❧ Section 15.1: Functions of Several Variables

Important concepts:

1. Finding and sketching the domain and/or range of a function
2. Sketching the graph of simple equations
    a. Planes
    b. Hemispheres
    c. Cylinders
    d. Not-too-bad wave-things with cosines
3. Drawing & understanding contour maps

❧ Section 15.2: Limits and Continuity

Important concepts:

1. Showing a limit does not exist
2. Determining the values at which a function is continuous

Example 1. Determine the set of points at which g(f(x,y)) is continuous.

$$g(t) = t + \ln t \qquad f(x,y) = \frac{1-xy}{1+x^2y^2}$$

Example 2. Determine the limit of the following function as (x,y) → (0,0), if it exists, or prove that the limit does not exist:

$$f(x,y) = \frac{xy}{\sqrt{x^2+y^2}}$$

Example 3. Determine the limit of the following function as $(x,y) \to (1,-1)$ if it exists, or prove that it does not exist:

$$f(x,y) = \frac{5 - 2x^2 + 3xy}{3 - \sqrt{2x^2 - 3xy + 4}}$$

❧ Section 15.3: Partial Derivatives

Important concepts:

1. Computing f_x and f_y of a function
2. Computing all second derivatives of a function
3. Verifying that Clauraut's Theorem holds

Example 1. Find $\frac{\partial z}{\partial x}$ and $\frac{\partial z}{\partial y}$ when $z = f(x+y)$.

See additional handout for some examples involving partial derivatives.

❧ Section 15.4: Tangent Planes and Linear Approximations

Important concepts:

1. Finding the equation for a tangent plane to a given point
2. Showing a function is differentiable at a given point

Reminder: When is a function **differentiable** (without using the definition of differentiability)?

Example 1. How would we show that $f(x,y) = \sin(2x + 3y)$ is differentiable at (-3, 2)?

Example 2. Find the linear approximation for $z = y\ln x$ at (1,4,0).

❧ Section 15.5: The Chain Rule

Important concepts:

1. Knowing which chain rule to use
2. Being able to apply each of the chain rules
3. Understanding implicit differentiation

	Chain Rule #1	Chain Rule #2
When do we use it?		
What does it say?		
What does it say for $w = F(x, y, z)$?		
An example in which you would use this chain rule		

Example 1. Find *dw*/*dt* when:

$w = \ln\sqrt{x^2+y^2+z^2} \qquad x = \sin t,\ y = \cos t,\ z = \tan t$

Example 2. Find $\frac{\partial z}{\partial t}$ when z = e^(x+y), $x = s/t$, and $y = t/s$.

Example 3. Find $\frac{\partial z}{\partial x}$ when $xyz = \cos(x + y + z)$. What's the formula for finding $\frac{\partial z}{\partial y}$?