Physics 102-Rec
Quiz#5-Sect.24
Chapter 22

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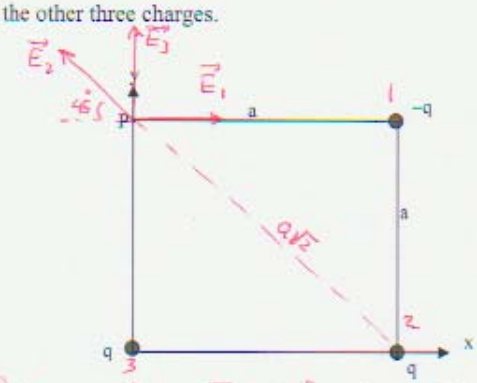
Name: Key Id:

Consider the configuration of charges shown in the figure. The charge the charge q = 5 μC, and the distance a = 10 cm.

(a) Find the net electric field at point P due to the other three charges.



$E_1 = \frac{kq}{a^2}$

$E_2 = \frac{kq}{2a^2}$

$E_3 = \frac{kq}{a^2}$

$E_x = E_1 - E_2 \cos 45^\circ = \frac{kq}{a^2} - \frac{kq}{2a^2}\frac{\sqrt{2}}{2} = \frac{kq}{a^2}\left(1 - \frac{\sqrt{2}}{4}\right)$

$= 2.9 \times 10^6$ N/C

$E_y = E_3 + E_2 \sin 45^\circ = \frac{kq}{a^2} + \frac{kq}{2a^2}\frac{\sqrt{2}}{2} = \frac{kq}{a^2}\left(1 + \frac{\sqrt{2}}{4}\right)$

$= 6.1 \times 10^6$ N/C

$$\vec{E} = 2.9 \times 10^6 \hat{i} + 6.1 \times 10^6 \hat{j} \ (\text{N/C})$$

(b) What is the net force on a charge Q = −2 μC if placed at point P?

$$\vec{F}_{net} = Q\vec{E}_{net} = -2 \times 10^{-6} \times (2.9 \times 10^6 \hat{i} + 6.1 \times 10^6 \hat{j})$$

$$\vec{F}_{net} = -(5.8\hat{i} + 12.2\hat{j}) \ \text{N}$$