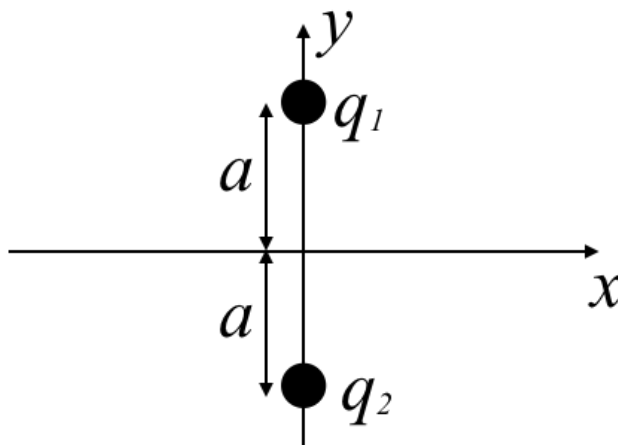


Electric Potential and Field in a Plane with Two Charges

Two charges  $q_1$  and  $q_2$  lie along the  $y$ -axis in the  $x, y$  plane as shown here:



Find an expression for the electrostatic potential  $\phi(x, y)$  by adding the potentials from the two point charges, that is  $\phi = k/r$ . Then find the components  $E_x(x, y)$  and  $E_y(x, y)$  of the electric field  $\mathbf{E}(x, y)$  using  $\mathbf{E} = -\nabla\phi$ .

Set  $k = a = q_1 = q_2 = 1$  and plot  $E_x$  versus  $x$  for  $y = 0$ . The result should look like the force on the test charge that you plotted in Exercise #1. For fun, you might also plot  $E_y$  versus  $y$  for  $x = 0$ , and try other combinations including different relative charges and other lines through the  $x, y$  plane.

For  $k = a = q_1 = q_2 = 1$ , expand  $E_x$  for  $y = 0$  near  $x = 0$  and include the first two nonzero orders. Does this look like your plot above?

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