

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 θ 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° . Leave your answer in terms of π .
 \Rightarrow A 90° 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 π .

- | | |
|---|---|
| 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 π . _____
22. A lawn sprinkler sprays water over a 90° sector with a reach of 10 ft. What area of lawn does it water? Leave your answer in terms of π . _____
23. A clock’s minute hand is 9 cm long. As it sweeps from the 12 to the 4, it covers a 120° angle. How far does the tip travel? Leave your answer in terms of π . _____
24. A decorative fan opens to a 45° sector with a radius of 8 in. Find the area of the fan’s open shape in terms of π . _____



Answer Keys

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