Physics with Mathematica Fall 2019   Exercise #1   28 Aug 2019
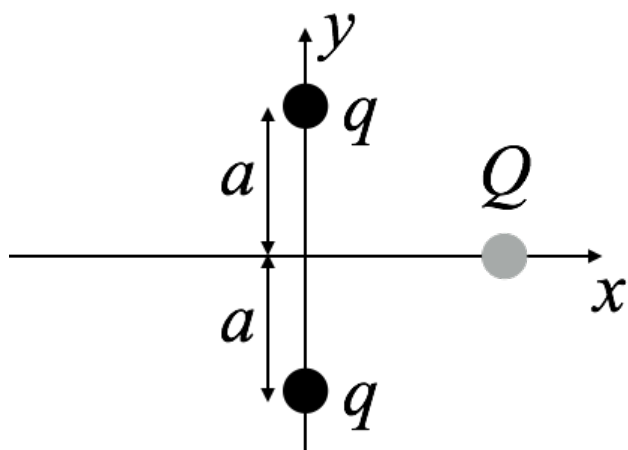
Force on a Charge

The figure below shows an arrangement of three charges:

The two charges q are fixed at $y = \pm a$ on the y-axis, that is $x = 0$, while the charge Q is free to move along the x-axis.

Find the net force $F(x)$ on Q as a function of x. (Note that the net force has only an x-component.) Write the result as an expression in terms of q, Q, a, and the fundamental constants of Coulomb's law.

Make two plots of $F(x)$, one where Q is the same sign as q and one where it is opposite. Use $a = 0.1$ m, $q = 2$ μC, and $Q = \pm 1$ μC and plot the force in Newtons and the position x in meters. Put the two plots on the same graph, each having a different color. Use the Plot option called PlotLegends to label the two plots.

From your graph, estimate the positions where the force is maximum and minimum. (Later we'll learn how to do this more precisely, by taking the derivative, and solving for the positions where the derivative is zero.)

Send the grader an email with your notebook as an attachment.