Math 266A A02 **Winter 2009** **Guide for Test 4**

The fourth test is in class on Friday 6 March, and covers sections 4.7, 4.8, 5.1, and 5.2.

Here are some sample questions, so that you have an idea of what to expect. The homework problems are also a good source of practice material.

1. Compute the following derivatives:

   (a) $f(x) = \arctan(x) \Rightarrow f'(x) =$

   (b) $f(x) = \ln(x) \Rightarrow f'(x) =$

   (c) $f(x) = \log_3(x) \Rightarrow f'(x) =$

   (d) $f(x) = \dfrac{\arctan(\log_3(7x))}{x^4 + 2x} \Rightarrow f'(x) =$

2. (a) Find the derivative of $y = \dfrac{x^x \sin(2x)(x^5 - 7x)^6}{(\sqrt{x^9+1})3^x}$

   (b) Let f be a continuous function with

   - $f(0) = 3$
   - $f(2) = 6$
   - $f'(x) = 0$ for $0 < x < 1$
   - $f'(x) < 2$ for $1 < x < 2$

   Sketch such a function or explain why it is impossible.

3. Let $f(x) = \dfrac{x^3}{3} - 2x^2 + 3x + 1$.

   (a) Find the intervals where f is increasing, and the intervals where it is decreasing.

   (b) Find the intervals where f is concave up, and the intervals where it is concave down.

   (c) We wish to approximate $f(0.01312)$. A crude approximation is $f(0.01312) \approx f(0) = 1$.
   Use a linear approximation to f based at $x = 0$ to give a better estimate for $f(0.01312)$.

4. The volume of a spherical cell of radius r is given by

$$V(r) = \frac{4}{3}\pi r^3 .$$

   If you can determine the radius within an accuracy of 3%, how accurate is your calculation of the volume?