PROBLEM SETS 3. DUE FRIDAY 8 SEPTEMBER

Problem Set 3. Problems from Lecture 3.

Reading. *Quick Calculus*, pp. 97–129.
Supplementary reading. Simmons, Chapter 3.

1. Differentiate the following functions, using the rules we learned in lecture today.
   (a) $y = 3x^4 + 2x^3 - x^2 + 4x - 7$
   (b) $y = (2x^2 + 3)(3x^4 - 2x - 5)$
   (c) $y = \frac{3x-7}{2x^2+4}$
   (d) $y = (10x - 2)^5(3x^2 - 1)^2$
   (e) $y = \sec\theta \csc\theta$
   (f) $y = \tan\theta = \frac{\sin\theta}{\cos\theta}$
   (g) $y = e^{5x+7}$
   (h) $y = \ln(\frac{3x^2}{4x+2})$
   (i) $y^3 = \sqrt{2xy - 4xy^2}$
   (j) $y = (x^2 + 4)^{\frac{5}{2}}$
2. Given a cubic equation $f(x) = ax^3 + bx^2 + cx + d$, for what constants a, b, c, and d does the graph of $f(x)$ have exactly
   (a) two horizontal tangents?
   (b) one horizontal tangent?
   (c) no horizontal tangents?
   (Hint: A horizontal tangent to the graph occurs when the derivative $f'(x) = 0$.)
3. Find the values of x for which the graph $f(x) = x + 2\sin(x)$ has a horizontal tangent.
4. Find the tangent line to
$$f(x) = \frac{x^3 + x}{x - 1}$$
   at the point $(2, 10)$.
5. We have talked about the tangent line to a graph at some point P on the graph. The *normal line* to a graph at the point P is the line that is perpindicular to the tangent line to the graph at P. Given a line $f(x) = mx + b$, the perpindicular line $g(x)$ to $f(x)$ at P is the line with slope $-\frac{1}{m}$, also going through P. (See the figure on the next page.) Find the tangent line and the normal line to the graph $y = \frac{6}{x+2}$ at the point $(1, 2)$.

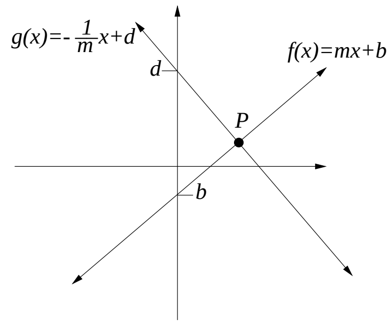

FIGURE 1. This shows the line $f(x) = mx + b$ and the perpindicular line $g(x) = -\frac{1}{m} + d$, where d is determined by our choice of P.