Part of a long piece of wire is bent into a semicircle of radius R. A current I flows from left to right through the wire.

a. Use the Biot-Savart Law to calculate the magnetic field at the center of the semicircle due to segments 1, 2, and 3 of the wire.

b. What is the direction of the magnetic field at the center of the circle?

\[ \mathbf{dB} = \frac{\mu_0 I}{4\pi} \frac{ds}{r^2} \sin \theta \]

1. \( \theta = 0^\circ \), \( \mathbf{B} = 0 \)
2. \( \theta = 90^\circ \), \( \mathbf{B} \)
3. \( \theta = 180^\circ \), \( \mathbf{B} = 0 \)

\[ \mathbf{B} = \frac{\mu_0 I \int_0^S \frac{ds}{r^2}}{4\pi} \]

\[ S = \frac{1}{2}(3\pi R) = \pi R \]

b. \( \overrightarrow{ds} \times \hat{r} \) for 2 is into paper

\[ = \frac{\mu_0 I (\pi R)}{4\pi R^2} = \frac{\mu_0 I}{4R} \text{ Tesla} \]