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. _____

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Answer Keys

1. 2π
2. 2π
3. 6π
4. 10π
5. 2π
6. 2π
7. 2π
8. 12π
9. 14π
10. 5π
11. 9π
12. 6π
13. 3π
14. 8π
15. 12π
16. 50π
17. 10π
18. 3π
19. π
20. 12π
21. 6π in^2
22. 25π ft^2
23. 6π cm
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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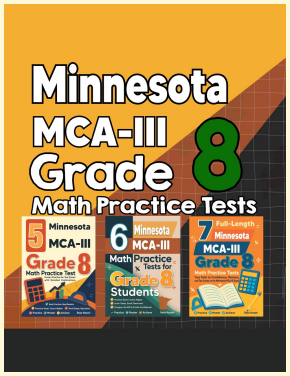

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