This worksheet is a *partial* study guide for your upcoming test. Other good sources of study material include your quizzes, WebAssign homework, and examples from lecture.

1. *(For similar problems see exercises 1-38 in Section 1.6.)* For each of the following, compute the first and second derivative. Do not use your calculator.

   (a) $f(x) = \left(\frac{\sqrt{2}}{x}\right)^{-9}$

   (b) $f(x) = \frac{1}{3x^3} + 7x$

   (c) $f(x) = 3\sqrt[5]{e^2 - 11x}$

   (d) $f(x) = (\pi x + 17)^7$

2. *(For similar problems see exercises 1-6 in Section 1.4 and 1-6 in Section 1.5.)* Sketch the graph of a function $f(x)$ that satisfies the following:

   (a) The limit $\lim_{x\to 2} f(x)$ does not exist

   (b) $f(x)$ is continuous at the point $x = 5$, but not differentiable.

   (c) The limit $\lim_{x\to 4} f(x)$ exists, and the function $f(x)$ is not continuous at $x = 4$.

3. *(For similar problems see 17-32 from Section 2.3 and 9-15 from Section 2.4.)* Consider the following function $f(x) = x^4 - 4/3x^3$.

   (a) Find the intervals of increasing and decreasing for $f(x)$.

   (b) Find any relative maxima or minima for $f(x)$.

   (c) Find the intervals of concavity for $f(x)$.

   (d) Find all inflection points for $f(x)$.

   (e) Use the above data to sketch the graph of $f(x)$. Label all of the relevant points.

4. *(This problem is number 44 in your text book. For similar problems try exercise 23 and 43 from Section 2.2.)*
   After a drug is taken orally the amount of the drug in the bloodstream after t hours is $f(t)$.

   (a) Is the amount of the drug in the bloodstream stream increasing or decreasing at $t = 5$ hours?

   (b) When is the level of the drug in the bloodstream decreasing at a rate of 3 units per hour?

   (c) Is the graph of $f(t)$ concave up or concave down at $t = 5$?

   (d) When is the amount of the drug in the bloodstream maximized?

   (e) When is the level of the drug in the bloodstream decreasing fastest? [Hint: we want to find a minimum for $f'(t)$.]