

Answer on Question #67117, Physics / Electromagnetism

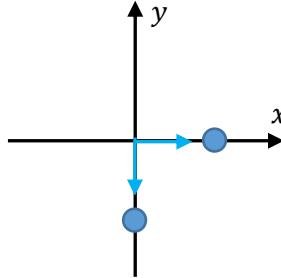
$$\vec{E} = 60 \vec{e}_x - 45 \vec{e}_y \left[\frac{V}{m} \right]$$

$$|\vec{E}| = 75 \left[\frac{V}{m} \right]$$

Question

A -15 nC point charged is placed on the x-axis at $x = 1.5 \text{ m}$ and a -20 nC charge is placed on the y-axis at $y = -2.0 \text{ m}$. What is the magnitude of the electric field at the origin?

Solution



Blue circles represents charges, arrows – partial electric fields.

1st charge:

$$q_1 = -15 \text{ nC}, \quad x_1 = 1.5 \text{ m}, \quad y_1 = 0 \text{ m}$$

$$\vec{E}_1 = k \frac{q}{r^3} \vec{r} = -\frac{kq_1}{x_1^2} \vec{e}_x \approx -\frac{9 \cdot 10^9 \cdot 15 \cdot 10^{-9}}{1.5^2} \vec{e}_x = 60 \vec{e}_x \left[\frac{V}{m} \right]$$

2nd charge:

$$q_2 = -20 \text{ nC}, \quad x_2 = 0 \text{ m}, \quad y_2 = -2.0 \text{ m}$$

$$\vec{E}_2 = k \frac{q}{r^3} \vec{r} = \frac{kq_2}{y_2^2} \vec{e}_y \approx -\frac{9 \cdot 10^9 \cdot 20 \cdot 10^{-9}}{2^2} \vec{e}_y = -45 \vec{e}_y \left[\frac{V}{m} \right]$$

Total electric field at the origin:

$$\vec{E} = \vec{E}_1 + \vec{E}_2$$

$$\vec{E} = 60 \vec{e}_x - 45 \vec{e}_y \left[\frac{V}{m} \right]$$

$$|\vec{E}| = \sqrt{60^2 + (-45)^2} = 75 \left[\frac{V}{m} \right]$$

Answer provided by <https://www.AssignmentExpert.com>