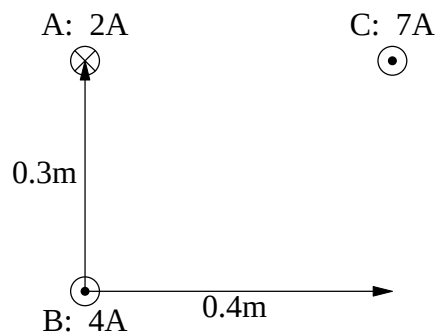
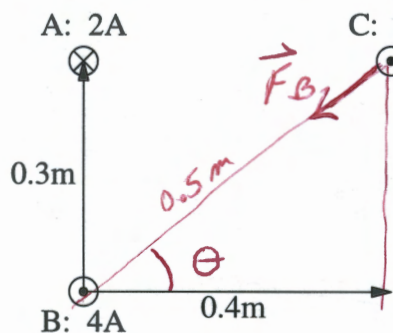


2. (20 pts.) Three long parallel wires are arranged as shown. Wire A has a current of 2A headed into the page, wire B has a current of 4A headed out of the page, and wire C has a current of 7A headed out of the page, as shown. Find the magnitude and direction of the net magnetic force per unit length on wire C.



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$$\tan \theta = \frac{.3}{.4}$$

$$\theta = 36.9^\circ$$

$$\vec{F}_A = \frac{\mu_0 I_A I_C}{2\pi r_{AC}} \quad \text{a) } 0^\circ, \quad I_A = 2, I_C = 7, r_{AC} = 0.4$$

$$\vec{F}_B = \frac{\mu_0 I_B I_C}{2\pi r_{BC}} \quad \text{b) } (180^\circ + 36.9^\circ = 216.9^\circ)$$

$$I_B = 4A, I_C = 7A, r_{BC} = 0.5$$

$$\vec{F}_{\text{Tot}} = \vec{F}_A + \vec{F}_B$$

x-components

$$F_{\text{Tot},x} = F_{Ax} + F_{Bx} = \frac{\mu_0 I_A I_C}{2\pi r_{AC}} + \frac{\mu_0 I_B I_C}{2\pi r_{BC}} \cos 216.9$$

$$= \frac{\mu_0 I_C}{2\pi} \left[ \frac{I_A}{r_{AC}} + \frac{I_B}{r_{BC}} \cos 216.9 \right]$$

$$= \frac{(4\pi \times 10^{-7})(7)}{2\pi} \left[ \frac{2}{.4} + \frac{4}{.5} \cos 216.9 \right] = -1.96 \times 10^{-6} \text{ N}$$

$$F_{\text{Tot},y} = F_{Ay} + F_{By} = 0 + \frac{\mu_0 I_B I_C}{2\pi r_{BC}} \sin 216.9 = \frac{(4\pi \times 10^{-7})(4)(7)}{2\pi(.5)} (-0.6)$$

$$= -6.72 \times 10^{-6} \text{ N}$$

$$F_{\text{Tot}} = 7.0 \times 10^{-6} \text{ N} \quad \text{a) } -106^\circ$$