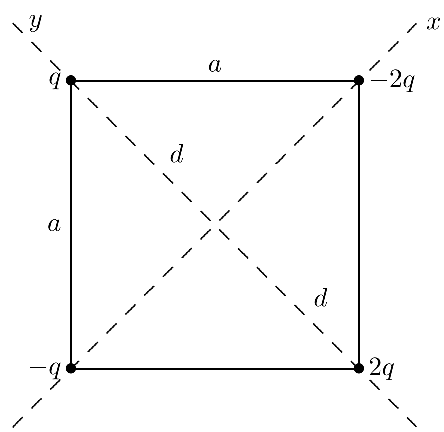
13. We choose the coordinate axes as shown on the diagram below. At the center of the square, the electric fields produced by the charges at the lower left and upper right corners are both along the x axis and each points away from the center and toward the charge that produces it. Since each charge is a distance $d = \sqrt{2}a/2 = a/\sqrt{2}$ away from the center, the net field due to these two charges is

$$\begin{aligned} E_x &= \frac{1}{4\pi\varepsilon_0}\left(\frac{2q}{a^2/2} - \frac{q}{a^2/2}\right) = \frac{1}{4\pi\varepsilon_0}\frac{q}{a^2/2} \\ &= \frac{\left(8.99\times 10^9\,\mathrm{N\cdot m^2/C^2}\right)\left(1.0\times 10^{-8}\,\mathrm{C}\right)}{(0.050\,\mathrm{m})^2/2} = 7.19\times 10^4\ \mathrm{N/C}\ . \end{aligned}$$



At the center of the square, the field produced by the charges at the upper left and lower right corners are both along the y axis and each points away from the charge that produces it. The net field produced at the center by these charges is

$$E_y = \frac{1}{4\pi\varepsilon_0}\left[\frac{2q}{a^2/2} - \frac{q}{a^2/2}\right] = \frac{1}{4\pi\varepsilon_0}\frac{q}{a^2/2} = 7.19\times 10^4\ \mathrm{N/C}\ .$$

The magnitude of the field is

$$E = \sqrt{E_x^2 + E_y^2} = \sqrt{2(7.19\times 10^4\,\mathrm{N/C})^2} = 1.02\times 10^5\,\mathrm{N/C}$$

and the angle it makes with the x axis is

$$\theta = \tan^{-1}\frac{E_y}{E_x} = \tan^{-1}(1) = 45^\circ\ .$$

It is upward in the diagram, from the center of the square toward the center of the upper side.