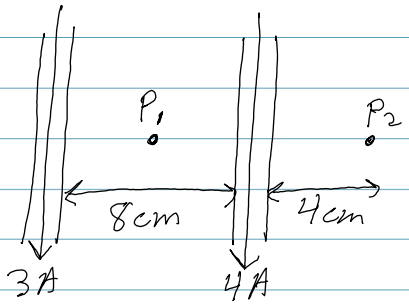
Magnetism 2

1) 

Find the magnitude & direction of the magnetic field at point P_1 & P_2.

$B = \frac{\mu_0 I}{2\pi r}$

P_1

$B_3 = \frac{4\pi \times 10^{-7}(3)}{2\pi(.04)} = 1.5\times10^{-5}$ T out of page

$B_4 = \frac{4\pi \times 10^{-7}(4)}{2\pi(.04)} = 2.0\times10^{-5}$ T into page

+ = out

- in

$+1.5\times10^{-5} - 2\times10^{-5} = -5\times10^{-6}$

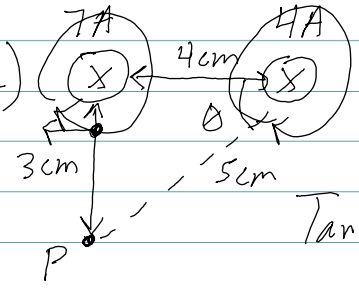
5×10^{-6} T into page

P_2

$B_3 = \frac{4\pi \times 10^{-7}(3)}{2\pi(.12)} = 5\times10^{-6}$ T out of page

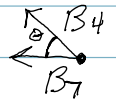
$B_4 = 2\times10^{-5}$ T out of page

$2\times10^{-5} + 5\times10^{-6} = 2.5\times10^{-5}$ T out of page

2) 

Find the magnitude & direction of the magnetic field at point P.

$\tan^{-1}\left(\frac{3}{4}\right) = \theta = 36.87°$

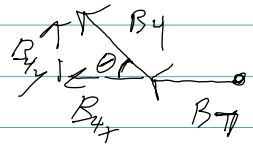


$B_7 = \frac{4\pi \times 10^{-7}(7)}{2\pi(.03)}$

$B_7 = 4.67\times10^{-5}$ T

$B_4 = \frac{4\pi \times 10^{-7}(4)}{2\pi(.05)}$

$B_4 = 1.6\times10^{-5}$ T

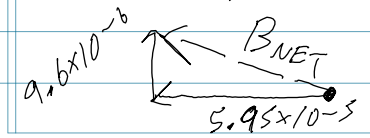


$B_{4x} = 1.6\times10^{-5}(\cos 36.87°) = 1.28\times10^{-5}$ T

$B_{4y} = 1.6\times10^{-5}(\sin 36.87°) = 9.6\times10^{-6}$ T

$\Sigma B_x = B_7 + B_{4x} = -4.67\times10^{-5} - 1.28\times10^{-5} = -5.95\times10^{-5}$ T

$\Sigma B_y = B_{4y} = 9.6\times10^{-6}$ T

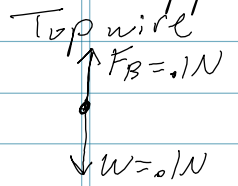


$a^2 + b^2 = c^2$

$\tan^{-1}\left(\frac{o}{a}\right) = \theta$

6.03×10^{-5} T at 9.17° N of W

3) A 0.10 N wire that is 2.0m long is suspended directly above a second wire. The top wire carries a current of 40 A & the bottom wire has a current of 65 A. What is the distance of separation between the wires if the top wire is in static equilibrium? Are the currents moving in the same or opposite directions?



$W = F_B = 0.1N$

$F_T = B_B I_T l_T$

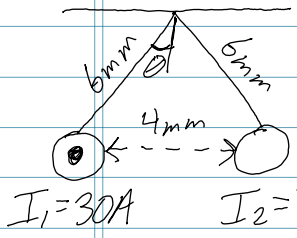
$B_B = \frac{\mu_0 I_B}{2\pi d}$

$F_T = \frac{\mu_0 I_B I_T l_T}{2\pi d}$

$.1N = \frac{4\pi \times 10^{-7}(65)(40)(2)}{2\pi d}$

$d = 0.0104m$ opposite directions

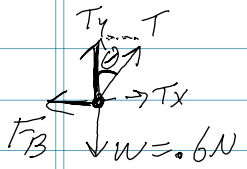
4)



Two wires that are ⊥ to the page are suspended by a string. What is I_2 if they are separated by 4 mm & have a weight per unit length of 0.6 N/m? What is the direction of current in I_2?

① $\sin^{-1}\left(\frac{.002}{.006}\right) = \theta$

$\theta = 19.47°$



② $T_y = W = .6N$

③ $\tan 19.47° = \frac{T_x}{.6}$

$T_x = 0.2121N$

④ $T_x = F_B = .2121N$

⑤ $F_1 = \frac{\mu_0 I_1 I_2 l_1}{2\pi d}$

$.2121 = \frac{4\pi \times 10^{-7}(30)(I_2)\,1}{2\pi(.004)}$

$I_2 = 141\,A$

into the page