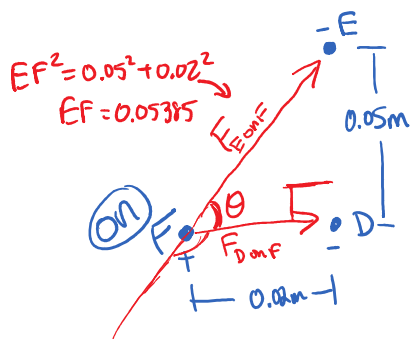


(similar to test question)

Point charge D,  $-3.2 \times 10^{-9}$  C, is 5.0 cm to the South of another point charge E,  $-4.5 \times 10^{-9}$  C. What is the magnitude of the resultant force on point charge F,  $+5.2 \times 10^{-9}$  C, which is 2.0 cm to the West of D? Sketch the situation as part of you solution.



$$\tan \theta = \frac{0.05 \text{ m}}{0.02 \text{ m}}$$

$$\theta = 68.20^\circ$$

Force vector diagram for charge F. Vector  $\vec{F}_{D \text{ on } F}$  points from F to D (upwards). Vector  $\vec{F}_{E \text{ on } F}$  points from F to E (up and to the right). The resultant force vector  $\vec{F}_{\text{on } F}$  is shown as the diagonal of a parallelogram formed by  $\vec{F}_{D \text{ on } F}$  and  $\vec{F}_{E \text{ on } F}$ . The angle between  $\vec{F}_{D \text{ on } F}$  and  $\vec{F}_{\text{on } F}$  is  $180 - 68.2 = 111.8^\circ$ .

$$\vec{F}_{D \text{ on } F} = \frac{k Q_D Q_F}{r^2}$$

$$= \frac{9 \times 10^9 (3.2 \times 10^{-9}) (5.2 \times 10^{-9})}{(0.02 \text{ m})^2}$$

$$= 3.744 \times 10^{-4} \text{ N}$$

$$\vec{F}_{E \text{ on } F} = \frac{k Q_E Q_F}{r^2}$$

$$= \frac{9 \times 10^9 (4.5 \times 10^{-9}) (5.2 \times 10^{-9})}{(0.05385)^2}$$

$$= 7.263 \times 10^{-5} \text{ N}$$

Cosine Law:

$$F_{\text{on } F}^2 = (3.744 \times 10^{-4})^2 + (7.263 \times 10^{-5})^2 - 2(3.744 \times 10^{-4})(7.263 \times 10^{-5}) \cos 111.8^\circ$$

$$F_{\text{on } F} = 4.1 \times 10^{-4} \text{ N}$$