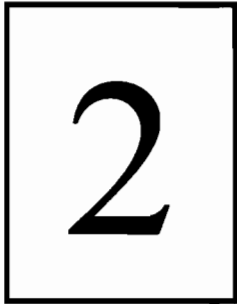


# THIRD MIDTERM



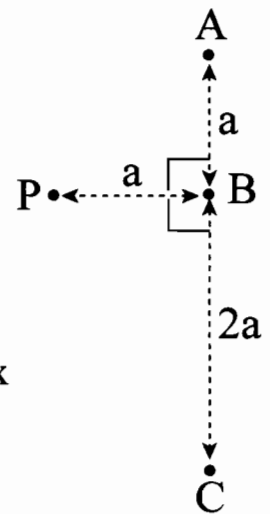
Name: \_\_\_\_\_ Student ID #: \_\_\_\_\_

Discussion Instructor (circle): Eric      Gary      Jose      Monica

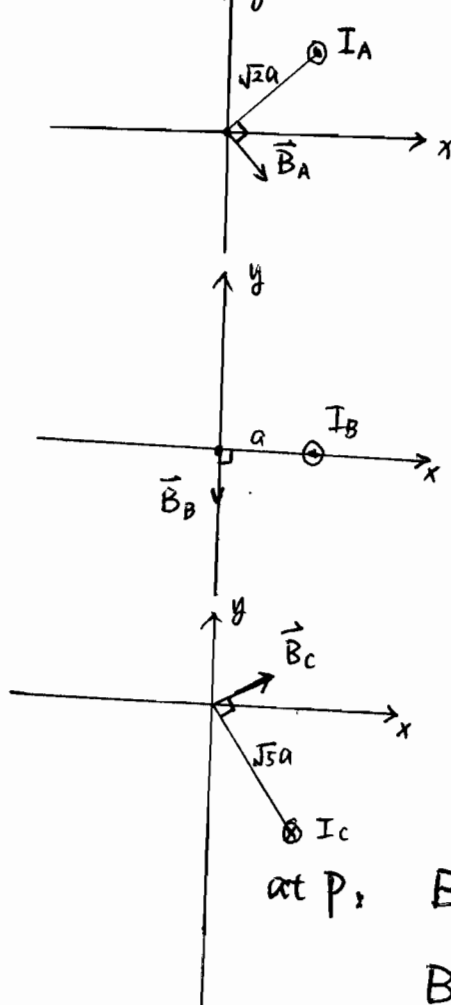
**SHOW ALL WORK!!!!**  
**REPORT ALL NUMBERS TO THREE SIGNIFICANT FIGURES!**  
**Use the conversion constants and data given on the front page.**

Three long straight wires are perpendicular to the paper at the points labeled A, B, C. The currents are given below. + is out of the paper, - is into the paper.

- 7 (a) Calculate the x-component of the magnetic field at P (with sign).
- 7 (b) Calculate the y-component of the magnetic field at P (with sign).
- 5 (c) Calculate the magnitude of the resulting magnetic field at P.
- 6 (d) Calculate the direction of the magnetic field at P, as an angle measured counter-clockwise from the positive x-axis.



$I_A = +15.2 \text{ A}$ ;  $I_B = +12.7 \text{ A}$ ;  $I_C = -17.2 \text{ A}$ ;  $a = 3.65 \text{ cm}$



$$B = \frac{\mu I}{2\pi d}$$

$$B_A = \frac{\mu I_A}{2\pi \cdot \sqrt{2}a}$$

$$B_{Ax} = B_A \cdot \frac{\sqrt{2}}{2} = \frac{\mu I_A}{4\pi a}$$

$$B_{Ay} = -B_A \cdot \frac{\sqrt{2}}{2} = -\frac{\mu I_A}{4\pi a}$$

$$B_B = \frac{\mu I_B}{2\pi \cdot a}$$

$$B_{Bx} = 0$$

$$B_{By} = -\frac{\mu I_B}{2\pi a}$$

$$B_C = \frac{\mu I_C}{2\pi \cdot \sqrt{5}a}$$

$$B_{Cx} = B_C \cdot \frac{2}{\sqrt{5}} = \frac{\mu I_C}{5\pi a}$$

$$B_{Cy} = B_C \cdot \frac{1}{\sqrt{5}} = \frac{\mu I_C}{10\pi a}$$

(c)  $B = \sqrt{B_x^2 + B_y^2}$   
 $\approx 12.2 \times 10^{-5} \text{ T}$

(d)  $\theta = 360^\circ - \tan^{-1} \frac{9.24}{7.93}$   
 $\approx 360^\circ - 49.3^\circ$   
 $= 310.7^\circ$

(a) at P:  $B_x = B_{Ax} + B_{Bx} + B_{Cx} = \frac{\mu I_A}{4\pi a} + 0 + \frac{\mu I_C}{5\pi a} \approx 7.93 \times 10^{-5} \text{ T}$

(b)  $B_y = B_{Ay} + B_{By} + B_{Cy} = -\frac{\mu I_A}{4\pi a} - \frac{\mu I_B}{2\pi a} + \frac{\mu I_C}{10\pi a} \approx -9.24 \times 10^{-5} \text{ T}$