HOMEWORK 2

due Wednesday, July 9, at 10:45am in 36-112

Reminder: You are encouraged to work with others, but each student must write up his or her own solutions. List the names of all collaborators on the front page of the problem set.

Part I

1. [18 pt] Differentiate the following functions. You don't have to simplify the resulting functions.

   (a) $f(x) = 4x^3 - 2x^2 + 5$

   (b) $f(x) = 2x^{-2} + 4x^{-1} - 3 + x - 3x^2$

   (c) $f(x) = \frac{x^2+1}{x^3-2x+1}$

   (d) $f(x) = 3e^x + 5\ln x$

   (e) $f(x) = \cos(3x) - 2\sin(2x+1) + 1$

   (f) $f(x) = e^{\sqrt{x}}$

   (g) $f(x) = \cos(x^2 + 3x - 1)$

   (h) $f(x) = 3\tan(2\cos x)$

   (i) $f(x) = \sin^2(\sqrt{x})$

   (j) $f(x) = \frac{\cos(x^2+1)}{x^2}$

   (k) $f(x) = \frac{x}{\sin(2x)}$

   (l) $f(x) = \sqrt[3]{\sin\sqrt{x}}$

   (m) [2 pt] $f(x) = \ln(\cos^2(\sin(x + \sin(\sin x))))$

   (n) [2 pt] $f(x) = \ln(5x) - \ln(x)$ (why?)

   (o) [2 pt] $f(x) = \tan x \cot x$ (why?)

Part II

2. [5 pt] Find the derivative of x^s for any *real* number s. Hint: Write x as $e^{\ln x}$ and use the chain rule.

3. [5 pt] Edwards & Penney, page 165, problem 60.

4. [4 pt] Edwards & Penney, page 200, problem 30.

5. [8 pt] Consider a function $f(x)$ satisfying the following properties:

- $f(x)$ is smooth when $x \neq -3$;
- $f(x)$ is continuous but not differentiable at $x = -3$;
- there is a horizontal asymptote at $y = 4$;
- $\lim_{x\to-\infty} f(x) = 0$;
- there is a local maximum at the point $(1, 1)$ and a local minimum at the point $(1, 0)$;
- on the interval $(-\infty, 2]$ there is exactly one point of inflection.

(a) Draw the graph of a function $f(x)$ satisfying these properties. Be careful and draw neatly!

(b) Explain why any function $f(x)$ satisfying the above properties must have another point of inflection somewhere in the interval $(2, \infty)$.