Directions: Please answer the following questions and make sure your answer are legible. You must show your work to receive credit for your answers. You may not use a calculator (or any other technology) on this quiz. Good Luck.

1. (2 points)

   Let \( f(x) = \begin{cases} 
   x + 5 & \text{if } x \leq -3 \\
   \sqrt{9 - x^2} & \text{if } -3 < x \leq 3 \\
   -x + 5 & \text{if } x > 3 
   \end{cases} \)

   Compute the following and simplify. (1.4 # 35)

   (a) \( f(3.001) = \frac{-1}{a_0} \approx 0.8 \)

   (b) \( f(-3) = -3 + 5 = 2 \)

2. (4 points) Let \( f(x) = -x^2 + x + 6 \) and \( g(x) = x^2 - 9 \) and \( h(x) = \left( \frac{g}{x} \right)(x) \). (1.5 # 16)

   (a) Find a simple expression for \( h(x) \).

   (b) State the domain of \( h(x) \), using interval notation.

   \[ h(x) = \frac{-x^2 + x + 6}{x^2 - 9} \]

   \[ = \frac{-(x^2 - x - 6)}{(x + 3)(x - 3)} \]

   \[ = \frac{-1}{x + 3} \quad \text{Domain: } (-\infty, -3) \cup (-3, 3) \cup (3, \infty) \]

3. (7 points) (1.5 # 41)

   Find and simplify the difference quotient \( \frac{f(x + h) - f(x)}{h} \) for the function \( f(x) = \frac{3x}{x + 1} \).

   \[ \frac{f(x + h) - f(x)}{h} = \frac{\left( \frac{3(x + h)}{x + h + 1} \right) - \frac{3x}{x + 1}}{h} \]

   \[ = \frac{3x + 3h - 3x}{(x + h + 1)(x + 1)} \]

   \[ = \frac{3h}{(x + h + 1)(x + 1)} \]

   \[ \lim_{h \to 0} \frac{3h}{(x + h + 1)(x + 1)} = \frac{3}{(x + 1)(x + 1 + 1)} \]

Continued on Reverse
4. (5 points) Determine analytically if the following functions are even, odd or neither. Make sure to show work

(a) \( f(x) = \sqrt{x} \) \hfill (1.6 \# 34)

(b) \( f(x) = \frac{x^2 - 3}{x - 4x^3} \) \hfill (1.6 \# 39)

a) \( f(-x) = \sqrt{-x} = \sqrt{1 \cdot -x} = -\sqrt{x} = -f(x) \)

Function is odd (sym about origin)

b) \( f(-x) = \frac{(-x)^2 - 3}{(-x) - 4(-x)^3} = \frac{x^2 - 3}{-x + 4x^3} = -\frac{x^2 - 3}{x - 4x^3} = -f(x) \)

Function is odd (sym about origin)

5. (7 points) Use the graph of \( f(x) \) to answer the following \hfill (1.6 \# 42-57)

(a) Find the zeros of \( f \).
\[ x = -4, -1, 1 \]

(b) Does \( f \) appear to be even, odd, or neither? Neither (not sym about y-axis or orig)

(c) List the intervals where \( f \) is increasing.
\[ [-\infty, -3) \cup (0, 2) \cup (-5, -3) \cup (3, \infty) \]

(d) List the local maximums, if any exist
\[ (-3, 4) \text{ and } (2, 3) \]

(e) List the local minimums, if any exist
\[ (0, -1) \text{ optimal: } (-5, -5) \text{ & } (3, 1) \]

(f) Find the maximum, if it exists
\[ f(-3) = 4 \]

(g) Find the minimum, if it exists
\[ f(-5) = -5 \]