

# 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  $9\pi$  cm<sup>2</sup>.

**Answer:**  $A = 9\pi$  cm<sup>2</sup>

## 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

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



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