2. Let \( f(x) := \sin(1/x) \) for \( x < 0 \) and \( f(x) := 0 \) for \( x > 0 \).

5.1

5. Yes. Define \( f(2) := \lim_{x \to 2} f(x) = 5. \)

6. Given \( \epsilon > 0 \), choose \( \delta > 0 \) such that if \( x \in V_{\delta}(c) \cap A \), then \( |f(x) - f(c)| < \epsilon/2 \).
   Then if \( y \in V_{\delta}(c) \cap A \), we have \( |f(y) - f(x)| \leq |f(x) - f(c)| + |f(c) - f(y)| < \epsilon/2 + \epsilon/2 = \epsilon. \)

11. Let \( c \in \mathbb{R} \) be given and let \( \epsilon > 0 \). If \( |x - c| < \epsilon/K \), then \( |f(x) - f(c)| \leq K|x - c| < K(\epsilon/K) = \epsilon. \)

5.2

5. The function \( g \) is not continuous at \( 1 = f(0). \)

7. Let \( f(x) := 1 \) if \( x \) is rational, and \( f(x) := -1 \) if \( x \) is irrational.

11. If \( h(x) := f(x) - g(x) \), then \( h \) is continuous and \( S = \{ x \in \mathbb{R} : h(x) \geq 0 \}. \)