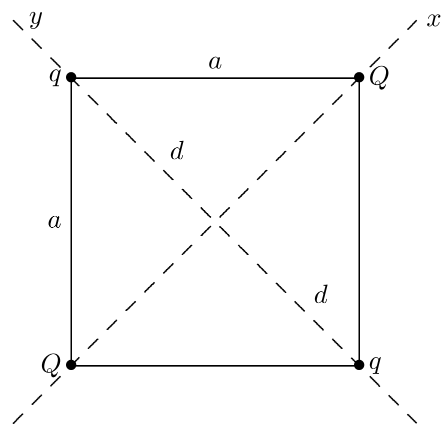
14. (a) We choose the coordinate axes as shown in the diagram below. For ease of presentation (of the computations below) we assume $Q > 0$ and $q < 0$ (although the final result does not depend on this particular choice). The repulsive force between the diagonally opposite Q's is along our (tilted) x axis. The attractive force between each pair of Q and q is along the sides (of length a). In our drawing, the distance between the center to the corner is d, where $d = a/\sqrt{2}$, and the diagonal itself is therefore of length $2d = a\sqrt{2}$.



Since the angle between each attractive force and the x axis is $45°$ (note: $\cos 45° = 1/\sqrt{2}$), then the net force on Q is

$$\begin{aligned} F_x &= \frac{1}{4\pi\varepsilon_0}\left(\frac{(Q)(Q)}{(2d)^2} - 2\frac{(|q|)\,(Q)}{a^2}\cos 45°\right) \\ &= \frac{1}{4\pi\varepsilon_0}\left(\frac{Q^2}{2a^2} - 2\frac{|q|\cdot Q}{a^2}\frac{1}{\sqrt{2}}\right) \end{aligned}$$

which (upon requiring $F_x = 0$) leads to $|q| = Q/2\sqrt{2}$ or $q = -\frac{Q}{2\sqrt{2}}$.

(b) The net force on q, examined along the y axis is

$$\begin{aligned} F_y &= \frac{1}{4\pi\varepsilon_0}\left(\frac{q^2}{(2d)^2} - 2\frac{(|q|)\,(Q)}{a^2}\sin 45°\right) \\ &= \frac{1}{4\pi\varepsilon_0}\left(\frac{q^2}{2a^2} - 2\frac{|q|\cdot Q}{a^2}\frac{1}{\sqrt{2}}\right) \end{aligned}$$

which (if we demand $F_y = 0$) leads to $q = -2Q\sqrt{2}$ which is inconsistent with the result of part (a). Thus, we are unable to construct an equilibrium configuration with this geometry, where the only forces acting are given by Eq. 22-1.