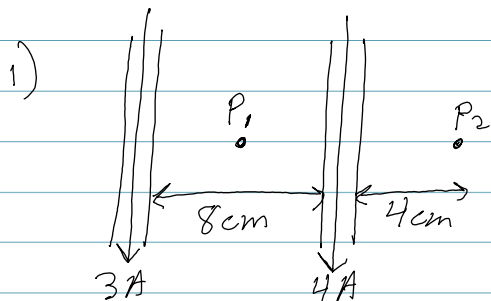


## Magnetism 2



Find the magnitude & direction of the magnetic field at point P<sub>1</sub> & P<sub>2</sub>.

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

P<sub>1</sub>

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

P<sub>2</sub>

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

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

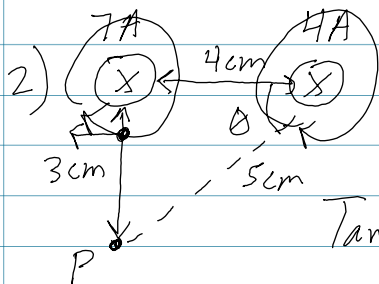
$$B_4 = 2 \times 10^{-5} \text{ T out of page}$$

+ = out  
- = in

$$+1.5 \times 10^{-5} - 2 \times 10^{-5} = -5 \times 10^{-6}$$

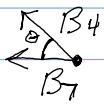
$$2 \times 10^{-5} + 5 \times 10^{-6} = 2.5 \times 10^{-5} \text{ T out of page}$$

$$5 \times 10^{-6} \text{ T into page}$$



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

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

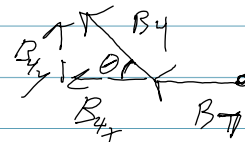


$$B_7 = \frac{4\pi \times 10^{-7} (7)}{2\pi (.03)}$$

$$B_7 = 4.67 \times 10^{-5} \text{ T}$$

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

$$B_4 = 1.6 \times 10^{-5} \text{ T}$$

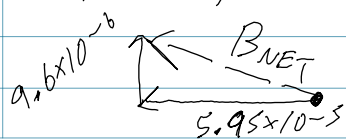


$$B_{4x} = 1.6 \times 10^{-5} (\cos 36.87^\circ) = 1.28 \times 10^{-5} \text{ T}$$

$$B_{4y} = 1.6 \times 10^{-5} (\sin 36.87^\circ) = 9.6 \times 10^{-6} \text{ T}$$

$$\Sigma B_x = B_7 + B_{4x} = -4.67 \times 10^{-5} - 1.28 \times 10^{-5} = -5.95 \times 10^{-5} \text{ T}$$

$$\Sigma B_y = B_{4y} = 9.6 \times 10^{-6} \text{ T}$$



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

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

$$6.03 \times 10^{-5} \text{ T}$$

$$at 9.17^\circ \text{ N of W}$$

3) A 0.10 N wire that is 2.0 m 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?

Top wire

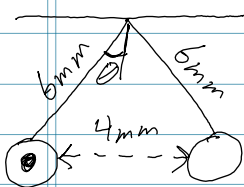
$F_B = 0.1 \text{ N}$     $W = F_B = 0.1 \text{ N}$     $F_T = \frac{\mu_0 I_B I_T l_T}{2\pi d}$

$W = 0.1 \text{ N}$     $F_T = B_B I_T l_T$     $B_B = \frac{\mu_0 I_B}{2\pi d}$

$0.1 \text{ N} = \frac{4\pi \times 10^{-7} (65)(40)(2)}{2\pi d}$

$d = 0.0104 \text{ m}$  opposite directions

4)



Two wires that are  $\perp$  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  $I_2$ ?

$I_1 = 30 \text{ A}$     $I_2 = ?$

①  $\sin^{-1}\left(\frac{0.002}{0.006}\right) = \theta$   
 $\theta = 19.47^\circ$

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

②  $T_y = W = 0.6 \text{ N}$

$0.2121 = \frac{4\pi \times 10^{-7} (30)(I_2) l}{2\pi (0.004)}$

③  $\tan 19.47^\circ = \frac{T_x}{0.6}$

$T_x = 0.2121 \text{ N}$

④  $T_x = F_B = 0.2121 \text{ N}$

$I_2 = 141 \text{ A}$

into the page

