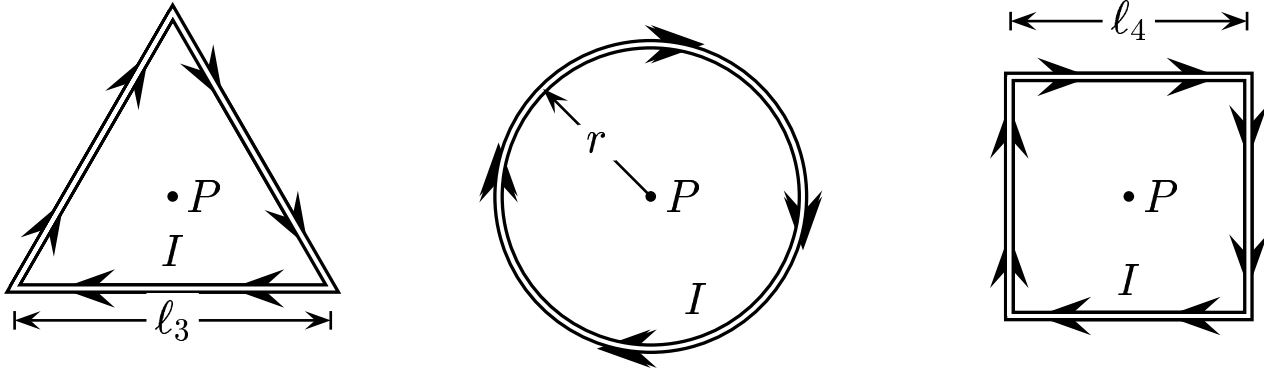


Given: Three conductors (same length, L) have the shape of an equilateral triangle (whose sides are of length ℓ_3), a ring (whose radius is of length r), a square (whose sides are of length ℓ_4).

These conductor's lengths are all equal (perimeters: $L = 3\ell_3 = 2\pi r = 4\ell_4$). All conductors carry the same current I .



Select the correct comparison for the magnitude of the magnetic field at the center points P of the current loops shown above.

- A) $B_{square} > B_{triangle} > B_{ring}$ B) $B_{triangle} > B_{ring} > B_{square}$
 C) $B_{ring} > B_{triangle} > B_{square}$ D) $B_{triangle} > B_{square} > B_{ring}$
 E) $B_{square} > B_{ring} > B_{triangle}$

Using $B = \frac{\mu_0 I}{4\pi a} \int_{\theta_1}^{\theta_2} \sin\theta d\theta$, at point P , we have

Triangle: $B_{triangle} = \frac{9}{2\pi} \frac{\mu_0 I}{\ell_3} \approx 1.4324 \frac{\mu_0 I}{\ell_3}$, largest

Square: $B_{square} = \frac{8\sqrt{2}}{3\pi} \frac{\mu_0 I}{\ell_3} \approx 1.2004 \frac{\mu_0 I}{\ell_3}$

Ring: $B_{ring} = \frac{\pi}{3} \frac{\mu_0 I}{\ell_3} \approx 1.0472 \frac{\mu_0 I}{\ell_3}$, smallest

Therefore, $B_{triangle} > B_{square} > B_{ring}$.

Note: We expect B to be smallest at its center point for the wire ring since the wire is farthest from its center point.

Note: We expect B to be largest at its center point for the wire triangle since the wire is (on average) the closest to its center point.

Answer D.