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. (4 points) Let \( f(x) = x^2 - 4 \) and \( g(x) = 3x + 6 \) and \( h(x) = \left( \frac{f}{g} \right)(x) \). (1.5 # 15)
   (a) Find a simple expression for \( h(x) \).
   (b) State the domain of \( h(x) \), using interval notation.

\[
\begin{align*}
\text{Domain} & \quad \frac{-b \pm \sqrt{b^2-4ac}}{2a} \\
0 & \quad \frac{-4 \pm \sqrt{0^2-4*3*6}}{6} \\
\text{Domain} & \quad (-\infty, -2) \cup (-2, \infty)
\end{align*}
\]

2. (7 points) Find and simplify the difference quotient \( \frac{f(x + h) - f(x)}{h} \) for the function
   \( f(x) = \sqrt{-4x + 5} \). Hint: rationalize the numerator. (1.5 # 41)

\[
\begin{align*}
DQ &= \frac{\sqrt{-4(x+h) + 5} - \sqrt{-4x + 5}}{h} \\
&= \frac{(-4x-4h+5) + \sqrt{-4x-4h+5} \sqrt{-4x+5}}{h} \left( \frac{-4x-4h+5}{h} \right) \\
&= \frac{-4h}{h(\sqrt{-4x-4h+5} + \sqrt{-4x+5})} \\
&= \frac{-4}{\sqrt{-4x-4h+5} + \sqrt{-4x+5}} \\
&\text{Domain: } (-\infty, \infty) \\
&\text{Not defined when } h = 0
\end{align*}
\]

3. (4 points) Determine analytically if \( f(x) = \frac{\sqrt{x^3 + x}}{5x} \) is even, odd or neither. (1.6 # 41)

Make sure to show work

\[
\begin{align*}
\frac{f(-x)}{f(x)} &= \frac{\sqrt{(-x)^3 + (-x)}}{5(-x)} = \frac{\sqrt{-x^3 - x}}{S} = \frac{\sqrt{-x^3 - x}}{-5x} = \frac{-x}{-5x} = \frac{x}{5x} = \frac{f(x)}{5x} \\
\text{So } f(x) \text{ is an even function (symm over } y = 0)\end{align*}
\]

Continued on Reverse
4. (7 points) For \( f(x) = 3 - 2\sqrt{x + 2} \)
   (a) Find the \( x \)- and \( y \)-intercepts
   (b) State the domain.
   (c) Sketch the graph of \( f \).

   \[
   \begin{align*}
   x &= \frac{3 - y}{2} \\
   \Rightarrow \quad y &= 3 - 2\sqrt{x + 2} \\
   \Rightarrow \quad y &= 3 - 2\sqrt{3 - 3} \\
   \Rightarrow \quad y &= 3
   \end{align*}
   \]

   Domain

5. (3 points) Use the graph of \( f(x) \) to answer the following

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

   (b) Does \( f \) appear to be even, odd, or neither? Neither

   (c) Solve \( f(x) \leq 0 \).
   \( [-5, 4] \cup [-1, 1] \)