Show all work. Answers given with incomplete reasoning will not receive full credit.

**Question 1 (2 points)** Calculate the following limit, if it exists. If the limit does not exist, explain why.

\[
\lim_{x \to -2} \frac{x^2 - x - 6}{|x + 2|}
\]

\[
\begin{align*}
\lim_{x \to -2^-} & \frac{x^2 - x - 6}{1} = \frac{(-2)^2 - (-2) - 6}{1} = 5 \\
\lim_{x \to -2^+} & \frac{(x+2)(x-3)}{1} = \frac{(-2+2)(-2-3)}{1} = -5 \\
\text{The limit DNE as the LH and RH limits do not agree.}
\end{align*}
\]

**Question 2 (2 points)** Sketch a graph of a function:

a.) \( f(x) \) such that \( f \) is defined at \( a \) but \( f \) is not continuous at \( a \)

b.) \( g(x) \) such that \( g \) is continuous from the left at \( b \) but not from the right at \( b \)
Question 3 (2 points) Let

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

Find \( \lim_{x \to 1^-} f(x) \) and \( \lim_{x \to 1^+} f(x) \). Is \( f(x) \) continuous at \( x = 1 \)? Explain why or why not.

\[
\lim_{x \to 1^-} f(x) = \lim_{x \to 1^-} (x-1)^2 + 1 \\
= (1-1)^2 + 1 \\
= 0 + 1 \\
= 1 \quad (\text{5})
\]

\[
\lim_{x \to 1^+} f(x) = \lim_{x \to 1^+} 2x + 1 \\
= 2 \cdot 1 + 1 \\
= 3 \quad (\text{5})
\]

\( f(x) \) is NOT continuous at \( x = 1 \) since the above shows that \( \lim_{x \to 1^-} f(x) \) \text{ DNE.} \quad (\text{1})