15-4)

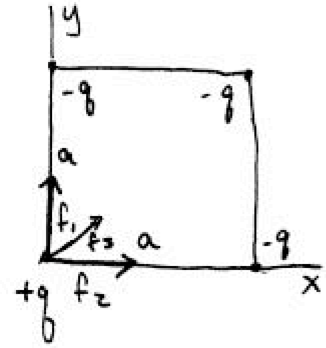
$|f_1| = |f_2| = k_e \frac{q^2}{a^2}$

$|f_3| = k_e \frac{q^2}{(\sqrt{2}a)^2} = k_e \frac{q^2}{2a^2}$

$|f_x| = |f_2| + \frac{1}{\sqrt{2}}|f_3|$

$f_x = k_e \frac{q^2}{a^2}\left(1 + \frac{1}{2\sqrt{2}}\right)$

$|f_y| = |f_x|$



15-22) $E_p = 3.25 \times 10^{-15}$ J

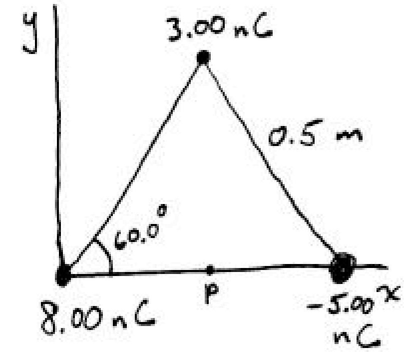
$\Delta E = W = F \cdot d \qquad F = Eq$

$E_p = Eqd$

$E = \frac{E_p}{qd} = \frac{E_p}{e \cdot 1.25m}$

$= 1.62 \times 10^4$ N/C opposite the direction of the protons

15-24 E at point p is the sum of the fields from each of the three charges.



$$E_x = k_e \left[\frac{8.00\,nC}{(0.25m)^2} + \frac{5.00\,nC}{(0.25m)^2} \right]$$

$$= k_e\, 2.08 \times 10^{-7} \frac{C}{m^2} = 1.87 \times 10^3 \frac{N}{C}$$

$$E_y = \frac{-k_e\, 3.00\,nC}{\left(\frac{\sqrt{3}}{2}\, 0.5m\right)^2} = -144 \frac{N}{C}$$

15-40) Solution previously posted is correct but does not have total net charge:

$$E = k_e \frac{q}{r^2}$$

$$q = \frac{E\, r^2}{k_e} = -5.57 \times 10^{-8}\ C$$