Mathematics 25 Midterm I, version 1
September, 2009

No calculators will be needed or allowed on the exam. Show all your work for full credit. Try to present your work in an organized fashion; to do this, it might be helpful to do rough work on scratch paper, and then to write up an organized answer in your exam book.

1. Give definitions of the following concepts:
   (a) $\lim_{x \to a} f(x) = L$.
   (b) A function f is continuous at a point a in its domain.
   (c) The derivative of a function f at a point a in its domain

2. Find the derivative of the function $f(x) = x^2 + \sqrt{x}$ at an arbitrary positive number a, directly from the definition of derivative. In doing the caclulation, you will have to evaluate one or more limits. Carefully use laws for limits to evaluate the limit, including all steps.

3. The function $f(x) = x^{3/2}$ has derivative $f'(x) = (3/2)x^{1/2}$. Find the tangent line to the graph of the function at the point $(2, 2^{3/2})$.

4. Professor Goodman drops an eraser. It has a height in meters by $h(t) = 2 - 5t^2$ where t is the time in seconds since he dropped it. Find the average velocity of the eraser between $t = 0$ and $t = 1/2$ and the instantaneous velocity at time $t = 1/2$.

5. Explain in detail why the function

$$f(x) = \sqrt{\frac{x^4 + 1}{(x - 2)^2}}$$

   is continuous, except at $x = 2$.