Physics 2220
Spring 2000
George A. Williams

# FOURTH MIDTERM

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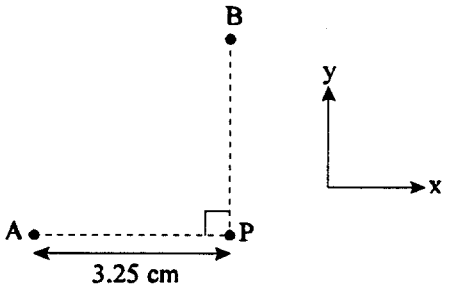
Discussion Section # _____ Student ID #: _____

**SHOW ALL WORK!!!!!**
**REPORT ALL NUMBERS TO THREE SIGNIFICANT FIGURES!**
**Use the conversion constants and data given on the front page.**

In the diagram + means currents out of the paper, − means currents into the paper. There are two long straight wires, A and B perpendicular to the paper. A, B and P are at 3 corners of a square.




(a) Calculate the magnetic field, magnitude and direction, at point P. Measure angles counterclockwise from the positive x-direction.

(b) A third wire is placed at P perpendicular to the paper. Determine the force per meter, magnitude and direction, on the third wire if its current is −4.75 A.

$I_A = +7.75$ A $\qquad I_B = -6.25$ A

a) $\vec{B} = \frac{\mu_0 I_A}{2\pi a}\hat{j} - \frac{\mu_0 I_B}{2\pi a}\hat{i} = (4.78\,\hat{j} - 3.85\,\hat{i})\,10^{-5}\,T$ ✓

$|\vec{B}| = \sqrt{B_x^2 + B_y^2} = 6.14 \cdot 10^{-5}\,T$

$\theta_B = 90° + \tan^{-1}\left(\frac{I_B}{I_A}\right) = 90° + 39° = 129°$ (second quadrant)

b) $\vec{F} = I\vec{\ell} \times \vec{B}$

$\frac{F}{\ell} = I \cdot B = 4.75 \cdot 6.14 \cdot 10^{-5} = 2.92 \cdot 10^{-4}\,N$

$\theta_F = \theta_B - 90° = 39°$