Show all your work.

1. Evaluate the following limits:
   a. (3 pts) \( \lim_{{x \to 3}} \left( \frac{x - 2}{1 + \sqrt{x + 6}} \right) \)
   b. (2 pts) \( \lim_{{x \to x}} (x) \)

   c. (7 pts) \( \lim_{{x \to 2}} \left( \frac{4 - \sqrt{11x - 6}}{x - 2} \right) \)
   d. (6 pts) \( \lim_{{x \to -2}} \left( \frac{x^2 - x - 6}{2x^2 + 3x - 2} \right) \)

   e. (2 pts) \( \lim_{{x \to -3}} \left\lfloor \frac{x - 4}{x^2(x + 3)} \right\rfloor \)
   f. (2 pts) \( \lim_{{x \to 4}} \left[ \frac{x - 4}{|x - 4|} \right] \)
2. If \( f(x) = \begin{cases} 
5 & \text{if } x < -2 \\
\chi^2 + 1 & \text{if } -2 \leq x < 1 \\
2\chi^2 + 3 & \text{if } x \geq 1 
\end{cases} \) answer the following questions:

a. (4 pts) Is \( f \) continuous at \( x = -2 \)? Explain why or why not using the definition of continuous.

b. (4 pts) Is \( f \) continuous at \( x = 1 \)? Explain why or why not using the definition of continuous.

3. (9 pts) Use the definition of derivative to find \( f'(x) \) if \( f(x) = \sqrt{2x + 1} \)

4. (4 pts) The displacement (in meters) of a particle moving in a straight line is given by \( s(t) = t^2 - 5t - 1 \) where \( t \) is measured in seconds. Find the instantaneous velocity when \( t = 4 \) seconds.
5. Refer to the graph of \( f(x) \) to answer the following questions:

a. (1 pt) \( \lim_{x \to 2^-} f(x) = \) __________

b. (1 pt) \( \lim_{x \to 2^+} f(x) = \) __________

c. (1 pt) \( \lim_{x \to 2^-} f(x) = \) __________

d. (1 pt) \( \lim_{x \to 2} f(x) = \) __________

e. (1 pt) \( \lim_{x \to 4^-} f(x) = \) __________

f. (1 pt) \( \lim_{x \to 6^-} f(x) = \) __________

g. (6 pts) List the values of \( x \) at which \( f \) is discontinuous. For each of these values state the condition(s) from the definition of continuity that is (are) violated.

h. (8 pts) State, with reasons, the values of \( x \) at which \( f \) is not differentiable.
6. (10 pts) The graph of the function $f(x)$ is given below. Use it to sketch the graph of $f'(x)$. 

[Diagram of a sinusoidal function with a tangent line at various points indicating the slope]
7. Find the derivative of the following functions: \textbf{(DO NOT simplify your answer.)}

   a. \((7 \text{ pts})\) \(f(x) = 5x + \frac{7}{x^2} + 3\sqrt{x^2 + 4x^2}\)

   b. \((10 \text{ pts})\) \(f(x) = (x^7 + 3x^5 - 2x^4 + 8x^{1/5})(2x^{1/2} - 3x^{-2} + 7x^{1/2})\)

8. \((10 \text{ pts})\) Find and \textbf{SIMP L I F Y} the derivative of:

   \[ f(x) = \frac{x^2}{x^2 + 2x + 1} \]

   \textbf{AFTER} differentiation you may use \(x^2 + 2x + 1 = (x + 1)^2\)