

## Physics 227H Prerecitation 2 Problem

Go to the PHET simulation

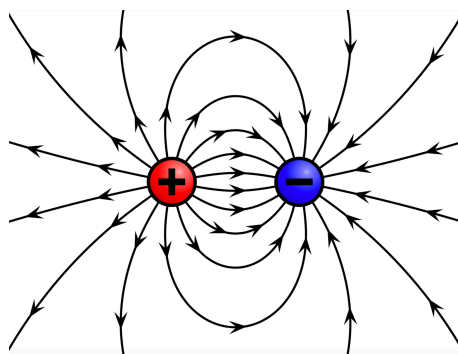
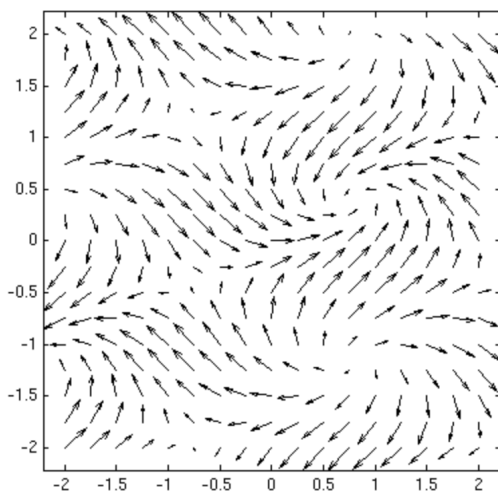
<https://phet.colorado.edu/en/simulation/charges-and-fields>

Here you can place charges on a plane and see the electric fields they produce. The basic charges have magnitude 1 nC – you can get multiples of this basic charge by placing two or more charges at the same point. Use the sensor tool to put a yellow dot at the point you would like to know the electric field value.

Play with the simulation.

- Position 2 point charges with different charge values and use the sensor to find the point or points where the electric field is zero.
- Position 3 point charges with different charge values NOT ALL ON THE SAME LINE and use the sensor to find the point or points where the electric field is zero.
- Can you find a configuration of 2 or 3 point charges for which the electric field is nonzero everywhere?

AN IMPORTANT NOTE ON THE SIMULATION: In your multivariable calculus math course, you learn about vector fields. These are functions that assign a vector to each point in space. In these courses, the graphical representation is usually with arrows at a sampling of points, with the length and direction of the arrow showing the direction and relative magnitude of the vector field. For example: on the left is a plot of the vector field  $F(x,y) = \cos(x+2y) \sin(x-2y)$  for the plane  $(x,y)$



In our physics courses we usually use a different graphical representation with field lines. These are lines with arrows. At any point the vector corresponding to that point is tangent to the line in the direction of the arrow, and the relative magnitude gets larger as the line spacing in the vicinity of the point gets smaller. An example is shown above on the right.

QUESTION: HOW IS THE VECTOR FIELD REPRESENTED IN THE SIMULATION?