**Final Exam**

**Multivariable Calculus**

Date and Times of the Final:

* 10am class: Monday from 10 – 11:50 am

Course Objectives: The student will be able to *…*

* Calculate partial derivatives
* Calculate the gradient and directional derivatives.
* Evaluate line and surface integrals.
* Evaluate multiple integrals in rectangular, polar, cylindrical, and spherical coordinate systems
* Apply Green's Theorem, Stokes' Theorem, and the Divergence Theorem

Select comments:

1. The final is cumulative.
2. Regarding length – the test will be between 8 and 12 questions in length.
3. Non-symbolic graphing calculators are acceptable. Bring your own or borrow one from me. No cell phones allowed during the exam.
4. What are the named theorems (someone’s name attached)? You don’t have to have the fine print memorized, but you had best know them pretty well.
5. Don’t forget your name, the quote, and the warm ups.
6. I have been known to get creative on final exams … giving hints, or having problems tie together. So, make sure you look the exam over in its entirety prior to getting started.
7. Anyone who receives a grade of 70% or better on the exam will receive no lower than a 2.0 GPA in the class (there is hope for everyone).
   1. The last time I taught this course, the mean final exam score was 71.7%.
8. I will post final exam grades in WebAssign when grading is complete, but GPA grades will show up online.
9. I do not give final exams back or post keys. If you want to see your exam, you will have to stop by my office and look at it. This is always a good idea … if only to make sure I counted points correctly.

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
    - Often times these parameterizations are given.



**Math 254 Final Exam Review Exercises**

**Chapter 16**

Using Stokes Theorem, evaluate , if *S* is the surface of the elliptical paraboloid which lies beneath the plane , oriented upward, if . Note the boundary of S is an ellipse, not a circle.

Use Stokes Theorem to find , if , and *C* is the intersection of the conewith the plane , traveled counter-clockwise when viewed from above.

Find , if  and *S* is the portion of the spherical solid with radius 2, center (0,0,0), in the first octant, oriented outward.

Find , if , and *C* is the line segment from (0,0,0) to (1,2,3).

Set up the integrals needed to find the center of mass of a wire bent into a quarter-circle in quadrant I with equation , if .

Evaluate, if , and *C* is given by , .

Evaluate , if , and *C* is the boundary of the region which lies between the circles and  in the upper half plane .

Find the surface area of the part of the plane  which lies inside the cylinder .

Evaluate , where *S* is given by , 

Calculate the flux of  across *S*, i.e., , if , and *S* is the sphere with center at the origin, radius 2

**Chapter 15**

Consider the region in the first octant bounded by the cylinder  and the plane . Find the limits of integration for , for the following orders of integration :

1. 
2. 

Change to cylindrical coordinates: 

Write using polar coordinates: , where *E* is the region between the spheres  and  and above the cone 

Write an iterated double integral in two different ways, to integrate f(x,y) over the region bounded by , and .

Sketch the region of integration, reverse the order of integration, and evaluate the integral: 

Find the volume of the wedge cut from the first octant by the cylinder  and the plane .

Evaluate 

Evaluate 

Find the centroid of the region in the first quadrant bounded by the *x* axis, , and , if .

Find, where *E* is the region in the first octant bounded by and the plane .

Find the volume of the region between the cylinder  and *z* = 0, bounded by the planes *x* = 0, *x* = 1, *y* = -1 and *y* = 1.

**Set up** an integral for the volume of the solid bounded by the cylinders and, below by *z* = 0, above by , using either spherical or cylindrical coordinates.

**Set up** the integral for the volume of the solid bounded below by the sphere  and above by . Hint: you might find it useful to get a rectangular equation for the sphere.

**Chapter 14**

Find the rate of change of  in the direction of  at the point (3,2,6)

Find the equation of the tangent plane to , at the point (-1,1,0).

If  find 

**Select answers with uncertain accuracy**:



4

3



, and moments: , 

Hint: The field is conservative and  is the potential function. So the integral is 

14/3







-1

x+y+z=0



(a.)  and (b.) 



