

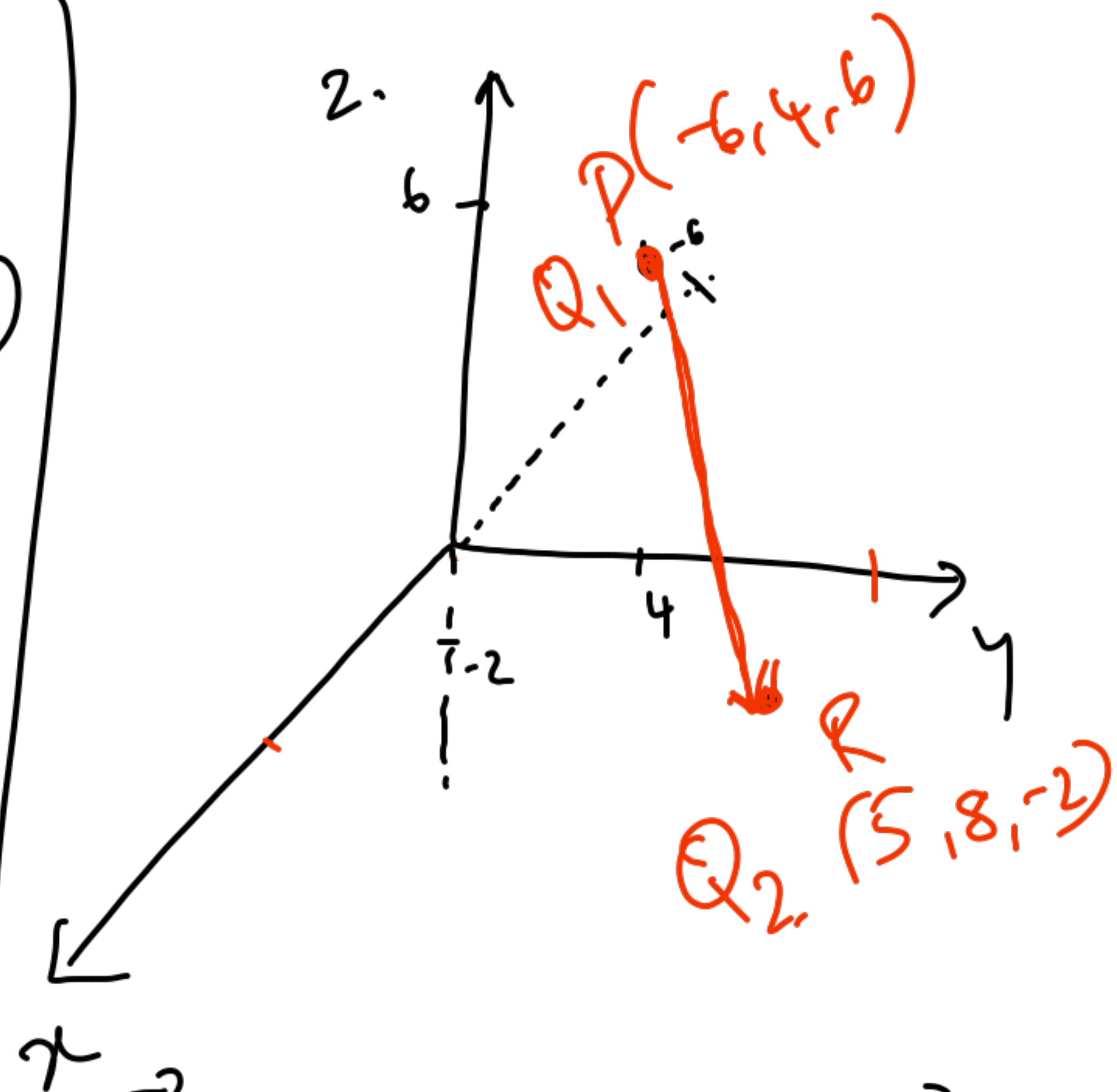
1) A Charge $Q_1 = -20 \mu\text{C}$ is located at $P(-6, 4, 6)$ and a Charge $Q_2 = 50 \mu\text{C}$ is located at $R(5, 8, -2)$ in a free space. Find the force exerted on Q_2 by Q_1 in vector form. The distance are in meter.

Soln.

$$Q_1 = -20 \times 10^{-6} \text{ C}$$

$$Q_2 = 50 \times 10^{-6} \text{ C}$$

$$P(-6, 4, 6) \quad R(5, 8, -2)$$



$$\vec{P} = -6\vec{a}_x + 4\vec{a}_y + 6\vec{a}_z$$

$$\vec{R} = 5\vec{a}_x + 8\vec{a}_y - 2\vec{a}_z$$

The force on the Q_2 is given by.

$$\vec{F} = \frac{Q_1 Q_2}{4\pi\epsilon_0 \times d_{PR}^2} \cdot \vec{a}_{PR}$$

$$\vec{PR} = (5 - (-6))\vec{a}_x + (8 - 4)\vec{a}_y + (-2 - 6)\vec{a}_z$$

$$\vec{PR} = 11\vec{a}_x + 4\vec{a}_y - 8\vec{a}_z$$

$$d_{PR} = |\vec{PR}| = \sqrt{(11)^2 + (4)^2 + (-8)^2}$$

$$d_{PR} = |\vec{PR}| = 14.18$$

$$\vec{a}_{PR} = \frac{\vec{PR}}{|\vec{PR}|}$$

$$= \frac{11\vec{a}_x + 4\vec{a}_y - 8\vec{a}_z}{14.18}$$

$$\vec{a}_{PR} = 0.78\vec{a}_x + 0.28\vec{a}_y - 0.56\vec{a}_z$$

$$\vec{F} = \frac{-20 \times 10^{-6} \times 50 \times 10^{-6}}{4 \times \pi \times 8.854 \times 10^{-12} \times (14.18)^2} \left[0.78\vec{a}_x + 0.28\vec{a}_y - 0.56\vec{a}_z \right]$$

$$\vec{F} = -0.034\vec{a}_x - 0.013\vec{a}_y + 0.025\vec{a}_z$$

$$|\vec{F}| = \sqrt{(-0.034)^2 + (-0.013)^2 + (0.025)^2}$$

$$|\vec{F}| = 44.63 \text{ mN}$$