Physics 2220
Spring 2000
George A. Williams

FIRST MIDTERM

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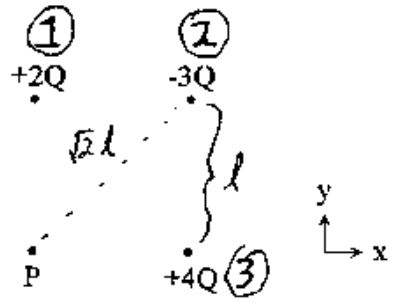
Discussion Instructor (circle): Billeter Bulson Muntean Paul Pomeroy Walker

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.

Three charges are placed at the corners of a square as shown. [$Q = 1.70 \times 10^{-10}$ C]



(a) Determine the electric field at point P in $\hat{i}$, $\hat{j}$ notation (numerical value).
(b) Calculate the magnitude of the electric field at point P (numerical value).

(a) The electric field at P is equal to the sum of the fields due to each charge. $\vec{E}_{Pi} = \frac{KQ_i}{r^2}\hat{r}$

$\vec{E}_{(at\ 2\ o'clock)\ P1} = -\frac{2KQ}{l^2}\hat{j} \quad (\hat{r} = -\hat{j} \quad r = l)$

$\vec{E}_{P2} = \frac{3kQ}{2\sqrt{2}l^2}\hat{i} + \frac{3kQ}{2\sqrt{2}l^2}\hat{j} \quad (\hat{r} = -\frac{1}{\sqrt{2}}\hat{i} - \frac{1}{\sqrt{2}}\hat{j} \quad r = \sqrt{2}l)$

$\vec{E}_{P3} = -\frac{4KQ}{l^2}\hat{i} \quad (\hat{r} = -\hat{i} \quad r = l)$

$\vec{E}_P = \left[\frac{3KQ}{2\sqrt{2}l^2} - \frac{4kQ}{l^2}\right]\hat{i} + \left[\frac{3kQ}{2\sqrt{2}l^2} - \frac{2kQ}{l^2}\right]\hat{j} =$

$= \boxed{(-1.997 \times 10^{12}\ N/C)\hat{i} + (-6.39 \times 10^{11}\ N/C)\hat{j}}$

b)

$\|\vec{E}_P\| = \sqrt{E_x^2 + E_y^2} = 2.10 \times 10^{12}\ N/C$