1. As x approaches 0, $f(x)$ and $g(x)$ both approach 0. What are the possible limits of $f(x)/g(x)$ as x approaches 0?

   (a) 0 (b) 1 (c) ∞ (d) any real number r (e) all of the above.

   Justify your answer with examples. DO NOT use L'Hospital's rule.

2. Consider the piecewise function

$$f(x) = \begin{cases} 2xA & x \leq 2 \\ x^2 + A & x > 2 \end{cases}$$

   (a) Find A so that $f(x)$ is continuous for all x.

   (b) Will that function be differentiable for all x?

3. A baseball is thrown at an angle to the ground and its path is given by the equation equation $y = x^2 - 32x + 11.6$ where x is its horizontal distance from a fixed point and y is its vertical distance from that same point. If t represents time and the derivatives of both x and y with respect to t exist, describe in terms of the derivatives

   (a) the ground velocity (b) vertical velocity (c) equation relating them

   (d) how you would find the highest point during its flight.

4. Find the area under the curve $y = 1/x$ for $x = 1$ to 11 using integration. Find an approximation to this integral by dividing the interval [1,11] into 10 intervals and using the values of $1/x$ at the left endpoints.

   Why does this show that $ln(11) < 1 + \frac{1}{2} + \frac{1}{3} + \ldots + \frac{1}{10}$?

5. Are the following true or false? If true prove it and if false give a counter-example.

   a) If the function f is continuous at a, then f is differentiable at a.

   b) If $f'(x) = g'(x)$, then $f(x) = g(x)$.