Homework for Week 5
April 28-May 1, 2008

The textbook exercises listed here should be completed before class begins; students will share solutions to these exercises at the beginning of class. You should be prepared to share a solution to any one of these.

Before Class on Monday, April 28, finish reading Section 11.4 and work the following exercises:
Section 11.4, # 19, 35

Before Class on Tuesday, April 29, read Section 11.5 and work the following exercises:
Section 11.5, # 7, 9, 29

Before Class on Wednesday, April 30, read Section 11.6 (upto page 793) and work the following exercises:
Section 11.6, # 7, 11

Before Class on Thursday, May 1, finish reading Section 11.6 and work the following exercises:
Section 11.6, # 15, 19, 35(a)

Additional Practice Problems

Practice as many of these problems as you can. You may use your solutions as notes during the quiz on Tuesday, May 6.
Section 11.5, # 5, 11, 13, 17, 35
Section 11.6, # 9, 13, 21, 37(a)

You really should end the day smarter than when you started it. If you don’t, you’re doing something wrong.
- Warren Buffett

More on back.
Written Homework

Your carefully written solutions to these questions are due at the beginning of class on Monday, May 5.

1. Suppose the temperature $T$ (in degrees Celsius) at a point in the plane is a function of $x$ and $y$ satisfying $T_x(1,1) = 3$ and $T_y(1,1) = 2$. Suppose the position of a particle at time $t$ minutes is given by $x(t)$ and $y(t)$ satisfying

$$x(2) = 1, \quad x'(2) = 3, \quad y(2) = 1, \quad y'(2) = 5.$$ 

Find the rate of change of temperature of the particle at time $t = 2$. (Include units in your answer.)

2. Show that, for any differentiable function $z$ of $x$ and $y$, if $x = s + t$ and $y = s - t$, we have

$$(\frac{\partial z}{\partial x})^2 - (\frac{\partial z}{\partial y})^2 = \frac{\partial z}{\partial s} \frac{\partial z}{\partial t}.$$ 

(Hint: Start by using the chain rule to calculate the derivatives on the right side.)

3. Let $f(x, y, z) = y \ln x + z^2$.

(a) Calculate $\nabla f(x, y, z)$.

(b) Find the directional derivative of $f$ at $(1,2,3)$ in the direction $2\vec{i} - \vec{j} + 2\vec{k}$.

(c) Find the direction in which $f$ is increasing fastest at the point $(1,1,1)$. Also, what is the rate of change of $f$ in that direction?

(d) Find the direction in which $f$ is decreasing fastest at the point $(1,1,1)$. Also, what is the rate of change of $f$ in that direction?