Math 116 Problem Set #3 Due Fri., Sept. 26, 2008, in class.

From Apostol, read Chapter 3, section 16. Read Chapter 4, sections 3-5, 10, 13, 14, 16, 17. Also read Chapter 1, sections 9-14. Optional: Read Chapter 3, sections 12-14 and 17; and Chapter 4, sections 1, 2, 7, 8, 11, 18, 20.

1. From Apostol, §4.6, pages 167-168, do problem 38; in §4.9, page 173, do problems 7 and 9; and in §4.12, page 179, do problem 14.

2. From Apostol, §1.15, page 70, do problems 1 (a,d,e), 2, 3, 5(a).

3. For each of the following functions f, determine whether f has a maximum value and whether it has a minimum value. If such values exist, find them and find for which values of x they are achieved. Relate your answer to the extreme value theorem.

a) $f(x) = x^3 - 2x^2 - 4x + 1$ on the interval $0 \leq x \leq 4$.
b) Same as (a) but on the interval $0 < x < 4$.
c) $f(x) = 1/x^2$ if $-1 \leq x \leq 1$ with $x \neq 0$; and $f(0) = 0$.
d) $f(x) = x - [x]$ for $0 \leq x \leq 3$.

4. Which of the following functions are differentiable at $x = 0$? For each one that is, find $f'(0)$, and determine whether the function f' is continuous at $x = 0$.

a) $f(x) = \sin(1/x)$ for $x \neq 0$, $f(0) = 0$.
b) $f(x) = x\sin(1/x)$ for $x \neq 0$, $f(0) = 0$.
c) $f(x) = x^2\sin(1/x)$ for $x \neq 0$, $f(0) = 0$.
d) $f(x) = x^3\sin(1/x)$ for $x \neq 0$, $f(0) = 0$.

5. Find a function f on $\mathbb{R}$ such that f is differentiable at $x = 0$ and f is discontinuous at *every* $x \neq 0$.