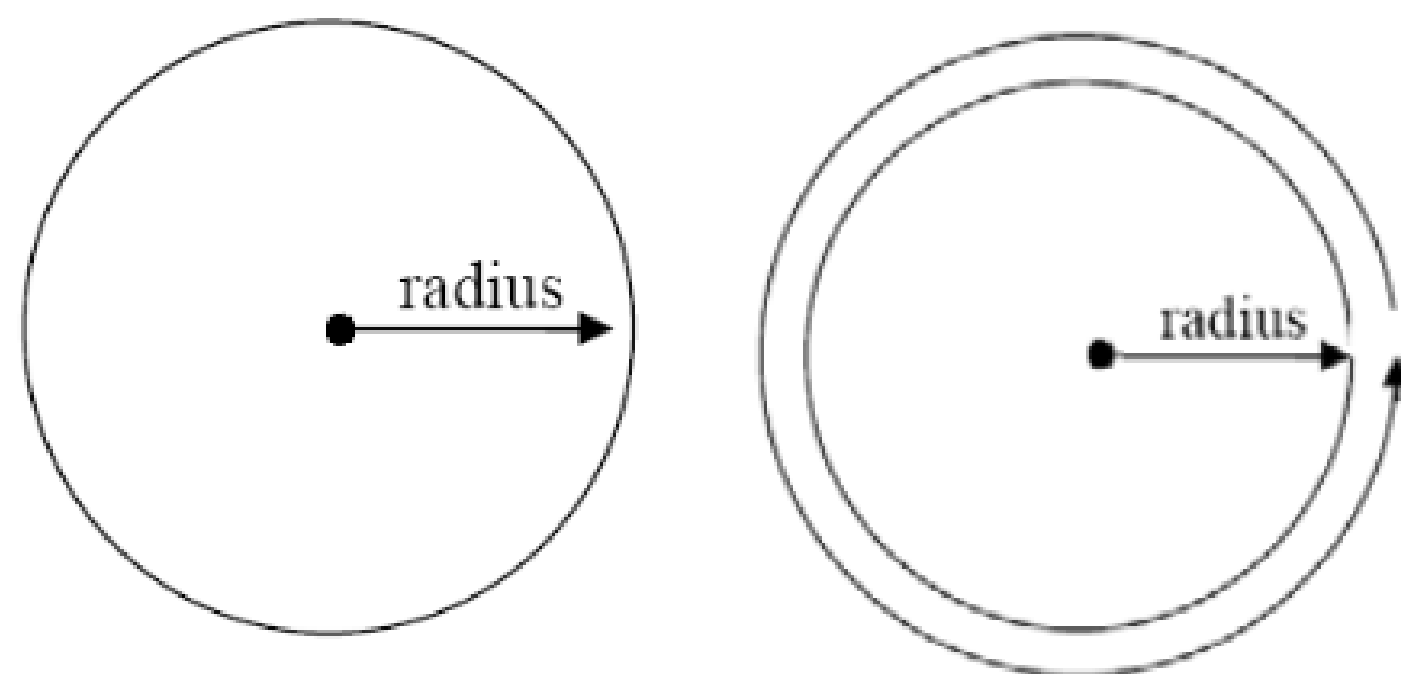## Circle:

Circumference (perimeter) $C = 2\pi r$
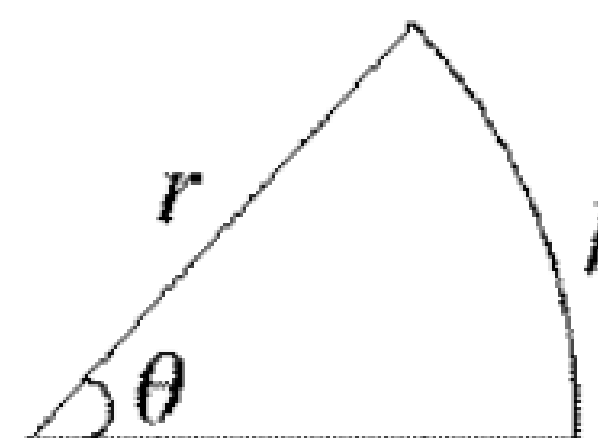
Area of a circle: $A = \pi r^2 = \dfrac{\pi}{4} d^2$

d is the diameter of the circle. $d = 2r$

Sector:

Given a sector of a circle where l is the length of the arc and A is the area of the sector:

$$l = 2\pi r \times \frac{\theta}{360}. \qquad A = \pi r^2 \times \frac{\theta}{360}.$$

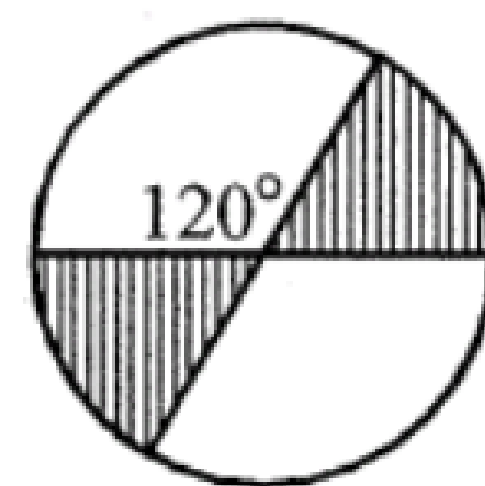**Example 18.** What is the area of a circle whose radius measures 4 cm?

(A) 16π (B) 18π (C) 20π (D) 64π (E) 49π

Example 19. What is the radius of a circle whose area is 64π cm^2?

(A) 64   (B) 32   (C) 16   (D) 8   (E) 128

Example 20. Find in terms of π the number of square inches in the area of the shaded region formed by the intersecting diameters of a circle with radius 6.

(A) 16π (B) 12π (C) 20π (D) 64π (E) 36π

☆**Example 21.** Four circles of radius 3 are drawn with the centers at the vertices of a square. The regions inside the square are shown. Find the area of the shaded region.

(A) $36-24\pi$ (B) $36-12\pi$

(C) $36-9\pi$ (D) $81-12\pi$

(E) $81-9\pi$
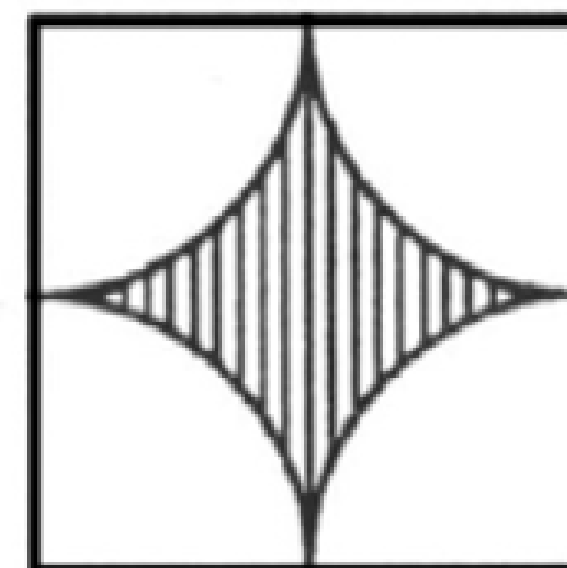
☆**Example 22.** (AMC 10) Circles A, B, and C each have radius 1. Circles A and B share one point of tangency. Circle C has a point of tangency with the midpoint of AB. What is the area inside circle C but outside circle A and circle B ?

(A) $3-\dfrac{\pi}{2}$ (B) (C) 2 (D) $\dfrac{3\pi}{4}$ (E) $1+\dfrac{\pi}{2}$
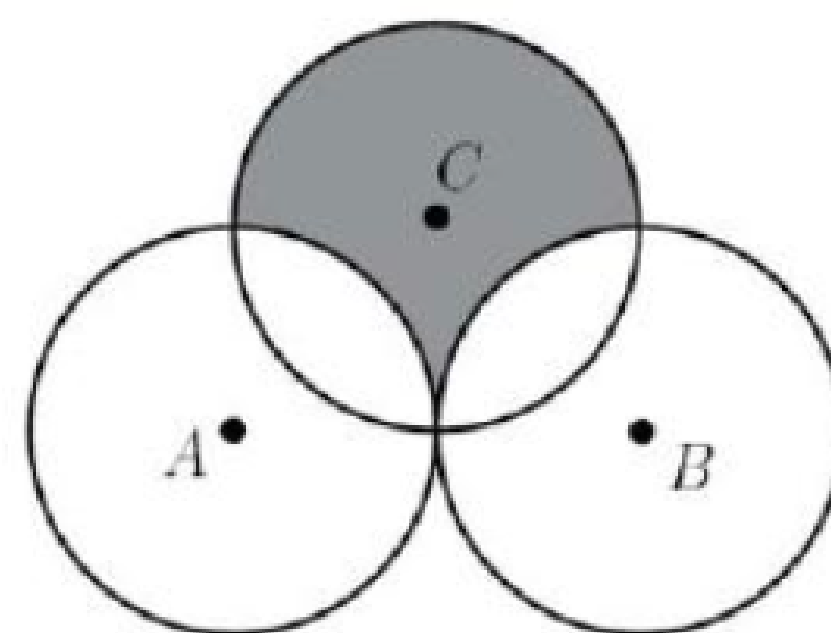
Example 23. $ABCD$ is a square with vertex A at the center of the circle. $AE = 10$ in. What is the number of square inches in the area of $\triangle BCD$?

(A) 100 (B) 50 (C) 25 (D) 8π (E) 12π
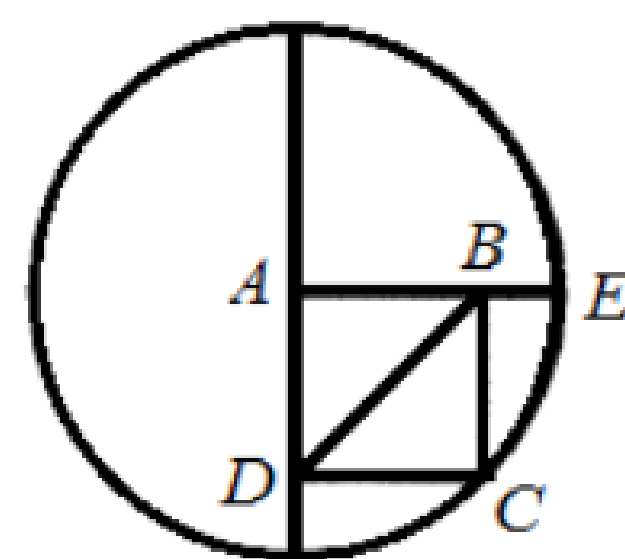
Example 24. The length of a side of equilateral triangle ABC is 12. D, E, and F are the midpoints of $\overline{AB}$, $\overline{BC}$, and $\overline{AC}$, respectively. A, B, and C are the centers of the circles that contain arcs DF, DE, and FE, respectively. What is the area of the shaded region?

(A) $72\sqrt{3}-18\pi$ (B) $36\sqrt{3}-9\pi$

(C) $72\sqrt{3}-9\pi$ (D) $36\sqrt{2}-18\pi$
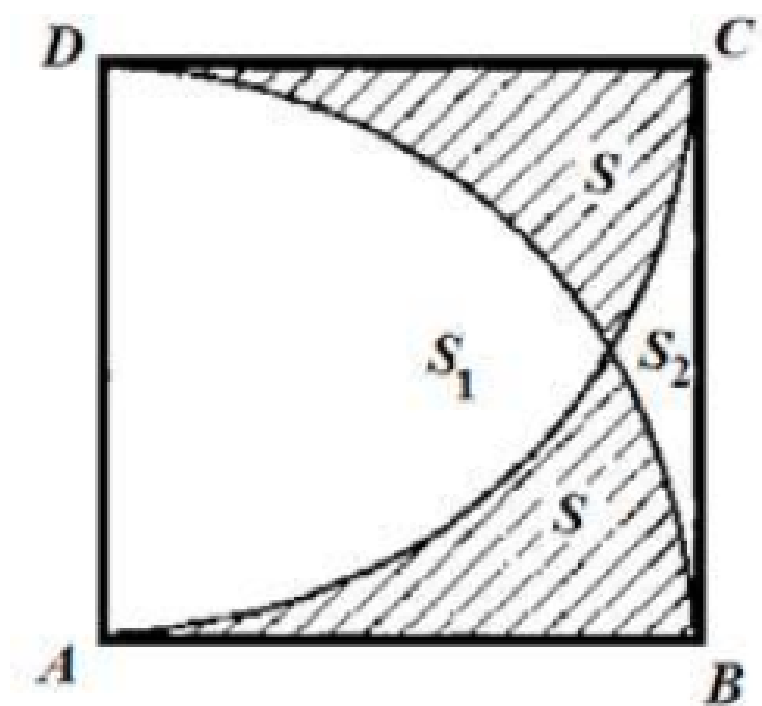
(E)
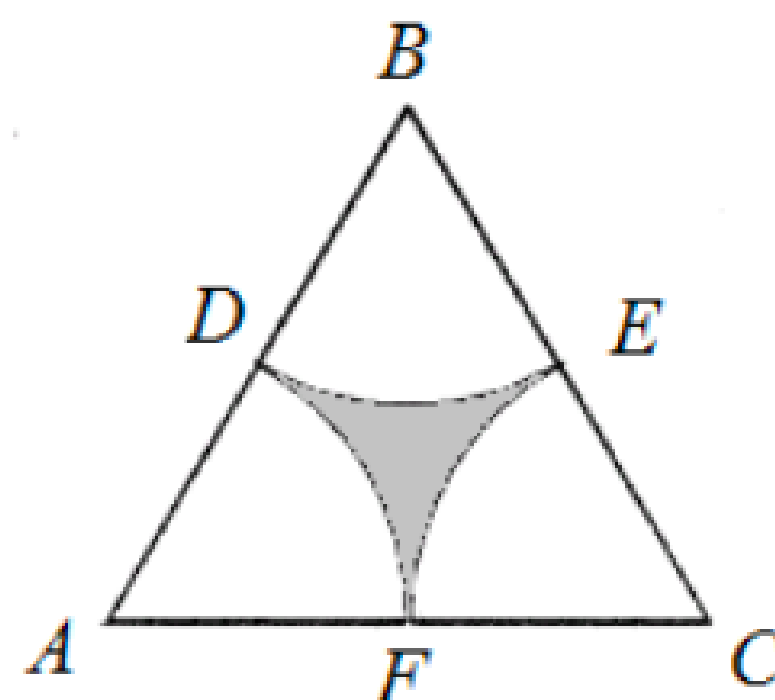
Example 25. In the rectangle shown, the radius of each quarter circle is 6. What is the area of the shaded region?

(A) $120 - 36\pi$

(B) 36π

(C) $200 - 36\pi$

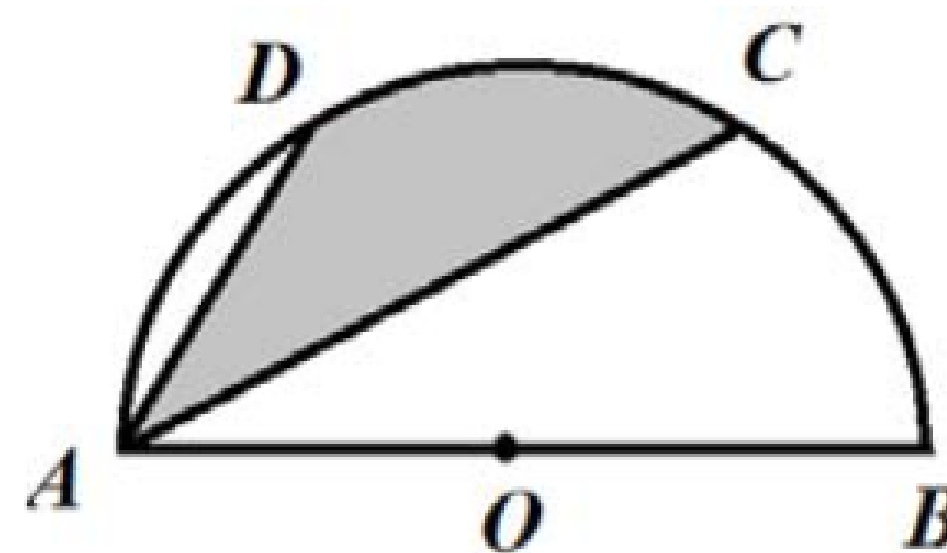(D) $120 - 18\pi$

(E) $240 - 36\pi$
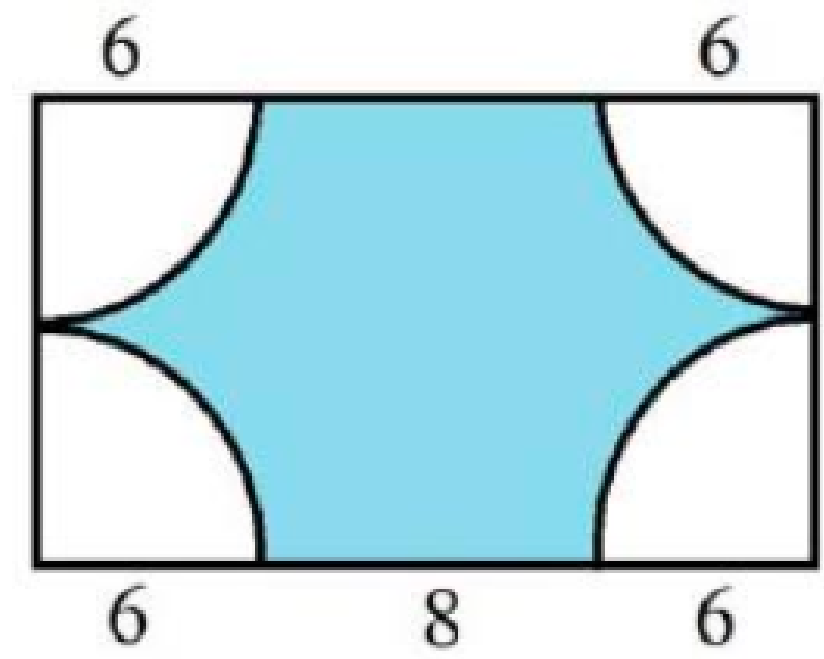
Example 26. In square $ABCD$, $AB = 1$. BD and AC are arcs of radius 1. Two shaded areas are the same. Find the difference of the unshaded areas.

(A) $\dfrac{\pi}{2} - 1.$ (B) $1 - \dfrac{\pi}{4}.$ (C) $\dfrac{\pi}{3} - 1.$

(D) $1 - \dfrac{\pi}{6}.$ (E) $2 - \dfrac{\pi}{2}.$

Example 27. D and C trisect the arc of the half circle as shown in the figure. Find the shaded area if the area of the half circle is 9π.

(A) 3π (B) 4π (C) 5π (D) 6π (E) 2π

☆**Example 28.** Semi-circles of radius 2 and 3 are externally tangent and are circumscribed by a third semi-circle, as shown in the figure. Find the area of the shaded region.

(A) 3π (B) 4π (C) 6π (D) 9π (E) 12π