Reading Assignment 7 (Due Monday 7/12/21 by 12:55 PM)

Basic learning objectives: These are the tasks you should be able to perform with reasonable fluency **when you arrive at our next class meeting**. Important new vocabulary words are indicated in italics.

1. Use the formula for the chain rule to compute the derivative $\frac{dz}{dt}$ of a function $z = f(x, y)$ when x and y are dependent on another variable t.
2. Utilize tree diagrams to find a formula for the chain rule when z is a function of more than two variables or when the independent variables of z depend on more than one quantity (the chain rule is hard to write down in general, but is easy to find in specific cases using the tree diagrams).
3. State the definition of the *directional derivative* and what it measures.
4. Compute the directional derivative using formula 10.6.3.

Advanced learning objectives: In addition to mastering the basic objectives, here are the tasks you should be able to perform **after class, with sufficient practice:**

1. Compute the *gradient* $\nabla f(x, y)$ of a function. Compute the directional derivative using the gradient.
2. Understand the direction of the gradient $\nabla f(x, y)$ relative to a point $(x, y, f(x, y))$ on the graph of f.
3. Understand the length of the gradient and what it measures.
4. Use the gradient to compute the tangent plane to a graph.

Directions: Read the following sections of the book:

- Sections 10.4.2 and 10.4.3.
- All of Section 10.5. If you need more examples, then I recommend reading Paul's Online Math Notes. There are some examples of tree diagrams in Example 4, specifically.
- Sections 10.6.1 and 10.6.2.

and complete the following tasks along the way. If an Activity is not listed, you do not need to complete it (although you are welcome to read it). Turn your write up in via gradescope. You do not need to write the questions down, as long as you clearly indicate the question number.

1. Activity 10.4.3 part (c). Recall that the linearization of f at $(2, 1)$ is the function $L(x, y) = f(2, 1) + f_x(2, 1) + f_y(2, 1)$. Use the appropriate symmetric difference quotients to estimate the partial derivatives. For example, $f_x(2, 1) \approx \frac{f(2+h,1)-f(2-h,1)}{2h}$. By choosing a convenient value of h, you can read $f(2 + h, 1)$ and $f(2 - h, 1)$ from the contour diagram.
2. Activity 10.4.4. For part (a), just use the formula for the differential that we derived in class. For part (b), you want to approximate ΔP by dP. Use the same formula, but you will need to determine the appropriate values of the differentials dV and dT.
3. Preview Activity 10.5.1.

4. Activity 10.5.2.
5. Activity 10.5.3.
6. Preview Activity 10.6.1
7. Compute the directional derivative of $f(x, y) = x^2 + y^2$ in the direction of $\mathbf{u} = \langle 1, 2 \rangle$. Make sure to use a unit vector in the same direction as $\mathbf{u}$.