Math 10A Midterm 1
January 30, 2009
Notes allowed (one page), graphing calculators allowed, show all work
50 points total, each problem worth 10 points

1. 
   a. Consider the functions graphed in Figure 1.89(a) [pg. 60]. Find the
      coordinates of $C$.
   b. Consider the functions in Figure 1.89(b) [pg. 60]. Find the coordinates of
      $C$ in terms of $b$.

2. If possible, choose a constant $k$ so that the following function is:
   a. Continuous on any interval: $h(x) = \begin{cases} 
   \frac{x^3 - 3x^2 + 2x}{x - 2} & x \neq 2 \\
   k + 1 & x = 2
   \end{cases}$
   b. Differentiable at $x = 0$: $g(x) = \begin{cases} 
   |x| & x < 0 \\
   x^2 + kx & x \geq 0
   \end{cases}$

3. The position function of an object is given by $s(t) = 2t$.
   a. Find the average velocity of the object on the intervals [2, 2.1], [2, 2.01],
      and [2.001, 2.1].
   b. Estimate the instantaneous velocity at $t = 2$ using your answer in part (a).
   c. Estimate the equation of the tangent line at $t = 2$ using your answer in part
      (b).

4. Given the function $f(x) = x^{-2}$:
   a. Estimate $f'(x)$ using the average rate of change formula. Let $h = 0.01$.
   b. Calculate $f'(x)$ using the definition $f'(x) = \lim_{h \to 0} \frac{f(x + h) - f(x)}{h}$.
   c. Calculate $f'(1)$ using your answer to part (b).

5. The graph of $f$ is given below. At which of the marked $x$-values can the following
   statements be true? No justification is necessary.
   a. $f(x) < 0$
   b. $f'(x) < 0$
   c. $f''(x) < 0$
   d. $f(x)$ is increasing
   e. $f'(x)$ is increasing