Arc Length and Area of Sectors

Name: _____	Date: _____	Score: _____ / 24

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 9π cm^2.

Answer: $A = 9\pi$ cm^2

PRACTICE

Find each arc length or sector area. Leave answers in terms of π.

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

♦ 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.** 6π in^2
10. 5π	**22.** 25π ft^2
11. 9π	**23.** 6π cm
12. 6π	**24.** 8π in^2

Step-by-Step Explanations

1. $\frac{90}{360} \cdot 2\pi(4) = \frac{1}{4} \cdot 8\pi = 2\pi$.
2. $\frac{60}{360} \cdot 2\pi(6) = \frac{1}{6} \cdot 12\pi = 2\pi$.
3. $\frac{120}{360} \cdot 2\pi(9) = \frac{1}{3} \cdot 18\pi = 6\pi$.
4. $\frac{180}{360} \cdot 2\pi(10) = \frac{1}{2} \cdot 20\pi = 10\pi$.
5. $\frac{45}{360} \cdot 2\pi(8) = \frac{1}{8} \cdot 16\pi = 2\pi$.
6. $\frac{72}{360} \cdot 2\pi(5) = \frac{1}{5} \cdot 10\pi = 2\pi$.
7. $\frac{30}{360} \cdot 2\pi(12) = \frac{1}{12} \cdot 24\pi = 2\pi$.
8. $\frac{270}{360} \cdot 2\pi(8) = \frac{3}{4} \cdot 16\pi = 12\pi$.
9. A full circle: $\frac{360}{360} \cdot 2\pi(7) = 14\pi$.
10. $\frac{1}{4} \cdot 2\pi(10) = \frac{1}{4} \cdot 20\pi = 5\pi$.
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. $\frac{1}{8} \cdot \pi(64) = 8\pi$.
15. $\frac{3}{4} \cdot \pi(16) = 12\pi$.
16. $\frac{1}{2} \cdot \pi(100) = 50\pi$.
17. $\frac{36}{360} \cdot \pi(100) = \frac{1}{10} \cdot 100\pi = 10\pi$.
18. $\frac{1}{12} \cdot \pi(36) = 3\pi$.
19. $\frac{1}{4} \cdot \pi(4) = \pi$.
20. $\frac{1}{3} \cdot \pi(36) = 12\pi$.
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 $\frac{1}{6}(36\pi) = 6\pi$ in^2.
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 $\frac{1}{4}(100\pi) = 25\pi$ ft^2.
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 $\frac{1}{3}(18\pi) = 6\pi$ cm.
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 $\frac{1}{8}(64\pi) = 8\pi$ in^2.

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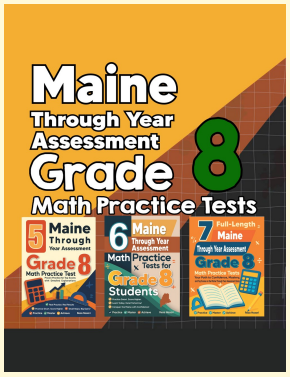

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