**Test 3: Vector Calculus**

**Multivariable Calculus**

**Course Objectives**: *The student will be able to …* apply Green’s Theorem, Stokes' Theorem, and the Divergence Theorem as well as evaluate line and surface integrals.

Below are a few comments/questions meant to highlight or clarify key points

1. Sections covered: 16.1 – 16.9.
2. Regarding length – the test will be between 6 and 10 questions in length.
3. Non-symbolic graphing calculators are acceptable. Bring your own or borrow one from me.
4. What are the named theorems (someone’s name attached)? You don’t need to memorize these, but you will be tested on your ability to apply the theorems.
5. Some problems will likely ask you to **set-up** but not solve integrals. Make sure that you follow the directions.
6. Regarding drawings
   1. Drawings are not a significant part of this chapter.
7. It is unlikely that I will ask you to graph a vector field. However, I might give a vector field and then ask you to work from it.
8. Key skill: Parametrization
9. You should be able to set up and evaluate integrals for work, flux, and surface integrals.
10. Key concept: conservative vector fields
    1. What are they?
    2. What are they good for?
    3. When are they helpful?
11. Big deal: Green’s Theorem, Stoke’s Theorem, and the Divergence Theorem
12. Regarding div and curl, I would hope that you would have a basic intuition.
13. Practice materials: In addition to the text, class notes, and your homework …
    1. The Stewart review problems.
    2. The MIT videos if you need additional instruction.
14. Formulas (you don’t need to memorize the assumptions or fine print):
    1. Fundamental Theorem of line Integrals: 
    2. Green’s Theorem:
       1. 
       2. 
    3. 
    4. 
    5. Stoke’s Theorem: 
    6. Divergence Theorem: 

Regarding Parametrization

* How many parameters?
  + Curve – 1
  + Surface – 2
* What are you parametrizing?
  + The graph of a function
    - In 2D
      *  goes to 
      *  goes to 
    - In 3D
      *  goes to 
      *  goes to 
      *  goes to 
  + Known shapes
    - Line
    - Plane
    - Circle (just a boundary curve)
    - Disk (a “filled in” circle)
    - Cylinder
    - Cone
    - Sphere/Hemisphere
  + Other
    - Pray and work really hard.
    - Often times these parameterizations are given.



1. A few practice problems
   1. If, evaluate  along the curve *C*:  where .

* 1. Evaluate , where *C* is the triangle from  to  to  to .
  2. For , find the curl and the divergence of . Is  conservative? If so, find the function *f* such that   
       
       
       
       
       
     .
  3. Find the area of the part of the surface , that lies above the triangle with vertices (0,0,0), (0,1,0), and (3,1,0).
  4. Find the flux of  across the part of the cylinder  that lies between the planes  and  with upward orientation (this is an example from my notes).

Soln: (a.)  (b.)  (d.)  (e.) 