APPM 1350 **Exam 1** **Spring 2011**

INSTRUCTIONS: Books, notes, and electronic devices are not permitted. Write (1) **your name**, (2) **1350/EXAM 1**, (3) **instructor's name** and (4) **SPRING 2011** on the front of your bluebook. Also make a scoring table with room for 5 problems and a total score. **Work all problems. Start each problem on a new page.** **Box your answers.** A correct answer with incorrect or no supporting work may receive no credit, while an incorrect answer with relevant work may receive partial credit.

— SHOW ALL WORK —

1. (30 pts) Use the **limit definition of the derivative** to find:
   (a) $f'(x)$ given $f(x) = \sqrt{x^2+9}$
   (b) $f'(0)$ given $f(x) = 5x^4 + 3x + 20$
   (c) $\dfrac{d^2f}{dx^2}$ given $\dfrac{d}{dx}f(x) = \dfrac{1}{10x+6}$

2. Suppose the position function of a particle in motion is given by $s(t) = 5t^4 + 3t + 20$ ft, where t is in seconds.
   (a) (8 pts) Find the average rate of change of the position of the particle from $t = 0$ seconds to $t = 2$ seconds.
   (b) (6 pts) Find the instantaneous rate of change of the position of the particle when $t = 0$ seconds.

3. (18 pts) Let $f(x) = x^2 + 1$, $m(x) = x$ and $b(x) = \sqrt{x^2-1}$,
   (a) Find $(f \circ m \circ b)(x)$ and state the domain.
   (b) Find $(f + m)(x)$ and state the domain.
   (c) Find $\left(\dfrac{b}{m}\right)(x)$ and state the domain.

4. (20 pts) Justify your answers for all the questions below. Consider the function $f(x) = \dfrac{1}{x+1} + \dfrac{2x}{|x|}$, does $f(x)$ have any:
   (a) *vertical* asymptotes? If so, what are they?
   (b) *horizontal* asymptotes? If so, what are they?
   (c) *removable* discontinuities? If so, what are they?
   (d) *jump* discontinuities? If so, what are they?

5. (18 pts) Let a, b and c be constants and consider the function $f(x)$ where
$$f(x) = \begin{cases} x + 6, & x \le 0 \\ cx^2 + bx + a, & 0 < x < 1 \\ 7x + c, & x \ge 1 \end{cases}$$
   (a) Find all values of a, b and c for which $f(x)$ will be *continuous* at $x = 0$ and $x = 1$?
   (b) For what values of a, b and c will $f(x)$ be *differentiable* at $x = 0$ and $x = 1$?
   (c) Find the equation of the tangent line to $f(x)$ at $x = -1$.

END