Spring 2008 Math 151

Week in Review # 9

sections: 5.2, 5.3, 5.5

courtesy: Joe Kahlig

Section 5.2

1. For the following functions, find all critical values.
   (a) $f(x) = xe^{2x}$
   (b) $f(x) = |x^2 - 4x|$
   (c) $f(x) = x^{\frac{1}{3}}(8 - x)$

2. Find the absolute and local extrema for these functions by graphing.
   (a) $f(x) = 1 - x^2$, $-2 \le x < 1$
   (b) $f(x) = \begin{cases} x^2, & \text{if } -1 \le x < 0 \\ 2 - x^2, & \text{if } 0 \le x \le 1 \end{cases}$

3. Find the absolute maximum and absolute minimum of the given function on the given interval
   (a) $f(x) = x^3 - 2x^2 + x - 5$ on $[-1, 3]$
   (b) $f(x) = x^{\frac{5}{3}} + 5x^{\frac{2}{3}}$ on $[-1, 4]$
   (c) $f(x) = \frac{1}{x-1}$, on $[0, 2]$

4. Sketch a graph of a function f satisfying the following conditions.
   (a) $x = 2$ is a critical number, but f has no local extrema.
   (b) f is continuous with a local maximum at $x = 2$, but f is not differentiable at $x = 2$.
   (c) f is defined on the interval $[1, 5]$ but does not have an absolute maximum.

Section 5.3

5. Find the value of c in the interval $[1, 4]$ that satisfies the conclusion of the Mean Value Theorem for $f(x) = x^3 + 5$

6. Find the intervals where the function is increasing or decreasing and identify all local extrema.
   (a) $f(x) = xe^{x^2-3x}$
   (b) $f(x) = \dfrac{x}{(x-1)^2}$
   (c) $f(x) = x\ln(x)$
   (d) $f(x) = x\sin x + \cos x$ on $[0, 2\pi]$

7. Determine the intervals where the given function, $f(x)$ is concave up or concave down and identify all inflection points:
   (a) $f(x) = 5x^7 - 7x^6 + 10$
   (b) $f(x) = x\ln(x - 2)$

8. Given $f(3) = 8$, $f'(3) = 0$, $f''(3) = 6$, $f(7) = 1$, $f'(7) = 0$, and $f''(7) = -5$, identify any local extrema of f.

9. Find the values of A and B so that the function $f(x) = Ax^3 - 36x^2 + Bx + 7$ will have an inflection point at $x = 3$ and will have a rate of change of -36 at $x = 2$.

Section 5.5

10. A poster is to have an area of 240 in^2 with 2-inch margins at the bottom and the sides and a 3-inch margin at the top. What dimensions will give the largest printed area?

11. A piece of wire 12 inches long is being used to make up to two figures: an equilateral triangle and a circle. How should the wire be divided so that the total area enclosed is a maximum? A minimum?

12. What are the dimensions of the largest rectangle that can be inscribed in the area bounded by the curve $y = 12 - x^2$ and the x-axis?