

## Homework Assignment for Week 15

1. Section 16.3: Problems 1, 3, 5, 9, 11, 19, 21, 26, 29, 33.
2. Let  $\mathbf{F} = \frac{x}{\sqrt{x^2+y^2}}\mathbf{i} + \frac{y}{\sqrt{x^2+y^2}}\mathbf{j} + 0\mathbf{k}$  and  $\mathbf{G} = \frac{-y}{x^2+y^2}\mathbf{i} + \frac{x}{x^2+y^2}\mathbf{j} + 0\mathbf{k}$ .
  - (a) Show that both  $\mathbf{F}$  and  $\mathbf{G}$  satisfy the component test.
  - (b) The natural domain for both  $\mathbf{F}$  and  $\mathbf{G}$  is  $\{(x, y, z), x^2 + y^2 \neq 0\}$  (that is where  $\mathbf{F}$  and  $\mathbf{G}$  are defined). Show that  $\mathbf{F}$  is conservative in this domain by finding its potential function.
  - (c) Show that  $\mathbf{G}$  is NOT conservative in this domain (read example 5).
  - (d) If given another  $\mathbf{H}$  satisfying the component test in this domain, how do you determine whether  $\mathbf{H}$  is conservative?
3. Let  $\mathbf{F} = \frac{x}{\sqrt{x^2+y^2+z^2}}\mathbf{i} + \frac{y}{\sqrt{x^2+y^2+z^2}}\mathbf{j} + \frac{z}{\sqrt{x^2+y^2+z^2}}\mathbf{k}$ . What is the natural domain for  $\mathbf{F}$ ? Show that  $\mathbf{F}$  satisfies the component test in this domain. Is this domain simply connected? Is  $\mathbf{F}$  conservative in this domain?
4. Section 16.4: Problems 10, 17, 19, 23, 27, 29, 38, 39.

Remark: we did not cover 16.4 this week, but hopefully will do on Tuesday. You may be able to do some of these problems first.