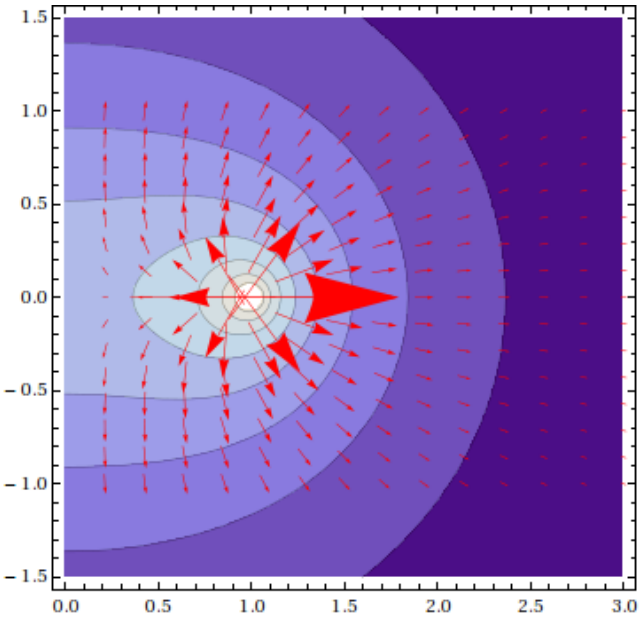
Course Philosophy:
Teaching is the art of leading students into a situation in which they can only escape by thinking.
- Dr. C. T. Bassoppo-Moyo, Zimbabwe

- Problem-Solving Learning Objectives

  1. Coordinate verbal, graphical, geometric, diagrammatic, and algebraic representations of physical objects.
  2. Use physical situations with simple geometries as idealized building blocks for more complicated physical situations.
  3. Use the symmetries of physical situations to check the validity of symbolic and graphical representations of those situations.



  4. Without panicking, break up a complicated algebraic problem into separate pieces related to the physical situation.

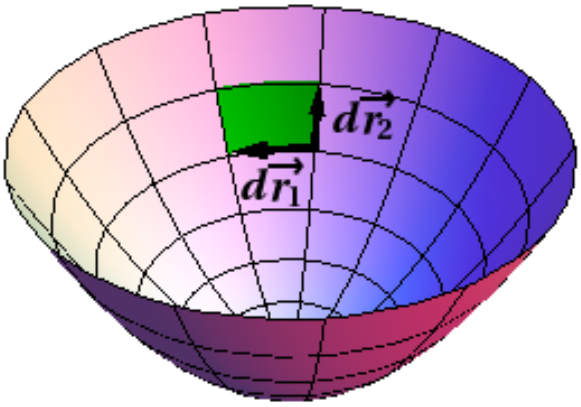
$$V(\vec{r}) = \frac{1}{4\pi\epsilon_0}\int \frac{\rho(\vec{r}')\,d\tau'}{|\vec{r}-\vec{r}'|}$$

- Mathmatics Content Learning Objectives

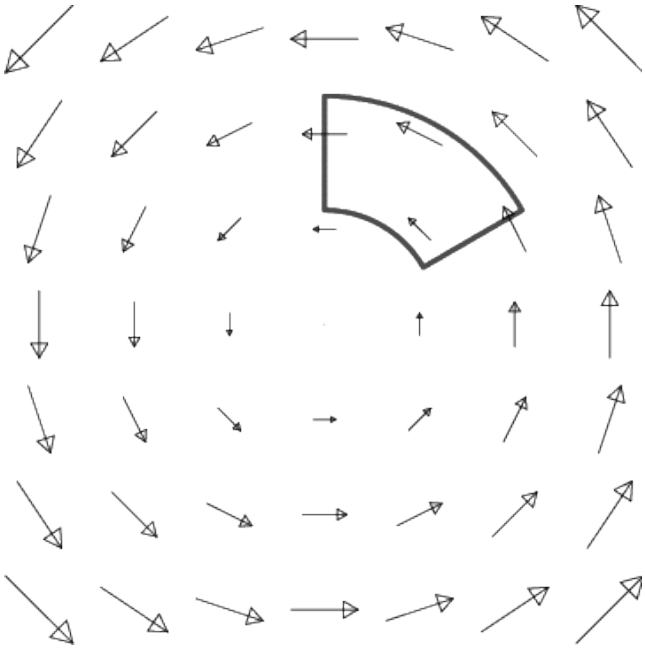
  1. Use power and Laurent series to approximate fields in regions very far or very near the sources.

$$V(x,0,0) = \frac{Q}{4\pi\epsilon_0}\frac{2}{|x|}\left(1 - \frac{1}{2}\frac{D^2}{x^2} + \frac{3}{8}\frac{D^4}{x^4} + ...\right) \qquad \text{for} |x| > D$$

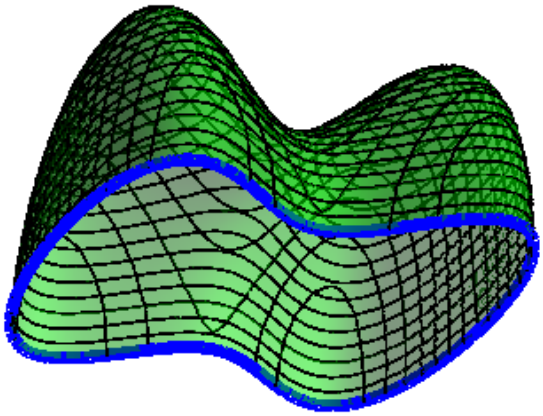
  2. Use the "chop, multiply, add" method and $d\vec{r}$ to set up and analyze the structure of line, surface, flux, and volume integrals in rectangular, cylindrical, and spherical coordinates.



3. Predict the gradient, divergence, and curl of fields from graphical representations.



4. Understand how simple geometric arguments are used to prove the big vector calculus theorems (Divergence and Stokes').

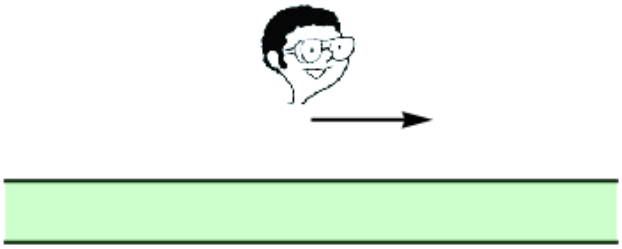


- Physics Content Learning Objectives

  1. Use line integration to calculate the electrostatic potential from a highly-symmetric, continuous distribution of charge.
  2. Use Maxwell's equations in differential form to predict the location of charge and current sources from graphs of vector fields .

$$\vec{\nabla} \times \vec{B} = \mu_0 \vec{J}$$

  3. Experience how Gauss's and Ampère's Laws in integral form to find electrostatic and magnetostatic fields in highly symmetric situations.



  4. Understand how the Divergence and Stokes' theorems are used to transform the integral form of Maxwell's equation to the differential form.