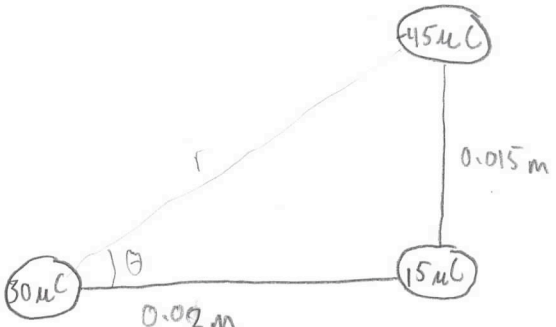
Psp 1 Alex Yeoh

(a) what is the net force & direction on the 15μC charge? What is the net E field and direction at 30μC?

(b)

(c)



(d) $F_{on\ 15\mu C} = ?$

θ of $F_{on\ 15\mu C} = ?$

E at 30μC = ?

θ of E at 30μC = ?

2a) Charges: 30μC, 15μC, −45μC

Distances: 0.03m, 0.015m

b) $r = \sqrt{0.03^2 + 0.015^2} = 0.0335\ m$

$\theta = 26.565°$

3a) pythag theorm: $a^2+b^2=c^2$

trig: SOH-CAH-TOA

Charged particle forces: $F = k\frac{qq}{r^2}$

Electric Field calculation: $E = k\frac{q}{r^2}$

3b) forces: $F = k\frac{qq}{r^2}$, calculate forces on 15μC

pythag theorm: $a^2+b^2=c^2$, calculate the net force on 15μC

Trig: $\theta = \tan^{-1}\left(\frac{opp}{adj}\right)$ calculate the angle on 15μC

E-field calc: $E = k\frac{Q}{r^2}$, Calculate the E-field from 15μC & −45μC.

Trig: $\theta = \tan^{-1}\left(\frac{opp}{adj}\right)$ calculate the angle to get the x & y from −45μC

pythag theorm: $a^2+b^2=c^2$, magnitude of E-field

Trig: $\theta = \tan^{-1}\left(\frac{opp}{adj}\right)$, Calculate the angle of net E-field

3c)

4a) $F_{30\ on\ 15} = 9\cdot10^9\left(\frac{30\cdot10^{-6}\cdot15\cdot10^{-6}}{0.03^2}\right) = 4500N$

$F_{-45\ on\ 15} = 9\cdot10^9\left(\frac{45\cdot10^{-6}\cdot15\cdot10^{-6}}{0.015^2}\right) = 27000N$

$E_{-45\ to\ 30} = 9\cdot10^9\frac{45\cdot10^{-6}}{0.0335^2} = 3.6\cdot10^8\ \frac{N}{C}$

$E_{15\ to\ 30} = 9\cdot10^9\frac{15\cdot10^{-6}}{0.03} = 1.5\cdot10^8\ \frac{N}{C}$

4b) Net $F = \sqrt{4500^2+27000^2} = 27372.43\ N$

θ of $F = \tan^{-1}(27000/4500) = 80.54°$

4a) continued (forgot to calculate earlier)

E_y −45 to 30 $= \sin(26.565)\cdot3.6\cdot10^8 = 1.61\cdot10^8\ N/C$

E_x −45 to 30 $= \cos(26.565)\cdot3.6\cdot10^8 = 3.23\cdot10^8\ N/C$

Net $E_x = 323\cdot10^8 - 1.5\cdot10^8 = 1.73\cdot10^8\ N/C$

4b) continued

Net $E = \sqrt{(1.73\cdot10^8)^2+(1.61\cdot10^8)^2} = 2.36\cdot10^8\ N/C$

θ of $E = \tan^{-1}(1.61\cdot10^8/1.73\cdot10^8) = 42.9°$