1. Evaluate each limit, provide a detailed calculation to get full credit. Write you final answer in the box.

(1) \[ \lim_{x \to 4} \frac{x^2 - x - 12}{x - 4} \]

(2) \[ \lim_{x \to 2} \frac{1 - x}{x^2 + 1} \]

(3) \[ \lim_{x \to \infty} \frac{5x^2 - 19}{x^2 + 2} \]

(4) \[ \lim_{x \to 2} \frac{-100}{(x - 2)^2} \]

(5) \[ \lim_{x \to \infty} (\sqrt{9x^2 + x} - 3x) \]
2. If \( f(x) = \begin{cases} 
8x + 1, & x \leq 1 \\
2x + 4, & x > 1 
\end{cases} \),

Find \( \lim_{x \to 1^{-}} f(x) \) and \( \lim_{x \to 1^{+}} f(x) \).

3. State the domain of the following functions, show your work to get full credit.

1). \( f(t) = \ln(t^{4} - 81) \)

2). \( G(x) = \sin^{-1}(x^{2} - 1) \)
4. Show that there is a root of \( \cos x = x \) in the specified interval \((0, 1)\).

5. (1) Use the definition of the derivative to obtain \( f'(x) \), with \( f(x) = \frac{5x}{1 + x^2} \)

(2) Determine the equation of the line tangent to the graph of the function \( f(x) = 3x^2 - 6x \) at point \((2, 0)\).
6. Answer the questions on the basis of the graph of $f$ shown in the figure above, write your answer a or b in the corresponding box to get credit.

(1) Is $f$ continuous at 1?
   a. Yes; b. No

(2) Is $f$ continuous at 2?
   a. Yes; b. No

(3) Is $f$ continuous at 0?
   a. Yes; b. No

(4) Does $\lim_{x \to 2} f(x)$ exist?
   a. Yes; b. No

(5) Does $\lim_{x \to 1^-} f(x)$ exist?
   a. Yes; b. No

(6) Find $\lim_{x \to -\infty} f(x)$

(7) Find $\lim_{x \to 0} f(x)$
7. If a ball is thrown into the air with a velocity of 40 ft/s, its height (in feet) after $t$ seconds is given by $y = 40t - 16t^2$. Find the velocity when $t = 2$. 