Circumference of Circles

Name: \_\_\_\_\_

Date: \_\_\_\_\_

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The **circumference** is the distance all the way around a circle, and here is the amazing part: no matter what circle you measure, the ratio of circumference to diameter is always the same number— $\pi$ ! That gives you two handy formulas:  $C = \pi d$  and  $C = 2\pi r$ . Learning when to use radius versus diameter, and whether to leave your answer in terms of  $\pi$  or as a decimal, will make every circle problem feel manageable.



## Key Concepts & Quick Review

$C = \pi d$  or  $C = 2\pi r$  where  $d = \text{diameter}$ ,  $r = \text{radius}$ ,  $d = 2r$ .

**Find  $d$  or  $r$  from  $C$ :**  $d = \frac{C}{\pi}$ ;  $r = \frac{C}{2\pi}$ . Use  $\pi \approx 3.14$  unless told to use  $\frac{22}{7}$  or leave exact ( $\pi$ ).

## Examples

① Find the circumference of a circle with: (a) radius  $7\text{ cm}$  (b) diameter  $15\text{ m}$ . Give exact and approximate answers.

**Think It Through:** Use the version of the formula that matches the measurement you are given. For part (a), the radius is known, so use  $C = 2\pi r = 2\pi(7) = 14\pi$ . For part (b), the diameter is given directly, so use  $C = \pi d = \pi(15) = 15\pi$ . Leave the exact answer with  $\pi$ , then use  $\pi \approx 3.14$  for the decimal approximation.

**Answer:** (a)  $14\pi \approx 44.0\text{ cm}$ ; (b)  $15\pi \approx 47.1\text{ m}$

② A bicycle wheel has circumference  $188.4\text{ cm}$ . Find its diameter and radius. How many full rotations does it make in  $1\text{ km}$ ?

**Think It Through:** Work backward from circumference to diameter using  $d = \frac{C}{\pi}$ . That gives  $d = \frac{188.4}{3.14} = 60\text{ cm}$ , so the radius is half of that:  $30\text{ cm}$ . For the number of wheel rotations in  $1\text{ km}$ , change  $1\text{ km}$  to  $100,000\text{ cm}$  so the units match. Then divide total distance by distance per rotation:  $100,000 \div 188.4 \approx 531$  rotations.

**Answer:**  $d = 60\text{ cm}$ ,  $r = 30\text{ cm}$ ;  $\approx 531\text{ rotations/km}$



**Practice Problems**

Find the circumference (use  $\pi \approx 3.14$  unless indicated). Leave some exact ( $\pi$ ).

- 1. Find the circumference of a circle with radius  $5\text{ cm}$ .
- 2. Find the circumference of a circle with radius  $9\text{ m}$ .
- 3. Find the circumference of a circle with diameter  $14\text{ cm}$ .
- 4. Find the circumference of a circle with diameter  $20\text{ m}$ .
- 5. Find the exact circumference of a circle with radius  $3.5\text{ cm}$ .
- 6. Find the exact circumference of a circle with diameter  $11\text{ cm}$ .



- 7. Find the circumference of a circle with radius  $\frac{7}{2}\text{ m}$ .



- 8. Find the circumference of a circle with diameter  $6\text{ cm}$ .
- 9. A circle has circumference  $62.8$ . Find its diameter.
- 10. A circle has circumference  $31.4$ . Find its radius.
- 11. Find the exact circumference of a circle with radius  $12\text{ cm}$ .
- 12. Find the circumference of a circle with diameter  $25\text{ m}$ .
- 13. A circle has circumference  $\pi \times 8$ . Find its diameter.
- 14. Find the circumference of a circle with radius  $0.5\text{ m}$ .



- 15. Find the circumference of a circle with diameter  $4.2\text{ cm}$ .



**Study Tips**

- Diameter or radius?** Read the problem carefully —  $C = \pi d$  uses diameter;  $C = 2\pi r$  uses radius. Using the wrong one doubles or halves your answer.
- For an **exact answer**, keep  $\pi$  as a symbol: write  $10\pi\text{ cm}$ , not  $31.4\text{ cm}$ .
- Semicircle perimeter** = half circumference + diameter =  $\pi r + 2r$ .

**Word Problems**

- 16. A circular running track has a radius of  $40\text{ m}$ . Find the circumference. An athlete wants to run  $5\text{ km}$ . How many complete laps must she run? If she runs at  $8\text{ km/h}$ , how many minutes will the run take? \_\_\_\_\_
- 17. A pizza has a diameter of  $36\text{ cm}$ . A baker wants to press a decorative crust border around the entire edge. Find the length of border needed. If the dough roll that makes the border is  $2\text{ cm}$  wide, what area does the border cover? (Hint: border area  $\approx C \times 2$ .) \_\_\_\_\_



## Answer Keys

- |   |   |
|---|---|
| <p>1) 31.4 <i>cm</i></p> <p>2) 56.52 <i>m</i></p> <p>3) 43.96 <i>cm</i></p> <p>4) 62.8 <i>m</i></p> <p>5) <math>7\pi</math> <i>cm</i></p> <p>6) <math>11\pi</math> <i>cm</i></p> <p>7) 21.98 <i>m</i></p> <p>8) 18.84 <i>cm</i></p> <p>9) 20</p> <p>10) 5</p> | <p>11) <math>24\pi</math> <i>cm</i></p> <p>12) 78.5 <i>m</i></p> <p>13) 8</p> <p>14) 3.14 <i>m</i></p> <p>15) 13.19 <i>cm</i></p> <p>16) Circumference about 251.3 <i>m</i>; 20 laps; 37.5 <i>min</i></p> <p>17) Circumference about 113.1 <i>cm</i>; border area about 226.2 <i>cm</i><sup>2</sup></p> |
|---|---|

### Step-by-Step Explanations

**Strategy:** For Triangle Angle-Sum Theorem, add the three interior angles to  $180^\circ$  and keep the unknown angle in that same equation. Once the triangle sum is written, the missing angle is usually one clean subtraction.

**Practice 1:** A triangle has two angles measuring  $40^\circ$  and  $75^\circ$ . Find the third angle and classify the triangle.

**Answer:**  $65^\circ$

At the beginning of the practice, use the fact that the three interior angles of a triangle add to 180 degrees.

**Practice 15:** An equilateral triangle has three equal angles. Find the measure of each angle. **Answer:**  $60^\circ$

For the second model problem, use the fact that the three interior angles of a triangle add to 180 degrees.

**Word-problem notes:**

**16. Answer:**  $2n + 8 + 3n - 12 + 90 = 180 \Rightarrow 5n = 94 \Rightarrow n = 18.8$ ; angles:  $45.6^\circ$ ,  $44.4^\circ$ ,  $90^\circ$  — valid right triangle.

A right triangle still follows the same angle-sum rule: the three angles add to  $180^\circ$ . Write  $(2n + 8) + (3n - 12) + 90 = 180$ . Simplifying gives  $5n + 86 = 180$ , so  $5n = 94$  and  $n = 18.8$ . Substituting back gives the other two angles as  $45.6^\circ$  and  $44.4^\circ$ . Both are acute, and together with the  $90^\circ$  angle they make a valid right triangle.

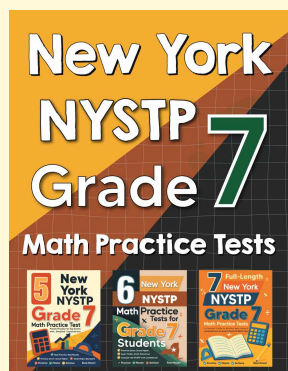
**17. Answer:**  $(4k - 5) + (2k + 15) + (k + 10) = 180 \Rightarrow 7k = 160 \Rightarrow k \approx 22.9$ ; angles:  $86.4^\circ$ ,  $60.7^\circ$ ,  $32.9^\circ$ ; acute; sharpest turn at peak ( $32.9^\circ$ ).

Add the three angle expressions and set the sum equal to  $180^\circ$ :  $(4k - 5) + (2k + 15) + (k + 10) = 180$ . This simplifies to  $7k + 20 = 180$ , so  $7k = 160$  and  $k \approx 22.9$ . Substituting back gives approximate angles of  $86.4^\circ$ ,  $60.7^\circ$ , and  $32.9^\circ$ . Since all three are less than  $90^\circ$ , the route forms an acute triangle. The sharpest turn is the smallest angle, which is at the peak.



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