PHYS 102: General Physics 2 **KOÇ UNIVERSITY** **Spring Semester 2011**

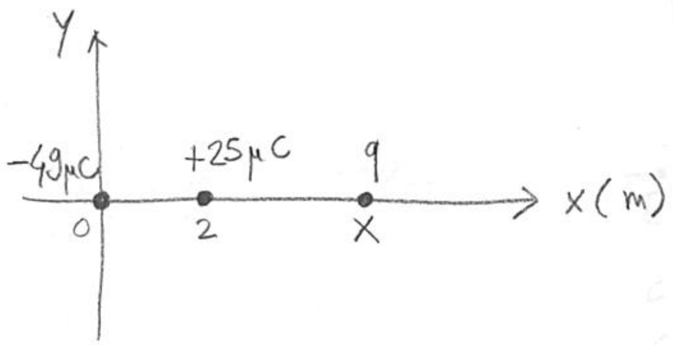
College of Sciences

Section 1 **Quiz 1** **17 February 2011**

Closed book. No calculators are to be used for this quiz.
Quiz duration: 10 minutes

Name: **Student ID:** **Signature:**

Three charged particles are positioned on the x-axis. A positive charge (25 μ C) is placed at x=2 m and a negative charge (-49 μ C) is positioned at the origin (x=0). Where on the positive x-axis must a third charge be placed so that the resultant force on it is zero?



$$k \frac{|(-49\mu C)\cdot q|}{x^2} = k \frac{|(+25\mu C)\cdot q|}{(x-2)^2}$$

$\rightarrow$ $x = 7$ m

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Section 2 **Quiz 1** **17 February 2011**

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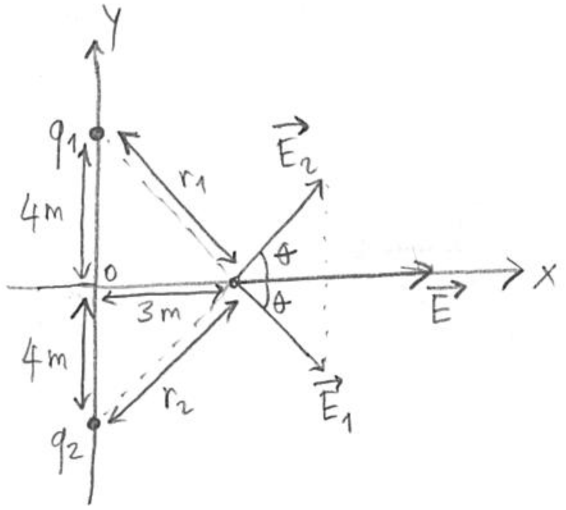
Quiz duration: 10 minutes

Name: **Student ID:** **Signature:**

Two identical $25x10^{-8}$ C charges are replaced on the y-axis at y=± 4m. What is the electric field vector on the x-axis at x=3m?



$q_1 = q_2 = 25\times10^{-8} C$

$\vec{E} = \vec{E_1} + \vec{E_2}$

$\cos\theta = 0.6$

$\sin\theta = 0.8$

$$E_1 = k \cdot \frac{q_1}{r_1^2} = k \cdot \frac{25\times10^{-8}}{25} = 10^{-8} k \quad N/C$$

$$E_2 = k \cdot \frac{q_2}{r_2^2} = k \cdot \frac{25\times10^{-8}}{25} = 10^{-8} \cdot k \quad N/C$$

$$E_{1x} = E_{2x} = E_1 \cdot \cos\theta = (10^{-8} \cdot k)(0.6) = 6\times10^{-9} \cdot k \quad N/C$$

$$\rightarrow E_x = E_{1x} + E_{2x} = 2E_{1x} = 1.2 \times 10^{-8} \cdot k \quad N/C$$

$$E_y = E_{1y} + E_{2y} = E_1 \cdot \sin\theta - E_2 \cdot \sin\theta = 0$$

$\rightarrow E = E_x = 1.2\times10^{-8} k$ (in the +x direction)

$= 108$ N/C

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Section 3 **Quiz 1** **17 February 2011**

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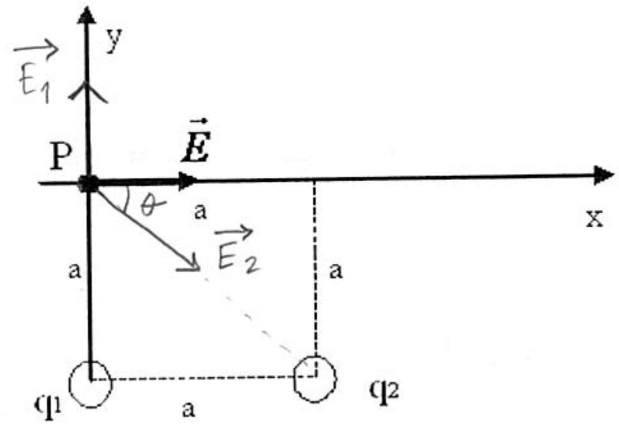
Quiz duration: 10 minutes

Name: **Student ID:** **Signature:**

Two point charges q_1 and q_2 are located at the corners of a square as in the figure. If the direction of the resultant electric field at point P is to the right, find the ratio (q_1/q_2) of the charges.



$E_1 = k\dfrac{|q_1|}{a^2}$, $E_2 = k\dfrac{|q_2|}{2a^2} \rightarrow |E_{2y}| = E_2 \cdot \sin\theta$

$= \dfrac{k|q_2|}{2a^2} \cdot \dfrac{1}{\sqrt{2}}$

$E_y = 0 \rightarrow E_1 = |E_{2y}|$

$$\frac{k|q_1|}{a^2} = k\frac{|q_2|}{2\sqrt{2}a^2}$$

$$\rightarrow \left|\frac{q_1}{q_2}\right| = \frac{1}{2\sqrt{2}}$$

• q_1 and q_2 are of opposite sign $\rightarrow \dfrac{q_1}{q_2} = -\dfrac{1}{2\sqrt{2}}$

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Section 4 **Quiz 1** **17 February 2011**

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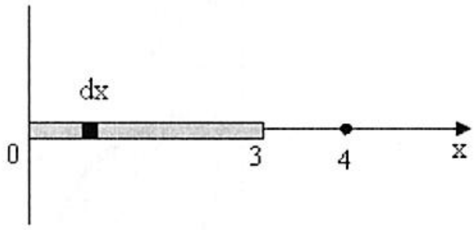
Quiz duration: 10 minutes

Name: **Student ID:** **Signature:**

A charge (uniform linear density= $8\text{x}10^{-9}$) is distributed along the x-axis from x=0 to x=3 m. Determine the magnitude of the electric field at a point on the x-axis with x=4 m.



$$(\text{charge over } dx) = dq = (8\times10^{-9})\,dx$$

$$\left(\begin{array}{l}\text{electric field at } x=4\text{m} \\ \text{due to } dq\end{array}\right) = dE = k\frac{dq}{(4-x)^2} = k\,\frac{(8\times10^{-9})\,dx}{(4-x)^2}$$

where x is the coordinate of dq

$$(\text{Total field at } x=4\text{ m}) = E = \int dE = \int_0^3 k\,\frac{(8\times10^{-9})\,dx}{(4-x)^2}$$

$$= k(8\times10^{-9})\left[\frac{1}{4-x}\right]_0^3$$

$$= k(8\times10^{-9})\left[1-\frac{1}{4}\right]$$

$$= (6\times10^{-9})k \text{ N/C}$$

$$= 54 \text{ N/C}$$

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Section 5 **Quiz 1** **17 February 2011**

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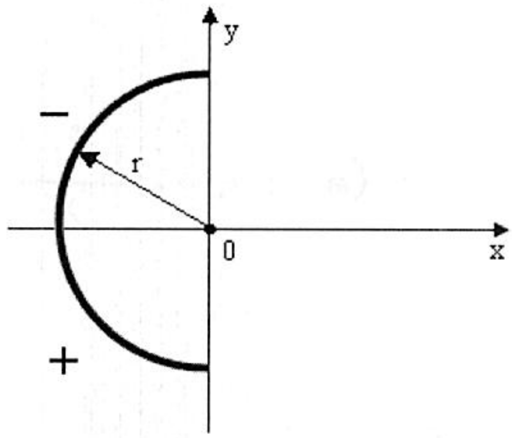
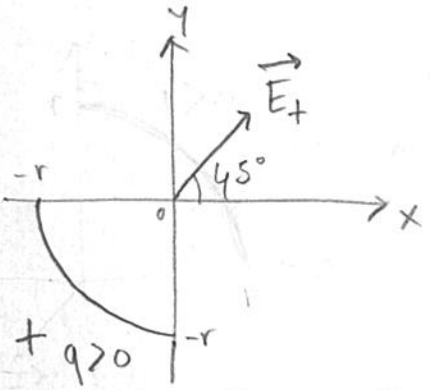
Quiz duration: 10 minutes

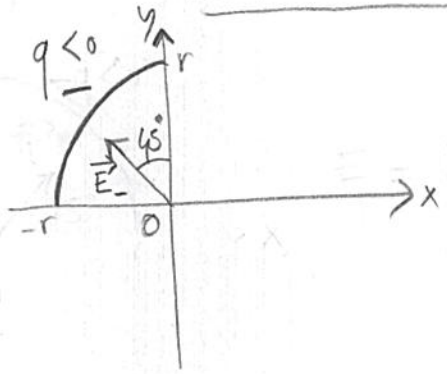
Name: **Student ID:** **Signature:**

A thin glass rod of length 15 cm is bent into a semicircle of radius r=5 cm. A charge q=-7.5 μ C is uniformly distributed along the upper half and a charge q=+7.5 μ C is uniformly distributed along the lower half as shown in the figure. Find the electric field vector at point 0.



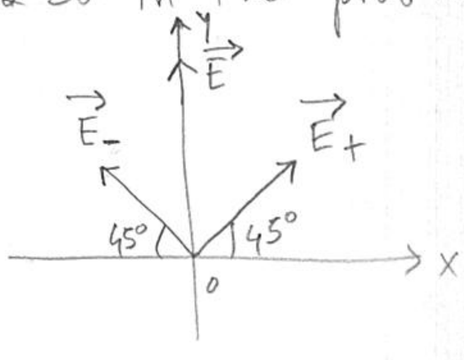
* Electric field at the origin due to charge q distributed uniformly over a $\frac{1}{4}$-circle:





$$(E_+)_y = (E_-)_y = \left(\frac{2}{\pi}\right)\frac{kq}{r^2}$$

* So in the problem:



$$(E_-)_y = (E_+)_y = \left(\frac{2}{\pi}\right) k \frac{(7.5\times10^{-6})}{(0.05)^2} = \left(\frac{k}{\pi}\right)(6\times10^{-3})\ \text{N/C}$$

$$\vec{E} = \vec{E}_- + \vec{E}_+$$

$$\to E_x = 0,\quad E_y = (E_-)_y + (E_+)_y = \left(\frac{12}{\pi}\times10^{-3}\right)k\ \text{N/C}$$

$$= 3.6\times10^{7}\ \text{N/C}$$