**Finding Potential from Electric Field**

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In this lab, you will calculate and graph the electric potential from a known electric field . Keep in mind that the relationship between these two can be written as either a *definite* or *indefinite* integral:

When evaluating the indefinite integral, remember that you always need to consider a constant of integration, .

1 2 3 *x*(m)

*E*(N/C)

5

1. The graph to the right shows a region of a uniform electric field .

­(a) If a positively charged particle starts at and is accelerated by the electric field to , would the particle’s kinetic energy *increase* or *decrease*?

(b) In part (a), would the particle’s potential energy *increase* or *decrease*?

(c) Calculate the change in electric potential from to . (Careful with your signs!)

(d) If the potential at the origin is defined as Volts (our “reference”), what is the value of the potential at ?

(e) Draw a graph of the electric potential on the axes below. Include a scale on the vertical axis.

1 2 3 *x*(m)

*V*

(f) Calculate the change in electric potential between and .

(g) Recalling your answers to parts (d) and (f), what is the value of the electric potential at ? (After you’ve answered this, you may want to go back and fix up your graph in part (e) to clarify for .

(h) Draw a graph showing the potential if we chose our reference so that instead.

1 2 3 *x*(m)

*V*

(i) Write an equation describing based on your graph above.

2. The graph to the right shows the electric field in some other region.

1 2 3 4 5 *x*(m)

*E*(N/C)

5

(a) Calculate the change in electric potential between and .

(b) Calculate the change in electric potential between and .

(c) Draw a graph showing the potential, where the reference is .

1 2 3 4 5 *x*(m)

*V*

(d) Use the indefinite integral to write an equation for in the region . (Remember to include an integration constant, . What equation should you use to find the value of ?)

(e) Write an equation describing for all . It will be of the form

3. The graph below shows the electric field in yet another region.

1 2 3 4 5 6 7 *x*(m)

*E*(N/C)

5

-5

(a) Calculate the change in electric potential over each of the three regions shown.

(b) Draw a graph of the potential , where the reference is .

*V*

1 2 3 4 5 6 7 *x*(m)

(c) Is at (bearing in mind that the correct answer is “No”)?

(d) In general, if , does it follow that ?

(e) Where on your graph does In general, if , does it follow that ?

4. The graph to the right shows the electric field near a uniformly charged sphere. The electric field is given by

R *r*

*E*

(a) Use a definite integral to calculate between and .

(b) Use a definite integral to calculate between and .

(c) Draw a graph of the potential , using as a reference.

R *r*

*V*

(d) Use indefinite integrals to write equations for for each of the two regions, using as your reference. Be careful with signs, and remember the integration constants!