

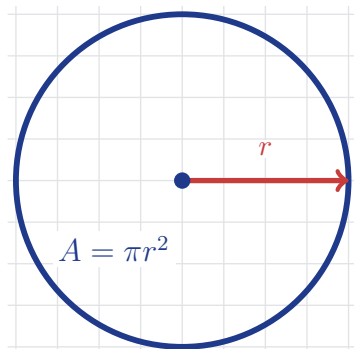
# Area of Circles

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

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The area of a circle tells you how much surface is inside, and the formula is  $A = \pi r^2$ . Because the radius is *squared*, even a small change in radius causes a big change in area—double the radius and the area becomes **four times** as large! A common mistake is forgetting to square the radius before multiplying by  $\pi$ , so careful order of operations is your best friend here. Get this formula down and you will be ready for composite-figure and real-world problems in no time!



$$\begin{aligned} r &= 5 \text{ cm} \\ r^2 &= 25 \\ A &= 25\pi \\ &\approx 78.5 \text{ cm}^2 \end{aligned}$$

## Key Concepts & Quick Review

$A = \pi r^2$  (radius squared, then multiply by  $\pi$ ).

**Given diameter:**  $r = d/2$ , then  $A = \pi(d/2)^2 = \pi d^2/4$ .

**Find  $r$  from  $A$ :**  $r = \sqrt{A/\pi}$ .

**Semicircle area:**  $A = \frac{1}{2}\pi r^2$ .

## Examples

① Find the area of a circle with: (a)  $r = 6 \text{ cm}$  (b)  $d = 10 \text{ m}$ . Give exact and  $\approx$  answers.

**Think It Through:** For part (a), square the radius first:  $6^2 = 36$ , so the area is  $A = \pi r^2 = 36\pi$ . Then approximate with  $36 \times 3.14 \approx 113.1$ . For part (b), the diameter is  $10 \text{ m}$ , so convert to radius first:  $r = 5 \text{ m}$ . Then use  $A = \pi(5)^2 = 25\pi \approx 78.5 \text{ m}^2$ . The most common mistake here is forgetting to halve the diameter before squaring.

**Answer:** (a)  $36\pi \approx 113.1 \text{ cm}^2$ ; (b)  $25\pi \approx 78.5 \text{ m}^2$

② A circular sprinkler covers an area of  $200.96 \text{ m}^2$ . Find its radius and diameter.

**Think It Through:** Work backward from the area formula. Since  $A = \pi r^2$ , divide by  $\pi$  to isolate  $r^2$ :  $r^2 = \frac{200.96}{3.14} = 64$ . Now take the square root to get the radius,  $r = 8 \text{ m}$ . The diameter is twice the radius, so  $d = 16 \text{ m}$ . When solving circle area problems backward, divide first and square-root second.

**Answer:**  $r = 8 \text{ m}$ ;  $d = 16 \text{ m}$



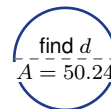
**Practice Problems**

Find the area (use  $\pi \approx 3.14$  or leave exact as indicated).

1. Find the area of a circle with radius 4 cm. \_\_\_\_\_
2. Find the area of a circle with radius 7 m. \_\_\_\_\_
3. Find the exact area of a circle with radius 10 cm. \_\_\_\_\_
4. Find the area of a circle with diameter 12 cm. \_\_\_\_\_
5. Find the area of a circle with diameter 18 m. \_\_\_\_\_
6. Find the area of a circle with radius 1.5 cm. \_\_\_\_\_
7. Find the exact area of a circle with radius  $\frac{7}{2}$  m. \_\_\_\_\_
8. Find the exact area of a circle with diameter 5 cm. \_\_\_\_\_
9. Find the area of a circle with radius 9. \_\_\_\_\_
10. Find the area of a circle with radius 0.5 m. \_\_\_\_\_

11. A circle has area 78.5. Find its radius. \_\_\_\_\_

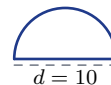
12. A circle has area 50.24. Find its diameter. \_\_\_\_\_



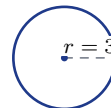
13. Find the area of a semicircle with radius 6. \_\_\_\_\_



14. Find the area of a semicircle with diameter 10. \_\_\_\_\_



15. Find the exact area of a circle with radius 3. \_\_\_\_\_



**Study Tips**

- Square the radius, not  $\pi$ .** Write  $\pi \times r^2$ , not  $(\pi r)^2$ . This is the most common algebra error in circle problems.
- Given the diameter?** Halve it *before* squaring:  $r = d \div 2$  first.
- If two circles have radii in ratio 1 : 2, their areas are in ratio 1 : 4 (square the scale factor for areas).

**Word Problems**

16. Two circular ponds are in a park. Pond A has radius 9 m and Pond B has radius 12 m. Find the area of each pond. How much greater is Pond B's area than Pond A's? If a maintenance crew can treat 50 m<sup>2</sup> per hour, how long does each pond take? \_\_\_\_\_
17. A circular cheesecake has a diameter of 28 cm. It is divided into 8 equal slices. Find the area of the whole cake and the area of one slice. If the cake is 5 cm tall, what is the volume of one slice? (Volume of a sector  $\approx$  slice area  $\times$  height.) \_\_\_\_\_



## Answer Keys

- |  |   |
|--|---|
| <p>1) <math>50.24 \text{ cm}^2</math></p> <p>2) <math>153.86 \text{ m}^2</math></p> <p>3) <math>100\pi \text{ cm}^2</math></p> <p>4) <math>113.04 \text{ cm}^2</math></p> <p>5) <math>254.34 \text{ m}^2</math></p> <p>6) <math>7.07 \text{ cm}^2</math></p> <p>7) <math>\frac{49\pi}{4} \text{ m}^2</math></p> <p>8) <math>\frac{25\pi}{4} \text{ cm}^2</math></p> <p>9) <math>254.34</math></p> <p>10) <math>0.79 \text{ m}^2</math></p> | <p>11) 5</p> <p>12) 8</p> <p>13) 56.52</p> <p>14) 39.25</p> <p>15) <math>9\pi</math></p> <p>16) A <math>254.34 \text{ m}^2</math>; B <math>452.16 \text{ m}^2</math>; difference <math>197.82 \text{ m}^2</math>; A about 5.1 hr; B about 9.0 hr</p> <p>17) Whole <math>615.44 \text{ cm}^2</math>; slice <math>76.93 \text{ cm}^2</math>; volume <math>384.6 \text{ cm}^3</math></p> |
|--|---|

### Step-by-Step Explanations

**Strategy:** For Exterior Angle Theorem, add the two remote interior angles or set that sum equal to the exterior angle. Exterior-angle answers need a degree label and should be larger than either remote angle.

**Practice 1:** A triangle has remote interior angles  $40^\circ$  and  $65^\circ$ . Find the exterior angle. **Answer:**  $105^\circ$   
In the first example, the exterior angle is the total of the two remote interior angles, so the setup is a direct addition equation.

**Practice 15:** An exterior angle is  $100^\circ$ , and the two remote interior angles are equal. Find each remote interior angle. **Answer:**  $50^\circ$  each

Toward the end, use the theorem in reverse if needed: the remote angles must add to the exterior angle.

**Word-problem notes:**

**16. Answer:**  $6m + 4 = 5m + 12 \Rightarrow m = 8$ ; exterior =  $52^\circ$ ; interior  $P = 34^\circ$ ,  $R = 18^\circ$ ,  $Q = 128^\circ$ ; obtuse.

Apply the Exterior Angle Theorem by setting the exterior angle equal to the sum of the two remote interior angles:  $6m + 4 = (2m + 18) + (3m - 6)$ . Simplify to get  $6m + 4 = 5m + 12$ , so  $m = 8$ . Now find the exterior angle:  $6(8) + 4 = 52^\circ$ . The remote interior angles are  $2(8) + 18 = 34^\circ$  and  $3(8) - 6 = 18^\circ$ . The interior angle at  $Q$  forms a linear pair with the exterior angle, so it is  $180^\circ - 52^\circ = 128^\circ$ . Because one interior angle is greater than  $90^\circ$ , the triangle is obtuse.

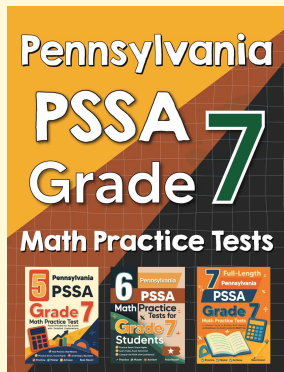
**17. Answer:**  $7t - 6 = 4t - 10 + 2t + 8 = 6t - 2 \Rightarrow t = 4$ ; exterior =  $22^\circ$ ; interior at  $B = 158^\circ$ ; very shallow angle.

The exterior angle at  $B$  equals the sum of the two remote interior angles, so write  $7t - 6 = (4t - 10) + (2t + 8)$ . Simplifying gives  $7t - 6 = 6t - 2$ , so  $t = 4$ . Substitute to find the exterior angle:  $7(4) - 6 = 22^\circ$ . The interior angle at  $B$  is adjacent to the exterior angle, so together they make  $180^\circ$ . That gives  $180^\circ - 22^\circ = 158^\circ$ . A very large interior angle means the cable meets the ground at a shallow angle.



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