Vector Field Introduction Module

Purposes: To introduce (or review) the student to vector fields using a computational system.

To review vector calculus using a computational system.

To acquaint the student with the basic usage of a computational system for investigating vector field problems.

Timeframe: Used at the beginning of the course to introduce (or review) the student with vector calculus/vector fields and to prepare the student to use a computational system in E&M.

Assumptions: Majority of students are weak on vector calculus and have not encountered vector fields in a formal mathematical context. Majority of students have not used a computational system nor numerical representations in vector field analysis.
[What should be assumed about an understanding of errors in representing problems numerically?]

Components: Traditional lecture(s) on vector fields and their basic theorems. Review of vector calculus.

Demonstration-lecture(s) on representation of vectors and vector fields in computational system data types - should include both numeric types for numeric computations and symbolic types for symbolic algebra.
Cover operations on vectors and vector fields in the system. Cover presentation techniques for vectors and vector fields (graphs and graphic processing). [This is a great place for visualizations.]

Computer project to analyze a numeric vector field supplied in a computer file and determine its properties. Show that basic theorems are satisfied within numeric error. Produce presentations of the results.

Computer project to analyze a supplied symbolic vector field and analyze its properties. Show that basic theorems are satisfied. Produce presentations of the results.