

**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  $G'(3)$ .

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

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

b)  $xy = 2 + \cos y$

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

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

$$x^2 + y^2 = (2x^2 + 2y^2 - x)^2$$

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

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!