A rectangular loop of wire is placed next to a straight wire as shown in the figure below. There is a current of 2.5A in both wires. What are the magnitude and direction of the net force on the loop?

\[ B_{\text{wire}} = \frac{\mu_0 I}{2\pi r} \quad \mu_0 = 4\pi \times 10^{-7} \text{ Tm/A} \]

RHAD \Rightarrow point the thumb of your RH in the direction of conventional current; your fingers curl in the direction of the magnetic field

\[ \text{current} \]

\[ F = I L B \sin \theta \]

RHAT \Rightarrow point fingers of RH along \( \vec{B} \) and thumb along \( \vec{F} \); palm points in the direction of \( \vec{F} \) on a charged particle
\[ F_{net} = -F_L \]

\[ F = I L B \sin \theta \]

\[ F_{net} = F_{top} - F_{bottom} \]

\[ = I_1 L B_{top} \sin 90^\circ - I_2 L B_{bottom} \sin 90^\circ \]

\[ = I_1 L \left( \frac{\mu_0 I_2}{2 \pi \Gamma_{top}} \right) - I_2 L \left( \frac{\mu_0 I_2}{2 \pi \Gamma_{bottom}} \right) \]

\[ I_1 = I_2 = 2.5 A \]

\[ F_{net} = \frac{\mu_0 I_1 I_2 L}{2 \pi} \left[ \frac{1}{\Gamma_{top}} - \frac{1}{\Gamma_{bottom}} \right] \]

\[ \Gamma_{top} = 3.0 \text{ cm} = 0.030 \text{ m} \]

\[ \Gamma_{top} = 8.0 \text{ cm} = 0.080 \text{ m} \]

\[ F_{net} = \frac{\left(4 \pi \times 10^{-7} \text{Tm/A}\right)(2.5 A)(2.5 A)(0.10 \text{ m})}{2 \pi} \left[ \frac{1}{0.030 \text{ m}} - \frac{1}{0.080 \text{ m}} \right] \]

\[ \vec{F}_{net} = 2.6 \times 10^{-6} \text{ N upward} \]