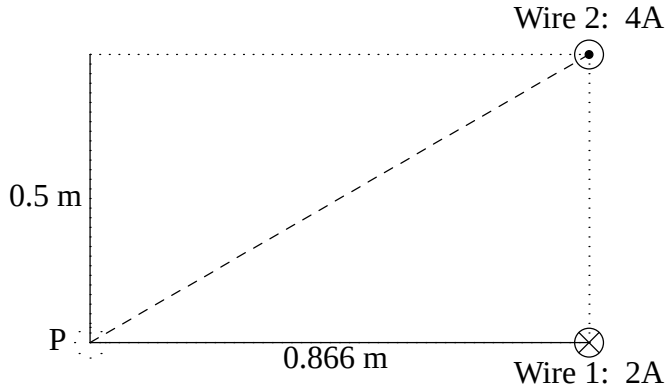
Physics 112-01
Spring 2001
Test 2

1. (30 pts.) Two long parallel wires are arranged as shown. Wire 1 has a current of 2A headed into the page, and wire 2 has a current of 4A headed out of the page.



a. (5 pts.) What is the magnitude of the magnetic field due to wire 1 at point "P" at the origin?

b. (5 pts.) What is the direction of the magnetic field due to wire 1 at point "P"? Express your answer in degrees away from the positive *x*-axis.

c. (5 pts.) What is the magnitude of the magnetic field due to wire 2 at point "P" at the origin?

d. (5 pts.) What is the direction of the magnetic field due to wire 2 at point "P"? Express your answer in degrees away from the positive *x*-axis.

e. (10 pts.) What are the magnitude and direction of the total magnetic field due to wires 1 and 2 at point "P"?

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March 28, 2001

Name: SOLUTIONS

Be sure to show your work **clearly** and **draw a box around your answer**. If any question is unclear, please ask immediately.

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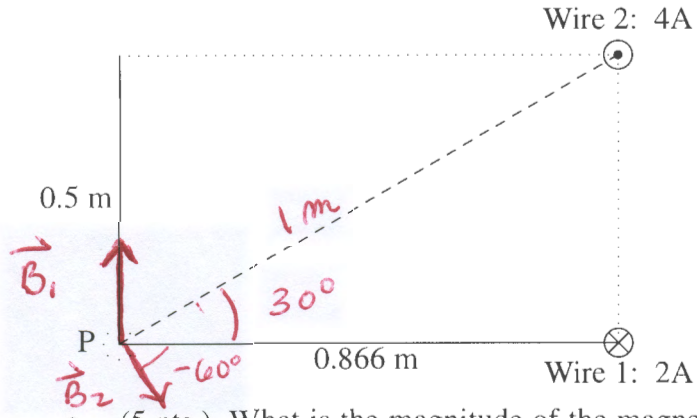

a. (5 pts.) What is the magnitude of the magnetic field due to wire 1 at point "P" at the origin?

$$B_1 = \frac{\mu_0 I_1}{2\pi R_1} = \frac{(4\pi \times 10^{-7})(2A)}{2\pi (0.866\,m)} = \boxed{4.62 \times 10^{-7}\,T}$$

b. (5 pts.) What is the direction of the magnetic field due to wire 1 at point "P"? Express your answer in degrees away from the positive x-axis.

$\boxed{+90^\circ}$

c. (5 pts.) What is the magnitude of the magnetic field due to wire 2 at point "P" at the origin?

$$B_2 = \frac{\mu_0 I_2}{2\pi r_2} = \frac{(4\pi \times 10^{-7})(4)}{2\pi\ (1)} = \boxed{8.00 \times 10^{-7}\ T}$$

d. (5 pts.) What is the direction of the magnetic field due to wire 2 at point "P"? Express your answer in degrees away from the positive x-axis.

$\boxed{-60^\circ}$

e. (10 pts.) What are the magnitude and direction of the total magnetic field due to wires 1 and 2 at point "P"?

$$B_{TOT,x} = B_{1x} + B_{2x}$$

$$= (4.62 \times 10^{-7}) \cos 90^\circ + (8.00 \times 10^{-7}) \cos(-60^\circ)$$

$$B_{TOT,x} = 4.00 \times 10^{-7}\ T$$

$$B_{TOT,y} = B_{1y} + B_{2y}$$

$$= (4.62 \times 10^{-7}) \sin 90^\circ + (8.00 \times 10^{-7}) \sin(-60^\circ)$$

$$B_{TOT,y} = -2.31 \times 10^{-7}\ T$$

$$\boxed{B_{TOT} = 4.62 \times 10^{-7}\ T\ @\ -30^\circ}$$