

# FINAL TEST - Review

## PHN 242

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NAME \_\_\_\_\_

SCORE \_\_\_\_\_

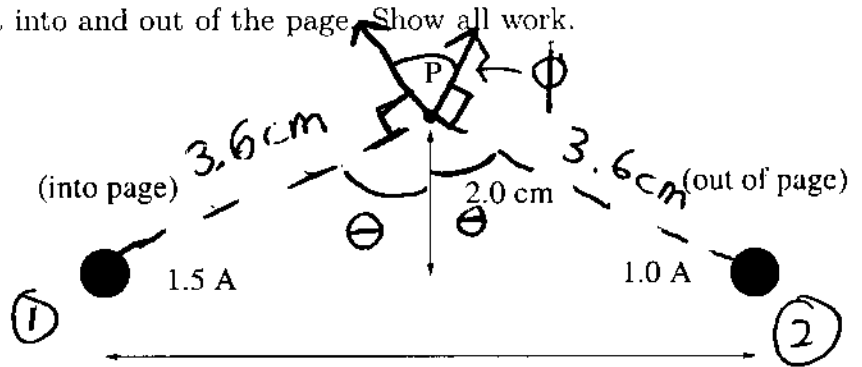
Remember to get full credit label answers with correct units, show all work, draw diagrams.

Useful constants and formulas:  $\epsilon_0 = 8.85 \times 10^{-12} \text{ F/m}$ ,  $\frac{1}{4\pi\epsilon_0} = 8.99 \times 10^9 \text{ Nm}^2/\text{C}^2$ ,  $q_{\text{electron}} = -1.6 \times 10^{-19} \text{ C}$ ,  $mass_{\text{electron}} = 9.11 \times 10^{-31} \text{ kg}$ ,  $q_{\text{proton}} = +1.6 \times 10^{-19} \text{ C}$ ,  $mass_{\text{proton}} = 1.67 \times 10^{-27} \text{ kg}$ ,  $1 \text{ eV} = 1.6 \times 10^{-19} \text{ J}$ ,  $\mu_0 = 1.26 \times 10^{-6} \text{ Tm/A}$ ,  $B_{\text{wire}} = \frac{\mu_0 i}{2\pi r}$ ,  $A_{\text{circle}} = \pi r^2$ ,  $C_{\text{circle}} = 2\pi r$ ,  $A_{\text{triangle}} = \frac{1}{2}bh$

1. [12 pts] What is the magnitude and direction of the **B** field at point P? The figure represents two wires carrying current into and out of the page. Show all work.

$$\theta = \tan^{-1}\left(\frac{2 \text{ cm}}{3 \text{ cm}}\right)$$

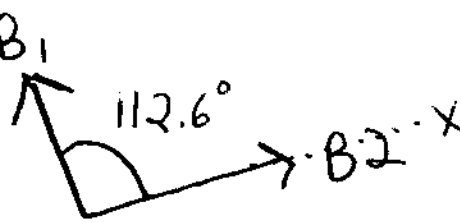
$$= 33.7^\circ$$



$$\phi + 33.7 + 33.7 + 180 = \cancel{360} \quad 360$$

$$\phi = 112.6^\circ$$

$$r = 3.6 \text{ cm}$$



$$B_1 = \frac{\mu_0 I_1}{2\pi r} = 8.33 \times 10^{-6} \text{ T}$$

$$B_2 = \frac{\mu_0 I_2}{2\pi r} = 5.55 \times 10^{-6} \text{ T}$$

Let  $B_2$  be on the "x" axis

$$B_x = (B_2) - B_1 \sin(22.6^\circ) = +2.35 \times 10^{-6} \text{ T}$$

$$B_y = B_1 \cos(22.6^\circ) = +7.69 \times 10^{-6} \text{ T}$$

$$\theta' = \tan\left(\frac{B_y}{B_x}\right) = 73^\circ \text{ (as measured from x axis - } B_2)$$

$$B = \sqrt{B_x^2 + B_y^2} = 8.04 \times 10^{-6} \text{ T}$$

