Reading Stewart §2.6, 2.8.

1. Let $g(x) = \cos^2 x$. Compute the second derivative $g''(x)$.

2. Let f and g be differentiable functions such that

$$f(3) = 7, \quad f'(3) = 4, \quad f(-2) = 5, \quad f'(-2) = 3, \quad g(-2) = 3, \quad g'(-2) = 6.$$

Let $F = f \circ g$. Compute $F'(-2)$.

3. Let f be a differentiable function such that $f(3) = 7$ and $f'(3) = -2$. Let $G(x) = \sqrt{4 + 3f(x)}$. Compute $G'(3)$.

Note You may wish to save the remaining problems until after Monday's class.

4. For each of the following equations, find $\frac{dy}{dx}$ using implicit differentiation.

a) $2x^3 + x^2y - xy^3 = 4$

b) $xy = 2 + \cos y$

5. Use implicit differentiation to find (and then simplify) an equation of the tangent line to the curve

$$x^2 + y^2 = \left(2x^2 + 2y^2 - x\right)^2$$

at the point $\left(0, \frac{1}{2}\right)$.

6. A spherical balloon is being inflated. At noon, the radius of the balloon is increasing at a rate of 0.4 mm/sec. Also at noon, the diameter of the balloon is 100 mm. How fast is the volume of the balloon increasing at noon?

Make sure to draw and label a diagram, define your variables clearly, set up an equation, and so forth!

7. A cargo plane flying at an altitude of 2000 m flies in a straight, horizontal path directly over the Seeley Mudd building, heading due north. At 1:00pm, its distance from the front entrance (ground floor) of Seeley Mudd is 2500m, and it is flying at 800 km/hr north, away from the building. How fast is the distance from the plane to front entrance increasing at that moment?

Make sure to draw and label a diagram, define your variables clearly, set up an equation, and so forth!