

Name (Print) MING ZHAO Name (Signed) _____

Discussion Instructor (Circle One): Cady McAllister Molina Stone

Discussion Section #: _____

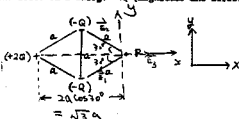
SHOW ALL WORK!!!!

REPORT ALL NUMBERS TO THREE SIGNIFICANT FIGURES!

Use the conversion constants and data given on the front page.

Three charges are at the corners of an equilateral triangle as shown.

- (a) Calculate the electric field (magnitude and direction) at point P.
(b) Calculate the force on a charge $-4Q$ (magnitude and direction) placed at P.



$$E_1^x = -\frac{kQ}{a^2} \cos 30^\circ = -\frac{\sqrt{3}}{2} \frac{kQ}{a^2} ; E_1^y = -\frac{kQ}{a^2} \sin 30^\circ = -\frac{1}{2} \frac{kQ}{a^2}$$

$$E_2^x = -\frac{kQ}{a^2} \cos 30^\circ = -\frac{\sqrt{3}}{2} \frac{kQ}{a^2} ; E_2^y = \frac{kQ}{a^2} \sin 30^\circ = \frac{1}{2} \frac{kQ}{a^2}$$

$$E_3^x = \frac{k(2Q)}{(\sqrt{3}a)^2} = \frac{2}{3} \frac{kQ}{a^2} ; E_3^y = 0$$

$$E_x = E_1^x + E_2^x + E_3^x = \frac{kQ}{a^2} \left(\frac{2}{3} - \sqrt{3} \right) = -1.065 \frac{kQ}{a^2} \quad (-9.55 \times 10^{-9} \frac{Q}{a^2})$$

$$E_y = E_1^y + E_2^y + E_3^y = 0$$

magnitude: $E = \sqrt{E_x^2 + E_y^2} = 1.065 \frac{kQ}{a^2}$

4-points. direction: along negative x-axis. ($\theta = 180^\circ$)

$$F_x = q E_x = 2(-4Q) \frac{4kQ^2}{a^2} (\sqrt{3} - \frac{2}{3}) = 4.26 \frac{kQ^2}{a^2} \quad (3.83 \times 10^{-10} \frac{Q^2}{a^2})$$

$$F_y = 0$$

magnitude: $F = \sqrt{F_x^2 + F_y^2} = 4.26 \frac{kQ^2}{a^2}$

3-points. direction: along positive x-axis ($\theta = 0^\circ$)