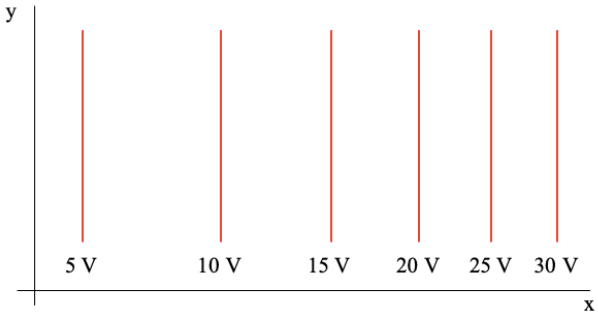
Off-the-Wall question 3: Consider the equipotential lines shown in the sketch.



a.) Discuss the electric field in the y-direction. Justify your response.

--the electric field in a particular direction is related the minus the change in the electric potential along that line;
--looking at any x-coordinate and you will find an equipotential line,
--equipotential lines are lines upon which the voltage is the same at every point;
--this means the change of voltage in the y-direction is zero, which means the electric field in the y-direction must be zero.

b.) Discuss the electric field in the x-direction. Justify your response.

--the electric field in a particular direction is related the minus the change in the electric potential along that line;
--close to the origin, the voltage is changing slowly as you move along the +x-axis;
--as you get farther out, the change happens faster and faster;
--the conclusion is that the electric field exists in the x-direction and it is increasing in a non-liner way;
--electric fields proceed from higher voltage to lower voltage, so the direction of the E-fld is to the left.

c.) In what direction is the net electric field? Justify.

--the vector sum of the electric field components in the x and y directions yield a net direction in the -x direction only.

d.) An proton moving to the right passes the 15 volt equipotential line moving with known velocity v. Explain how you might use the graph to determine where the charge stops?

--using conservation of energy, specifically:
  --you know the initial velocity and the proton's mass, so you can determine its initial KE;
  --you know the proton's charge and initial voltage, so you can determine its initial potential energy;
  --there is no extraneous work done;
  --the final KE is zero;
  --from the final potential energy, you can determine the final voltage;
  --knowing the final voltage, you can use the graph to determine the x-coordinate at which that equipotential line exists.

e.) There is a point to the left of the origin at which the electric potential is -15 volts. Explain why this is a perfectly reasonable possibility.

--electrical potential functions are modified potential energy functions;
--the only use there is for potential energy functions is to determine the amount of work a force field does as a body moves from one point in the field to another;
--there is nothing wrong with a negative potential energy, or a negative electric potential, as long as taking minus the change in the function yields either the *work done* (or the *work per unit charge* available) as you go from one point to another in the field.