LECTURE OUTLINE
Practicalities

Professor Leibon

Math 15

Nov. 2, 2004

Goals

The Fundamental Theorem of Line Integrals: Practicalities

The Fundamental Theorem of Line Integrals

Theorem: $\vec{F}$ is conservative if and only if $\vec{F} = -\nabla V$.

We call $-V$ the force's *potential*.

Caveat: Avoid any place where you do not expect V to be continuously differentiable!

Potentials Give Forces

(Ex. 181 #1.) Find the force associated to the potential

$$\varphi = \frac{1}{\sqrt{x^2 + y^2 + z^2}}.$$

Where should we be careful?

Using the Fundamental Theorem of Line Integrals

(Example 71) Is $\vec{F}(x,y) = y\hat{i} + (y+x)\hat{j}$ conservative? If so, then find its potential.

Construct an argument using both sides of:

Theorem: $\vec{F}$ is conservative if and only if $\vec{F} = -\nabla V$.

Using the Fundamental Theorem of Line Integrals

(Example 71) Is $\vec{F}(x,y) = y\hat{i} + y\hat{j}$ conservative? If so, then find its potential.

Construct an argument using both sides of:

Theorem: $\vec{F}$ is conservative if and only if $\vec{F} = -\nabla V$.

Using the Fundamental Theorem of Line Integrals

(Ex. 183 #4.) $\vec{F}(x, y, z) = yz\hat{i} + xz\hat{j} + (xy + 2z)\hat{k}$ conservative? If so, then find its potential.

Construct an argument using both sides of:

Theorem: $\vec{F}$ is conservative if and only if $\vec{F} = -\nabla V$.