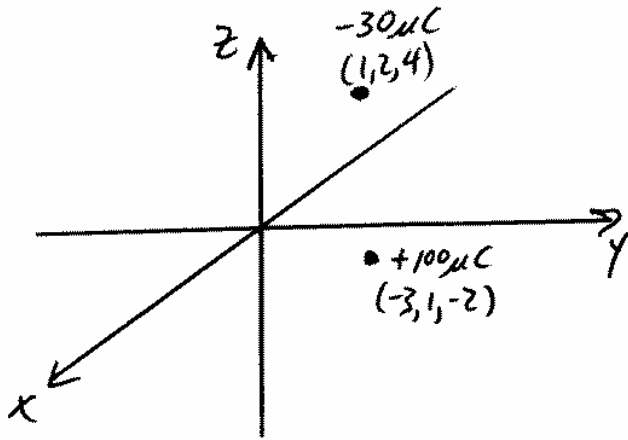


ex. Find the force exerted on a  $+100\mu\text{C}$  charge located at  $(-3, 1, -2)\text{m}$  by a  $-30\mu\text{C}$  charge located at  $(1, 2, 4)\text{m}$ .



Designate the  $+100\mu\text{C}$  to be  $Q_2$  and the  $-30\mu\text{C}$  to be  $Q_1$

$$\vec{F}_{12} = \frac{Q_1 Q_2}{4\pi\epsilon_0} \frac{\vec{r}_2 - \vec{r}_1}{|\vec{r}_2 - \vec{r}_1|^3}$$

Find position vectors to charge  $Q_1$  (source) +  $Q_2$  (field)

$$\vec{r}_1 = \hat{a}_x + 2\hat{a}_y + 4\hat{a}_z \quad (\text{m})$$

$$\vec{r}_2 = -3\hat{a}_x + \hat{a}_y - 2\hat{a}_z \quad (\text{m})$$

Find  $(\vec{r}_2 - \vec{r}_1)$  distance vector and  $|\vec{r}_2 - \vec{r}_1|$  distance

$$\vec{r}_2 - \vec{r}_1 = (-3-1)\hat{a}_x + (1-2)\hat{a}_y + (-2-4)\hat{a}_z$$

$$\vec{r}_2 - \vec{r}_1 = -4\hat{a}_x - \hat{a}_y - 6\hat{a}_z \quad (\text{m})$$

$$|\vec{r}_2 - \vec{r}_1| = \sqrt{(-4)^2 + (-1)^2 + (-6)^2} = \sqrt{53} \text{ m}$$

$$\vec{F}_{12} = \frac{(-30 \times 10^{-6})(100 \times 10^{-6})}{4\pi(8.854 \times 10^{-12})} \frac{(-4\hat{a}_x - \hat{a}_y - 6\hat{a}_z)}{(\sqrt{53})^3}$$

$$= \frac{-26.963}{(53)^{3/2}} (-4\hat{a}_x - \hat{a}_y - 6\hat{a}_z) = \underline{\underline{0.2795\hat{a}_x + 0.0699\hat{a}_y + 0.4193\hat{a}_z \text{ (N)}}}$$

Newtons

