(1) Evaluate the limit, if it exists:

(a) \( \lim_{x \to 1^-} \frac{|x^2-3x+2|}{x^2-1} \)

(b) \( \lim_{x \to 2} \sqrt{\frac{x^4-16}{x^2-x-2}} \)

(c) \( \lim_{x \to \frac{1}{2}} \left( \frac{2x}{2x-1} - \frac{3}{2x^2+x-1} \right) \)
(d) \( \lim_{x \to 1} \frac{5}{1-x} \).

(e) \( \lim_{x \to 0^+} \frac{3}{2} \left( \frac{1}{4+x} - \frac{1}{4-x} \right) \).

(f) \( \lim_{x \to \infty} \frac{2x + x \cos x}{5x^2 - 2x + 1} \).

(g) \( \lim_{x \to 0^+} x \sin \left( \frac{\sqrt{x^2 + 3}}{x} \right) \).
(2) Use the Intermediate Value Theorem to show that there is a root of the equation 
\[ x \ln x = \sin x \] 
between 1 and \( e \).

(3) Use the graph of \( f(x) = \frac{1}{x} \) to find a number \( \delta \) such that 
\[ |\frac{1}{x} - \frac{1}{3}| < \frac{1}{5} \] 
whenever 
\[ |x - 3| < \delta. \]
(4) The displacement (in meters) of a particle moving in a straight line is given by
\[ s(t) = \frac{1}{\sqrt{5-t}} \] where \( t \) is measured in seconds. Use limits to find the instantaneous
speed of the particle when \( t = 1 \).
(5) Sketch the graph of the function \( f(x) = \frac{x^2+4}{x+2} \). Include the graphs and equations of the asymptotes and dominant terms.
(6) Find all values of $a$ and $b$ that makes the function

$$f(x) = \begin{cases} 
    x^2 - a & \text{if } x < 1 \\
    a+bx & \text{if } 1 \leq x \leq 2 \\
    b-x^3 & \text{if } x > 2 
\end{cases}$$

continuous on the real line. (Use limits to justify your steps)
(7) Find the horizontal asymptote(s) of the graph of the function

\[ f(x) = \arctan \frac{\sqrt{x^2 + 2}}{x - 7}. \]
(8) Sketch the graph of a function f that satisfies all of the given conditions:

\[ \lim_{x \to -5^+} f(x) = \infty ; \quad \lim_{x \to -5^-} f(x) = -\infty ; \quad \lim_{x \to -\infty} f(x) = 0 ; \quad \lim_{x \to -1} f(x) = 1 ; \quad f \text{ is undefined at } -1 ; \quad \lim_{x \to 2^-} f(x) = 0 ; \quad \lim_{x \to 2^+} f(x) = 2 ; \quad f(2) = 1. \]

(9) If \( x^3 - x + 4 \leq x + f(x) \leq 3x^2 + 1 \) for all real number x, then find \( \lim_{x \to -1} f(x) \).

(Given reasons to your steps)