

# Fall 2009 Math 151

## Week in Review VII

courtesy: David J. Manuel

(covering 3.8, 3.9, 3.10)

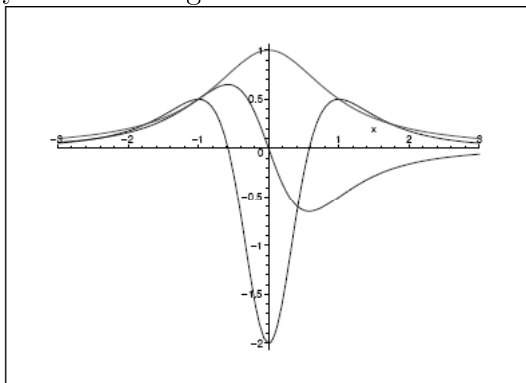
### 1 Section 3.8

1. Find and simplify the first and second derivatives of the following:

(a)  $f(x) = \sin^2 x$

(b)  $y = \frac{1}{x^2 + 1}$

2. The graph of  $f$ ,  $f'$ , and  $f''$  are shown below. Label which is which. Explain your reasoning.



3. Find the fiftieth (50th) derivative of  $f(x) = \cos 2x$ .
4. Given  $f(x) = \frac{1}{x}$ , find a formula for the  $n$ th derivative ( $f^{(n)}(x)$ )

### 2 Section 3.9

1. Find an equation of the line tangent to the curve parametrized by  $x = \sec \theta$ ,  $y = \tan \theta$  at the point where  $\theta = \frac{\pi}{3}$ .

2. Find an equation of the line tangent to the curve given by  $x = t^2 + 2t$ ,  $y = t^3 - t$  at the point  $(3, 0)$ .
3. Find the points on the curve  $x = 4t - t^2$ ,  $y = 1 + t^2$  where the tangent line is horizontal or vertical.
4. The curve  $x = t^3 - 4t$ ,  $y = t^2$  crosses itself at the point  $(0, 4)$ . Find the point-slope equations of both tangent lines.

### 3 Section 3.10

1. Oil spilled from a broken tanker spreads in a circular pattern whose radius increases at a constant rate of 0.6 m/sec. How fast is the area of the spill increasing when the radius is 10m?
2. A man sitting on a pier 3m above water pulls on a rope attached at water level to a boat at the rate of 0.5 m/s. At what rate is the boat approaching the pier when 5m of rope remain?
3. A camera is positioned 800m from a rocket launch pad. If the rocket rises vertically at 300 m/sec, how fast is the angle of elevation of the camera changing when the rocket is 1000m above ground?
4. A man 6ft tall is walking at a rate of 3 ft/sec toward a streetlight 18ft high.
  - a) How fast is the length of his shadow changing when he is 12ft from the streetlight?
  - b) How fast is the tip of his shadow moving at that instant?
5. A feed trough 4m long has a cross section that is an isosceles triangle with a base of 1.5m at the top and a height of 1m. If water pours into the trough at a rate of  $0.25 \text{ m}^3/\text{min}$ , how fast is the depth of the water changing when the depth is 0.4m?