Math 141.1 – Test I
Tuesday, Sept. 21, 1993

Name _____ **Show your work for full credit**

1. Let f be defined by
$$f(x) = \begin{cases} 5 - x^2, & \text{if } -1 < x < 1 \\ 2(2 - x), & \text{if } x \geq 1. \end{cases}$$
   (a) Sketch the graph of f.
   (b) Determine the domain and range of f.
   (c) Is f continuous at the points $x = -1, 0, 1$? Verify your answer.

2. Using the properties of limits, find the the following limits putting in each step:
   (a) $\lim_{x\to 3} \frac{x^2-4x+3}{x^2-9}$
   (b) $\lim_{x\to 2} \frac{x^2-4x+3}{x^2-9}$
   (c) $\lim_{x\to 0} \frac{tan(x)}{xcos(x)}$

3. Using the definition of derivative and the properties of **limits**, compute the derivative of f at $x = 2$ where f is given by
$$f(x) = x^2 + x - 3.$$

4. Let
$$f(x) = 2x^3 - 6x - 2.$$
   (a) Compute the slope of the tangent line to the graph of f when $x = 1$.
   (b) Give the equation of the tangent line to the graph of f at the same point.
   (c) For which values of x is the tangent line horizontal?

5. Using the properties of **derivatives**, determine the derivatives of each of the following functions:
   (a) $g(x) = (2x^2 - 3)(1 - 2x + x^2)$
   (b) $f(x) = x^2e^x - 2x^3$ (Hint: You can use $D_x(e^x) = e^x$)

6. **[EXTRA CREDIT]**
Using the definition of 'limit', prove that
$$\lim_{x\to 0} x^2 = 0.$$