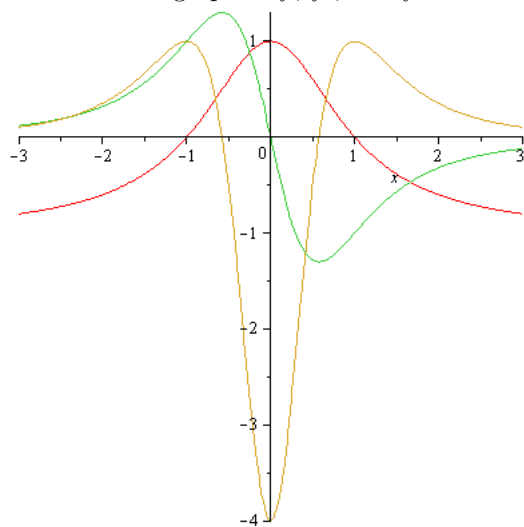

Sections 3.8-3.10

Exercise 1. The graph of f , f' , and f'' are shown below. Label which is which.



Exercise 2. Calculate the second derivative of

$$f(x) = \frac{x+1}{x-1}, \quad g(x) = \sqrt{2x^3 - 3x^2}.$$

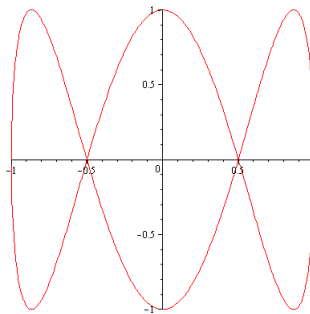
Exercise 3. Find $\frac{d^2y}{dx^2}$ for

$$y^3 + x^3 = 8$$

Exercise 4. Find a formula for $\frac{d^n f}{dx^n}$ for $f(x) = \frac{3}{5+x}$.

Exercise 5. The trajectory of a particle is given by

$$\vec{r}(t) = \langle \sin t, \cos 3t \rangle, \quad t \in [0, 2\pi]$$



1. Find the acceleration at $t = \frac{\pi}{4}$.
2. Find the equations of the tangent lines at the point $(0.5, 0)$.
3. At what point does the curve have an horizontal tangent, or a vertical tangent?

Exercise 6. Given the parametric curve,

$$x(t) = t(t^2 - 9), \quad y(t) = t^2 - 1,$$

1. At what point does the curve cross itself. Find the equations of the tangent lines at that point.

2. At what point(s) is the curve parallel to the line

$$x(s) = 1 + 3t, \quad y(x) = 4 + t$$

Exercise 7. (21p220) Gravel is being dumped from a conveyor belt at a rate of $30\text{ft}^3/\text{min}$ and its coarseness is such that it forms a pile in the shape of a cone whose base diameter and height are always equal. How fast is the height of the pile increasing when the pile is 10ft high?

Exercise 8. (30p220) A lighthouse is on a small island 3km away from the nearest point P on a straight shoreline and its light makes 4 revolution per minutes. How fast is the beam of light moving along the shoreline when it is at 1km from P ?

Exercise 9. (fall 2011) An observer stands 10 feet from the base of a balloon launching point. At the instant the balloon has risen vertically 5 feet, the height of the balloon is increasing at a rate of 8 feet per minute. How fast is the distance from the observer to the balloon changing at this same instant? Assume the balloon starts on the ground and rises vertically.

Exercise 10. (17p219) Water is leaking out of an inverted conical tank at a rate of $10,000\text{cm}^3/\text{min}$ at the same time that water is being pumped into the tank at constant rate. The tank has height 6m and the diameter at the top is 4m. If the water level is rising at a rate of $20\text{cm}/\text{min}$ when the height of water is 2m, find the rate at which water is being pumped into the tank.