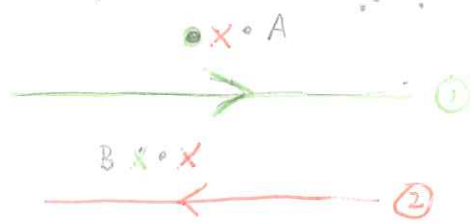
Electromagnetism 2 • Fields Produced by Moving Charges

(1)



let X be +
• be −

A: $B_{1A} = \frac{\mu_0 I_1}{2\pi(0.10)} = 8.0\times10^{-6}\,T$ out

$B_{2A} = \frac{\mu_0 I_2}{2\pi(0.26)} = 1.53846\times10^{-6}\,T$ in

$\vec{B}_A = \vec{B}_{1A} + \vec{B}_{2A} = \boxed{6.5\times10^{-6}\,T \text{ OUT}}$

B: $B_{1B} = \frac{\mu_0 I_1}{2\pi(0.12)} = 6.\bar{6}\times10^{-6}\,T$ in

$B_{2B} = \frac{\mu_0 I_2}{2\pi(0.04)} = 1.0\times10^{-5}\,T$ in

$\vec{B}_B = \vec{B}_{1B} + \vec{B}_{2B} = \boxed{1.7\times10^{-5}\,T \text{ IN}}$

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(2) $\vec{F}_1 = B_2 I_1 \ell = \frac{\mu_0 I_2}{2\pi(0.16)} I_1 (2.0) = \boxed{2.0\times10^{-5}\,N \text{ UP!}}$

$\vec{F}_2 = -\vec{F}_1$ (N3) $= \boxed{2.0\times10^{-5}\,N \text{ DOWN!}}$

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(3) $B = \frac{\mu_0 N I}{\ell} = \frac{\mu_0 N\left(\frac{V}{R}\right)}{\ell} = \frac{\mu_0(400)\left(\frac{6.0V}{2.0\Omega}\right)}{0.20m} = \boxed{0.0075\,T}$

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(4) $\boxed{\text{ATTRACT}}$

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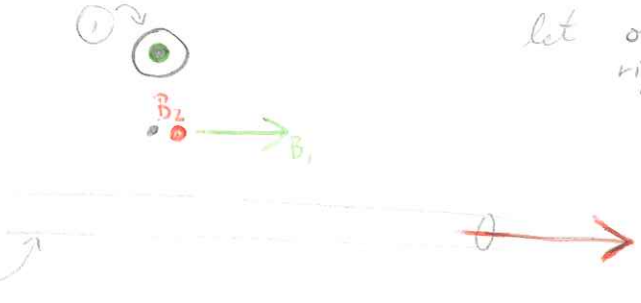
(5)



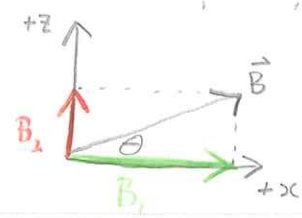
let out be called $+z$
right be called $+x$

$\vec{B}_1 = \frac{\mu_0 I_1}{2\pi(0.1)} = 4.0\times10^{-5}\,T\,\hat{x}$

$\vec{B}_2 = \frac{\mu_0 I_2}{2\pi(0.1)} = 1.0\times10^{-5}\,T\,\hat{z}$

Now I have to add these two ⊥ vectors

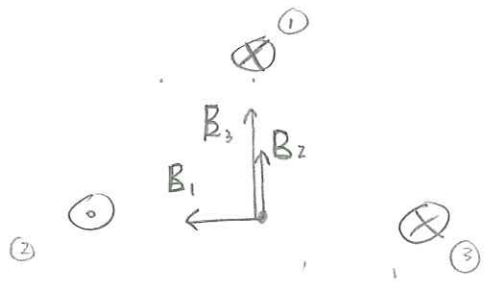
I can rearrange my axes so they look like



$B = \sqrt{B_1^2 + B_2^2}$ $\qquad \theta = \tan^{-1}\left(\frac{B_2}{B_1}\right)$

$\vec{B} = 4.1\times10^{-5}\,T$ @ 14° toward +z from +x
(out from +x)

(6)



$B_1 = \frac{\mu_0 I_1}{2\pi(0.04)} = 2.0\times10^{-5}\,T$ left.

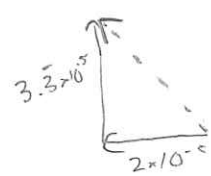
$B_2 = \frac{\mu_0 I_2}{2\pi(0.03)} = 1.333\times10^{-5}\,T$ up

$B_3 = \frac{\mu_0 I_3}{2\pi(0.03)} = 2.0\times10^{-5}\,T$ up

Then vector addition:

$\vec{B}_x = \vec{B}_1$

$\vec{B}_y = B_2 + B_3$



$\vec{B} = 3.9\times10^{-5}\,T$ @ 59° above $-x$