APPM 1350 **Forgiveness EXAM 1** **FALL 2006**

INSTRUCTIONS: Books, notes, flying monkeys and electronic devices are not permitted. Write your (1) name, (2) instructor's name, and (3) recitation number on the front of your bluebook. Work all **7 problems**. Start each problem on a **new page**. Show your work clearly and box your final answer. A correct answer with incorrect or no supporting work may receive no credit, while an incorrect answer with relevant work may receive partial credit.

1. (18 points) The function $y = f(x)$ is sketched here. For each of the following statements, if it is true, mark **TRUE** meaning always true. If it is not always true, mark **FALSE** and replace it with a correct statement about $y = f(x)$. For this problem only, you do not need to justify your answer.

   (a) $\lim_{x \to 0^-} f(x) = 0$.

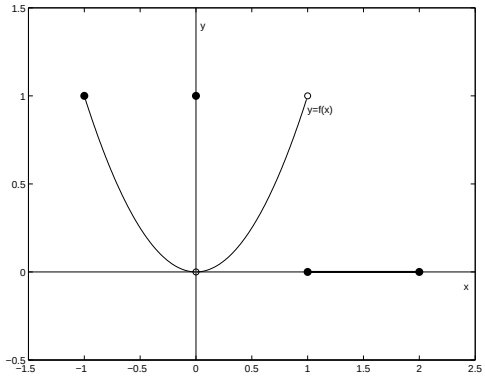
   (b) $\lim_{x \to 0}$ exists.

   (c) $\lim_{x \to 1} f(x) = 1$.

   (d) $f(x)$ is continuous at $x = 0$.

   (e) $\lim_{x \to 0^+} f(x) = \lim_{x \to 0^-} f(x)$.

   (f) $f(1) = 0$.



2. (10 points) Define the function f as follows:

$$f(x) = \begin{cases} x^2 - 1 & \text{for } x < 3 \\ 2ax & \text{for } x \geq 3 \end{cases}$$

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   (a) State the definition of continuity at a point.

   (b) For what value of a is f continuous at every x?

3. (20 points) Find the following limits, if they exist. If the limit does not exist or is infinite, clearly state this. Show all your work and be sure to justify your answers.

   (a) $\lim_{x \to 0} \dfrac{\sqrt{x+1}}{x^2}$

   (b) $\lim_{x \to 0^+} \sqrt{x}\, \sin \dfrac{1}{x}$

   (c) $\lim_{x \to 6} \dfrac{x^{-1} - 6^{-1}}{x - 6}$

   (d) $\lim_{t \to -2} \dfrac{t}{|t|}$

4. (15 points)

   (a) State the definition of $f'(x)$ at a point x_0 in the domain of $f(x)$.

   (b) Use this definition to calculate the derivative of $f(x) = 2\sqrt{3x}$ at $x_0 = 1$.

   (c) Find an equation of the straight line tangent to the curve $y = f(x)$ at $x = 1$.

THERE IS MORE ON THE BACK

5. (20 points) Using appropriate rules of differentiation, find the following:

   (a) y' where $y = (x + \frac{1}{x})(x - \frac{1}{x} + 1)$;

   (b) the derivatives of all orders of the function $y = \frac{x^4}{2} - \frac{3}{2}x^2 - x$; and

   (c) $g(2) + g'(2)$ where $g(x) = \dfrac{-x^2 + 2x}{x + 1}$.

6. (10 points) If $f(x) = x^3 - 8x + 10$ show that there is a value for c for which $f(c) = -\sqrt{3}$. Be sure to justify your answer using an appropriate theorem. You need not find the value of c.

7. (7 points) Graph $y = \sin(2x)$. Clearly label the graph, and show x-axis and y-axis intercepts. What is the period of y?

Did you write Exam 1 on the front of your bluebook?

Now that you have finished the exam, please decide whether to turn it in or to walk away with it. If you turn in your finished exam, your score on this exam will replace your previous score on exam 1. If you do not turn it in, your current score on exam 1 will stand.