APPM 1350 **EXAM 1** **SUMMER 2009**

On the front of your bluebook write: (1) your name, (2) your student ID number, (3) your instructor's name, and (4) a grading table. You must work all of the problems on the exam. Show **ALL** of your work in your bluebook and BOX in your final answers. A correct answer with no relevant work may receive no credit, while an incorrect answer accompanied by some correct work may receive partial credit. Textbooks, class notes, calculators, flying monkeys, and crib sheets are NOT permitted. Please start each new problem on a new page of the bluebook.

1. (21 points) For each of the following, answer either TRUE or NOT NECESSARILY TRUE. No justification is necessary.

   (a) The points (2,5), (4,10), and (-3,$-\frac{15}{2}$) lie on the same straight line.

   (b) If f is odd and g is odd, then $\frac{f}{g}$ is odd.

   (c) There is an x for which $\cos^2 x + 1 = \frac{\pi}{2}$.

   (d) If the velocity $v(t)$ of a particle is increasing, the particle is speeding up.

   (e) All polynomials are continuous functions.

   (f) If $\tan\phi = -\frac{1}{\sqrt{3}}$, then $\phi = -\frac{\pi}{6}$.

   (g) If $\dfrac{2}{|x-2|} < 1$ then $|x| > 4$.

2. (18 points) Evaluate each of the following limits, if it exists. If the limit does not exist, state this and state your justification.

   (a) $\displaystyle\lim_{\theta\to 0^-} \frac{\csc(2\theta)}{\theta}$

   (b) $\displaystyle\lim_{s\to 0} \frac{1/\sqrt{1+s}-1}{s}$

   (c) $\displaystyle\lim_{x\to -2} \frac{\sqrt{x^2+4x+4}}{(x+2)}$

3. (11 points)

   (a) State the conditions necessary for $f(x)$ to be continuous at the point $x = c$.

   (b) Determine the values of b and c so that the following function is continuous:

$$f(x) = \begin{cases} x+1, & 1 < x < 3 \\ x^2 + bx + c, & |x+2| \geq 1 \end{cases}$$

4. (11 points)

   (a) State the definition of $\frac{d}{dx}f(x)$.

   (b) Use the *definition* to find $\dfrac{d}{dx}\sqrt{x+1}$.

THE EXAM IS CONTINUED ON THE BACK

5. (24 points) Using the appropriate rules of differentiation, find the requested derivatives for the following functions. Do not simplify your answers.

   (a) $f(x) = x^{4/5} - x^{-4/5} + \pi^3, \quad f'(x)$

   (b) $g(s) = \dfrac{s^3 - s^2 + 4}{s^2}, \quad \dfrac{dg}{ds}$

   (c) $y(x) = (x^2 + 2x)(x^3 - 1), \quad \dfrac{d^2y}{dx^2}$

   (d) $r(\theta) = \dfrac{1}{\sqrt[3]{\theta^2}}, \quad \ddot{r}$

6. (15 points) At 0° Celsius, the wind-chill corrected temperature is given by

$$T(w) = 33 - (1.43)(10\sqrt{w} - w + 10.45)$$

   where T is measured in degrees Celsius and the wind speed, w, is measured in meters per second.

   (a) Find the change in the wind-chill corrected temperature when w changes from $w = 4$ to $w = 9$.

   (b) Find the instantaneous rate of change of T when $w = 1$ and $w = 4$.

   (c) Find the average rate of change of T as w changes from 1 to 4.