Math 165
Spring 2008
Exam 1

Show your work. Answers without work will not receive credit.

1. Calculate the following limits:

   (a) $\lim_{x \to -1} \dfrac{x^2 - 2x - 3}{x + 1}$

   (b) $\lim_{x \to \infty} \dfrac{3x^7 + 4x^6 - 2x^3 + 4}{2x^7 - 3x^5 + x + 11}$

   (c) $\lim_{x \to 0} \dfrac{\sin 2x}{\cos x}$

2. A ball is shot in the air and its height at time t is given by the function $h(t) = 96t - 16t^2$ where height is measured in feet. What is its velocity 2 seconds after launch?

3. Define a function $f(x)$ by:

$$f(x) = \begin{cases} \dfrac{1}{x} & \text{if } x < 1 \\ x + 1 & \text{if } x \geq 1 \end{cases}$$

As specifically as possible, evaluate:

(a) $f(1) =$

(b) $\lim_{x \to 1^+} f(x) =$

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

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

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

4. Find the derivative of each function:

(a) $f(x) = 3x^5 + 7x^2 + 32 + x^{-1}$

(b) $f(x) = (x + 3)(2x^2 - 5)$

(c) $f(x) = \dfrac{x}{x^2 + x + 1}$.

5. **Use the definition of the derivative** to calculate $f'(x)$ where

$$f(x) = \frac{3}{x}$$

6. Sketch the tangent line to the graph of $f(x)$ at $x = 2$.
   Is the derivative positive, negative or zero there?