Math 205 Test 2 Preparation

1. The test covers chapter 14
2. The test will be based in large part on the homework and examples from class. So use these as a study guide.
3. **Memorize** the following formulas.

   a) $f_x(x,y) = \lim_{\Delta x \to 0} \dfrac{f(x+\Delta x, y) - f(x,y)}{\Delta x}$ and $f_y(x,y) = \lim_{\Delta y \to 0} \dfrac{f(x, y+\Delta y) - f(x,y)}{\Delta y}$

   b) The **total differential**: $dz = f_x(x,y)dx + f_y(x,y)dy$

   c) The **chain rule** formulas

   d) Suppose that in the equation $F(x,y) = 0$, y is defined implicitly as a differentiable function of x. If F is differentiable, then $\dfrac{dy}{dx} = -\dfrac{F_x(x,y)}{F_y(x,y)}$.

   e) If the equation $F(x,y,z) = 0$ defines z implicitly as a differentiable function of x and y, then $\dfrac{\partial z}{\partial x} = -\dfrac{F_x(x,y,z)}{F_z(x,y,z)}$ and $\dfrac{\partial z}{\partial y} = -\dfrac{F_y(x,y,z)}{F_z(x,y,z)}$.

   f) The **directional derivative**: $D_u f(x,y) = f_x(x,y)u_1 + f_y(x,y)u_2$.

   g) The **gradient**: $\nabla f(x,y) = f_x(x,y)\,\mathbf{i} + f_y(x,y)\,\mathbf{j}$

   h) **Tangent plane**: $z - z_0 = f_x(x_0y_0)(x - x_0) + f_y(x_0, y_0)(y - y_0)$ or

   $$F_x(x_0,y_0,z_0)(x-x_0) + F_y(x_0,y_0,z_0)(y-y_0) + F_z(x_0,y_0,z_0)(z-z_0) = 0$$

   i) The **Second Derivative Test**

   j) **Lagrange Multipliers**

4. Be very familiar with all theorems and definitions from the chapter (i.e. read over the lecture outlines several times if necessary).
5. A well-prepared student should be able to…

   a) analyze functions of several variables numerically, algebraically, and visually.
   b) sketch level curves for a function of two variables and be able to use level curves to estimate partial derivatives, directional derivatives, and gradients.
   c) verify a limit using substitution (when possible).
   d) use a given table or graph to make a conjecture about the existence of a particular limit.
   e) prove that a limit doesn't exist by finding two different paths that give two different results for the limit value.
   f) use the definition of continuity to determine whether or not a function is continuous at a given point.
   g) calculate partial derivatives using the definitions.
   h) calculate partial derivatives using short-cuts.
   i) estimate partial derivatives using a table
   j) interpret the meaning of partial derivatives in an applied problem.
   k) calculate a total differential
   l) determine whether or not a function is differentiable.

m) use dz to approximate Δz.
n) calculate partial derivatives using the Chain Rules.
o) calculate partial derivatives implicitly.
p) calculate the directional derivative of a multivariable function.
q) calculate the gradient of a multivariable function.
r) solve applications involving a gradient.
s) find the equations of a tangent plane and normal line to a surface.
t) find the absolute and relative extrema of a two-variable function (don't forget to study Lagrange Multipliers!!!).
u) find local extrema using the Second Partials Test.
v) solve optimization problems using both the methods of 14.7 and 14.8.
w) solve homework-like problems!!!