ECE110 - Quiz #1

Only non-programmable calculators are allowed.

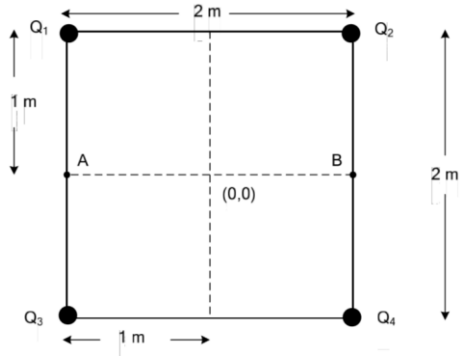
First Name: _____ *Last Name:* _____

*Student #:*_____ *Tutorial Location:* _____

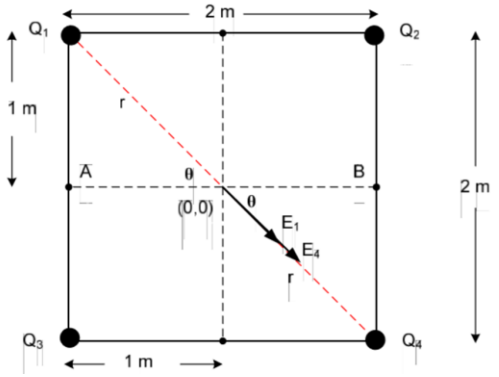
[5 Marks] Four charges are located at the corners of a square of side $a=2\ m$ as shown in the Figure below. If $Q_1 = Q_2 = Q_3 = 10\ \mu C$ and $Q_4 = -10\ \mu C$.

a) Find the magnitude of the electric field at the center of the square, at point (0, 0).

b) If a test charge $Q=2\ \mu C$ is placed at the square center, point (0, 0), find the magnitude of the electric force on this test charge due the other four charges.



Solution: No need to show the angle



Part a:

The electric field due to Q_3 cancels the electric field due to Q_2

$$|\mathrm{E}| = |E_1| + |E_4| = \frac{k\,|Q_1|}{r^2} + \frac{k\,|Q_4|}{r^2} = \frac{k}{r^2}(|Q_1| + |Q_4|)$$

$$r = \sqrt{1+1} = \sqrt{2}$$

$$|\mathrm{E}| = \frac{8.99\,\mathrm{x}10^9}{2}(10+10) * 10^{-6} = 89900\ \frac{N}{C}$$

$$\theta_E = -45^o$$

Part b:

$$|\mathrm{F}| = |\mathrm{E}|.\,\mathrm{q} = 89900 * 2\mathrm{x}\,10^{-6} = 0.1798\ \mathrm{N}$$

$$\theta_F = -45^o$$