

# Arc Length and Area of Sectors

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Score: \_\_\_\_\_ / 24

## Q Quick Review

A **sector** is a “pizza slice” of a circle, and an **arc** is the curved edge of that slice. A sector is just a *fraction* of the whole circle, and that fraction is  $\frac{\theta}{360}$ , where  $\theta$  is the central angle. So the **arc length** is  $\frac{\theta}{360} \times 2\pi r$  (a fraction of the circumference), and the **sector area** is  $\frac{\theta}{360} \times \pi r^2$  (a fraction of the circle’s area). Find the fraction first, then multiply — it keeps things simple.

◊ **Example:** A circle has radius 6 cm. Find the area of a sector with a central angle of  $90^\circ$ . Leave your answer in terms of  $\pi$ .  
 $\Rightarrow$  A  $90^\circ$  sector is a fraction of the full circle:  $\frac{90}{360} = \frac{1}{4}$  of it. The whole circle’s area is  $\pi r^2 = \pi(6^2) = 36\pi$  square cm. Now take a quarter of that:  $\frac{1}{4} \times 36\pi = 9\pi$  square cm. So the sector covers  $9\pi \text{ cm}^2$ .

**Answer:**  $A = 9\pi \text{ cm}^2$

## PRACTICE

Find each arc length or sector area. Leave answers in terms of  $\pi$ .

- |   |   |
|---|---|
| 1. Arc length: $\theta = 90^\circ, r = 4$ _____   | 11. Sector area: $\theta = 90^\circ, r = 6$ _____   |
| 2. Arc length: $\theta = 60^\circ, r = 6$ _____   | 12. Sector area: $\theta = 60^\circ, r = 6$ _____   |
| 3. Arc length: $\theta = 120^\circ, r = 9$ _____  | 13. Sector area: $\theta = 120^\circ, r = 3$ _____  |
| 4. Arc length: $\theta = 180^\circ, r = 10$ _____ | 14. Sector area: $\theta = 45^\circ, r = 8$ _____   |
| 5. Arc length: $\theta = 45^\circ, r = 8$ _____   | 15. Sector area: $\theta = 270^\circ, r = 4$ _____  |
| 6. Arc length: $\theta = 72^\circ, r = 5$ _____   | 16. Sector area: $\theta = 180^\circ, r = 10$ _____ |
| 7. Arc length: $\theta = 30^\circ, r = 12$ _____  | 17. Sector area: $\theta = 36^\circ, r = 10$ _____  |
| 8. Arc length: $\theta = 270^\circ, r = 8$ _____  | 18. Sector area: $\theta = 30^\circ, r = 6$ _____   |
| 9. Arc length: $\theta = 360^\circ, r = 7$ _____  | 19. Sector area: $\theta = 90^\circ, r = 2$ _____   |
| 10. Arc length: $\theta = 90^\circ, r = 10$ _____ | 20. Sector area: $\theta = 120^\circ, r = 6$ _____  |

## ◆ Word Problems

21. A circular pizza has a radius of 6 in and is cut into 6 equal slices. What is the area of one slice? Leave your answer in terms of  $\pi$ . \_\_\_\_\_
22. A lawn sprinkler sprays water over a  $90^\circ$  sector with a reach of 10 ft. What area of lawn does it water? Leave your answer in terms of  $\pi$ . \_\_\_\_\_
23. A clock’s minute hand is 9 cm long. As it sweeps from the 12 to the 4, it covers a  $120^\circ$  angle. How far does the tip travel? Leave your answer in terms of  $\pi$ . \_\_\_\_\_
24. A decorative fan opens to a  $45^\circ$  sector with a radius of 8 in. Find the area of the fan’s open shape in terms of  $\pi$ . \_\_\_\_\_



## Answer Keys

- |            |                          |
|------------|--------------------------|
| 1. $2\pi$  | 13. $3\pi$               |
| 2. $2\pi$  | 14. $8\pi$               |
| 3. $6\pi$  | 15. $12\pi$              |
| 4. $10\pi$ | 16. $50\pi$              |
| 5. $2\pi$  | 17. $10\pi$              |
| 6. $2\pi$  | 18. $3\pi$               |
| 7. $2\pi$  | 19. $\pi$                |
| 8. $12\pi$ | 20. $12\pi$              |
| 9. $14\pi$ | 21. $6\pi \text{ in}^2$  |
| 10. $5\pi$ | 22. $25\pi \text{ ft}^2$ |
| 11. $9\pi$ | 23. $6\pi \text{ cm}$    |
| 12. $6\pi$ | 24. $8\pi \text{ in}^2$  |

### Step-by-Step Explanations

- |   |  |
|---|--|
| <p>1. <math>\frac{90}{360} \cdot 2\pi(4) = \frac{1}{4} \cdot 8\pi = 2\pi</math>.</p> <p>2. <math>\frac{60}{360} \cdot 2\pi(6) = \frac{1}{6} \cdot 12\pi = 2\pi</math>.</p> <p>3. <math>\frac{120}{360} \cdot 2\pi(9) = \frac{1}{3} \cdot 18\pi = 6\pi</math>.</p> <p>4. <math>\frac{180}{360} \cdot 2\pi(10) = \frac{1}{2} \cdot 20\pi = 10\pi</math>.</p> <p>5. <math>\frac{45}{360} \cdot 2\pi(8) = \frac{1}{8} \cdot 16\pi = 2\pi</math>.</p> <p>6. <math>\frac{72}{360} \cdot 2\pi(5) = \frac{1}{5} \cdot 10\pi = 2\pi</math>.</p> <p>7. <math>\frac{30}{360} \cdot 2\pi(12) = \frac{1}{12} \cdot 24\pi = 2\pi</math>.</p> <p>8. <math>\frac{270}{360} \cdot 2\pi(8) = \frac{3}{4} \cdot 16\pi = 12\pi</math>.</p> <p>9. A full circle: <math>\frac{360}{360} \cdot 2\pi(7) = 14\pi</math>.</p> <p>10. <math>\frac{1}{4} \cdot 2\pi(10) = \frac{1}{4} \cdot 20\pi = 5\pi</math>.</p> <p>11. <math>\frac{1}{4} \cdot \pi(36) = 9\pi</math>.</p> <p>12. <math>\frac{1}{6} \cdot \pi(36) = 6\pi</math>.</p> <p>13. <math>\frac{1}{3} \cdot \pi(9) = 3\pi</math>.</p> <p>14. <math>\frac{1}{8} \cdot \pi(64) = 8\pi</math>.</p> | <p>15. <math>\frac{3}{4} \cdot \pi(16) = 12\pi</math>.</p> <p>16. <math>\frac{1}{2} \cdot \pi(100) = 50\pi</math>.</p> <p>17. <math>\frac{36}{360} \cdot \pi(100) = \frac{1}{10} \cdot 100\pi = 10\pi</math>.</p> <p>18. <math>\frac{1}{12} \cdot \pi(36) = 3\pi</math>.</p> <p>19. <math>\frac{1}{4} \cdot \pi(4) = \pi</math>.</p> <p>20. <math>\frac{1}{3} \cdot \pi(36) = 12\pi</math>.</p> <p>21. Each slice is <math>\frac{60}{360} = \frac{1}{6}</math> of the circle. The whole area is <math>\pi(6^2) = 36\pi</math>, so one slice is <math>\frac{1}{6}(36\pi) = 6\pi \text{ in}^2</math>.</p> <p>22. The sector is <math>\frac{90}{360} = \frac{1}{4}</math> of a circle. The full area is <math>\pi(10^2) = 100\pi</math>, so the watered area is <math>\frac{1}{4}(100\pi) = 25\pi \text{ ft}^2</math>.</p> <p>23. The tip traces an arc that is <math>\frac{120}{360} = \frac{1}{3}</math> of the circle. The full circumference is <math>2\pi(9) = 18\pi</math>, so the arc is <math>\frac{1}{3}(18\pi) = 6\pi \text{ cm}</math>.</p> <p>24. The fan is <math>\frac{45}{360} = \frac{1}{8}</math> of a circle. The full area is <math>\pi(8^2) = 64\pi</math>, so the fan's area is <math>\frac{1}{8}(64\pi) = 8\pi \text{ in}^2</math>.</p> |
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