29:129 Fall 2012 Chapter 1: Summary of important concepts

- Field: a quantity that is specified at each point in space (x,y,z)
  - scalar field *f(x,y,z):* a scalar specified at each (x,y,z)
  - vector field $\vec{A}(x, y, z)$: a vector specified at each (x,y,z)

- (Helmholtz theorem) A vector $\vec{A}(x, y, z)$ is completely specified (known) by giving its divergence, $\nabla \cdot \vec{A}$, and curl, $\nabla \times \vec{A}$.

- (Divergence theorem) The flux of a vector through a closed surface S is related to the integral of its divergence over the volume enclosed by S.

- (Stokes' theorem) The circulation of a vector around a closed loop C is related to the integral of its curl over any surface bounded by C.

- If $\nabla \times \vec{F} = 0$, then the vector $\vec{F}$ can be expressed as the gradient of a scalar function, $\vec{F} = \nabla f$. A vector having zero curl is called an "irrotational" vector.

- If $\nabla \cdot \vec{F} = 0$, then the vector $\vec{F}$ can be written as the curl of another vector $\vec{A}$, called the vector potential, $\vec{F} = \nabla \times \vec{A}$. A vector having zero divergence is called a "solenoidal" vector.