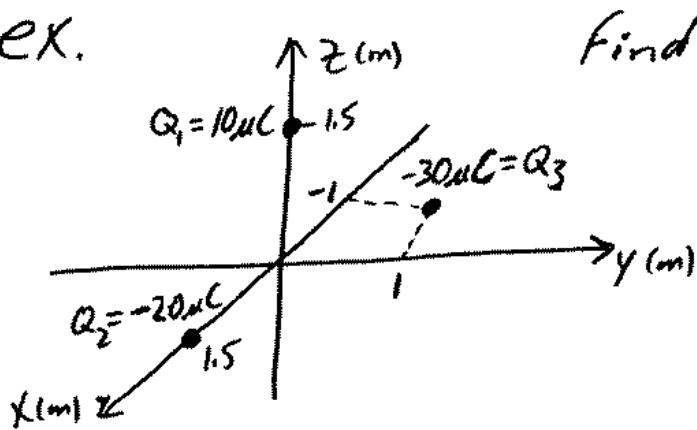


ex.



Find the force on charge \$Q_3\$.

$$\vec{F}_Q = \sum_{k=1}^2 \vec{F}_{Q_k}$$

$$\text{where } \vec{F}_Q = \frac{Q Q_k (\vec{r} - \vec{r}_k)}{4\pi\epsilon_0 |\vec{r} - \vec{r}_k|^3}$$

$$Q = Q_3 = -30 \mu\text{C}$$

1st Find force exerted by \$Q_1\$ on \$Q_3\$

source point position vector \$\vec{r}_1 = +1.5 \hat{a}_z\$ m

field point position vector \$\vec{r} = -1 \hat{a}_x + 1 \hat{a}_y\$ m

$$\begin{aligned} \vec{F}_{Q_1} &= \frac{(-30 \mu\text{C})(10 \mu\text{C})}{4\pi(8.854 \times 10^{-12})} \frac{((-1 \hat{a}_x + 1 \hat{a}_y) - 1.5 \hat{a}_z)}{(\sqrt{(-1)^2 + (1)^2 + (-1.5)^2})^3} \\ &= -0.30774 (-1 \hat{a}_x + 1 \hat{a}_y - 1.5 \hat{a}_z) \text{ (N)} \end{aligned}$$

2nd Find force exerted by \$Q_2\$ on \$Q_3\$

source \$\vec{r}_2 = +1.5 \hat{a}_x\$ m

field \$\vec{r} = -1 \hat{a}_x + 1 \hat{a}_y\$ m

$$\begin{aligned} \vec{F}_{Q_2} &= \frac{(-30 \mu\text{C})(-20 \mu\text{C})}{4\pi(8.854 \times 10^{-12})} \frac{((-1 \hat{a}_x + 1 \hat{a}_y) - 1.5 \hat{a}_x)}{(\sqrt{(-1-1.5)^2 + 1^2})^3} \\ &= 0.276245 (-2.5 \hat{a}_x + 1 \hat{a}_y) \text{ (N)} \end{aligned}$$

3rd Sum to get total force

$$\vec{F}_Q = \vec{F}_{Q_1} + \vec{F}_{Q_2}$$

$$\begin{aligned} &= (0.30774 - 2.5(0.276245)) \hat{a}_x + (-0.30774 + 0.276245) \hat{a}_y \\ &\quad + (1.5)(0.30774) \hat{a}_z \end{aligned}$$

$$\underline{\underline{\vec{F}_Q = -0.3829 \hat{a}_x - 0.0315 \hat{a}_y + 0.4616 \hat{a}_z \text{ (N)}}$$