Math 124M **First Midterm** **Autumn 2007**

Your Name

Your Signature

Student ID #

Section (Tues.) 2:30 2:30 4:00
(circle one) MA MB MC

Problem	Total Points	Score
1	10	
2	10	
3	10	
4	10	
5	10	
Total	50	

- This exam is closed book. You may use one $8\frac{1}{2} \times 11$ sheet of notes.
- Do not share notes.
- Graphing calculators are not allowed.
- In order to receive credit, you must show your work.
- **Place a box around YOUR FINAL ANSWER to each question.**
- Use only methods that have been covered in this course so far. Do not use more advanced methods that you may have learned in another calculus course.
- If you need more room, use the backs of the pages and indicate to the reader that you have done so.
- Do not panic! It's only a test. Remain calm and do the best you can.

1 (10 points) Determine if the following limits exist. If they exist, compute them (including the case when the limit is $\pm\infty$. Justify your answers.

(a) (3 points) $\lim_{x\to 0} \dfrac{\sqrt{4+x}-2}{x}$

(b) (3 points) $\lim_{x\to \infty} \dfrac{5x^4-2x^2+1}{7x^4+x^3-3}$

(c) (4 points) $\lim_{x\to \frac{\pi}{2}^+} e^{\tan x}$ and $\lim_{x\to \frac{\pi}{2}^-} e^{\tan x}$

2 (10 points) **Do not use differentiation rules on this problem. Use limits where appropriate.** According to Boyle's law, if the temperature of a confined gas is held fixed, then $V = \frac{c}{P}$, where V is volume (in cubic inches), P is pressure (in pounds per square inch), and c is a constant. Assume that $c = 500$.

a)(2 points) Find the average rate of change of V as P increases from 10 to 20.

b)(8 points) Find the instantaneous rate of change of V with respect to P when $P = 20$.

3 (10 points) **Do not use differentiation rules on this problem. Use limits where appropriate.** Find the equation of the tangent line to $y = 2x^3 + 1$ at the point $(2, 17)$.

4 (10 points) **You may and should use the differentiation rules on this problem, where appropriate.** Suppose $f(x) = 4x^3e^x + 5$. Find all values of a (if any) such that the graph of f has a horizontal tangent line at the point $(a, f(a))$.

5 (10 points) **You may and should use the differentiation rules on this problem, where appropriate.** A spherical balloon is expanding or shrinking according to the formula $r(t) = \dfrac{t}{1+t^2}$ where r is the radius of the balloon (in meters) and t is time (in minutes).

a)(8 points) For what values of t is the balloon expanding? For what values of t is it shrinking?

b)(2 points) What happens as $t \to \infty$? Justify your answer by computing the appropriate limit.