2.1 Introduction to Limits

4) Find the limit.
\[
\lim_{x \to -2} (x^2 + 2t - 1) = (-2)^2 + 2t - 1 = 4 + 2t - 1 = 3 + 2t
\]

6) Find the limit.
\[
\lim_{t \to -7} \frac{t^2 + 4t - 21}{t + 7} = \lim_{t \to -7} \frac{(t + 7)(t - 3)}{t + 7} = \lim_{t \to -7} (t - 3) = -7 - 3 = -10
\]

14) \[
\lim_{t \to 7^+} \frac{(t - 7)^3}{(t - 7)} = \lim_{t \to 7^+} \frac{\sqrt{(t - 7)^2} \cdot \sqrt{(t - 7)}}{t - 7} = \lim_{t \to 7^+} \frac{(t - 7) - \sqrt{(t - 7)}}{t - 7} = \lim_{t \to 7^+} \sqrt{t - 7} = \sqrt{7 - 7} = 0
\]
Sketch the graph of

\[ g(x) = \begin{cases} 
-x + 1 & \text{if } x < 1 \\
-x^2 & \text{if } x \geq 2 \\
x - 1 & \text{if } 1 \leq x < 2 
\end{cases} \]

then find each of the following or state that it does not exist.

\[ \lim_{x \to 1^-} g(x) = 0 \]

\[ g(1) \] does not exist

\[ \lim_{x \to 2^-} g(x) = 1 \]

\[ \lim_{x \to 2^+} g(x) = 1 \]
Sketch the graph of \( f(x) = \frac{x}{|x|} \) then find each of the following or state that it does not exist.

a) \( f(0) \) does not exist (no output)

b) \( \lim_{{x \to 0}} f(x) \) does not exist (not same on right and left)

c) \( \lim_{{x \to 0^-}} f(x) = -1 \) (from left)

d) \( \lim_{{x \to \frac{1}{2}}} f(x) = 1 \) (\( = 1 \) from both sides of \( \frac{1}{2} \))