1. (a) What is wrong with the following equation?

$$\frac{x^2 + x - 6}{x - 2} = x + 3$$

   (b) In view of part (a), explain why the equation

$$\lim_{x \to 2} \frac{x^2 + x - 6}{x - 2} = \lim x \to 2(x + 3)$$

   is correct.

2. Evaluate the limit, if it exists.

$$\lim_{t \to 0} \left(\frac{1}{t} - \frac{1}{t^2 + t} \right)$$

3. Prove that $\lim_{x \to 0} x^4 \cos\left(\frac{2}{x}\right) = 0$.

4. Is there a number a such that

$$\lim_{x \to -2} \frac{3x^2 + ax + a + 3}{x^2 + x - 2}$$

   exists? If so, find the value of a and the value of the limit.

5. Sketch the graph of a function f that is continuous except for the stated discontinuity.

   Neither left nor right continuous at -2, continuous only from the left at 2.

6. A parking lot charges \$3 for the first hour (or part of an hour) and \$2 for each succeeding hour (or part), up to a daily maximum of \$10.

   (a) Sketch a graph of the cost of parking at this lot as a function of the time parked there.

   (b) Discuss the discontinuities of this function and their significance to someone who parks in the lot.

7. Explain why the function is discontinuous at the given number a. Sketch the graph of the function.

$$f(x) = \begin{cases} \dfrac{x^2 - x}{x^2 - 1} & \text{if } x \neq 1 \\ 1 & \text{if } x = 1 \end{cases} \qquad a = 1$$

8. Use the Intermediate Value Theorem to show that there is a root of a given equation in the specified interval.

$$\sqrt[3]{x} = 1 - x, \qquad (0, 1)$$

Optional Challenge Problems

1. Find values of a, b, and c so that the following function is continuous.

$$f(x) = \begin{cases} 6 - 3bx & \text{if } x \leq -2 \\ cx^2 - ax + 4 & \text{if } -2 < x \leq -1 \\ 6 - bx & \text{if } -1 < x \leq 1 \\ ax^2 + c & \text{if } x > 1 \end{cases}$$

2. Evaluate the following limit. (For those that have had calculus before, feel free to confirm your answer using L'Hôpital's Rule, but solve it another way. This is an algebra challeng!)

$$\lim_{x \to 64} \frac{\sqrt[3]{x} - 4}{\sqrt{x} - 8}$$