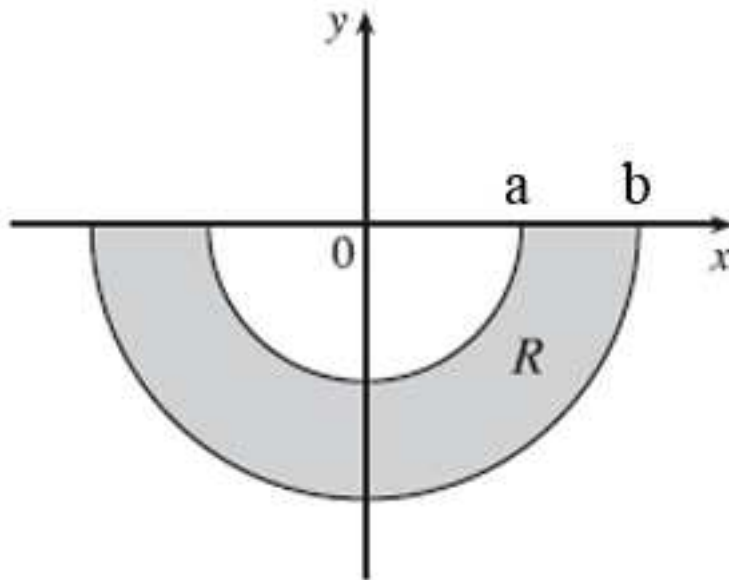The integral $\int_\pi^{2\pi} \int_3^5 4r \, dr \, d\theta$ represents the area of the region
$R = \{(r, \theta) \mid 3 \le r \le 5, \, \pi \le \theta \le 2\pi\}$, the lower half of a ring.

$$\int_\pi^{2\pi} \int_3^5 4r \, dr \, d\theta \;=\; 4 \left(\int_\pi^{2\pi} d\theta \right) \left(\int_3^5 r \, dr \right) = 4 \,[\,\theta\,]_\pi^{2\pi} \left[\frac{1}{2} r^2 \right]_3^5 = 4\pi \cdot \frac{1}{2} (25 - 9) = 32\pi$$

Assume $a = 3$
$\qquad\quad b = 5$