Limit laws for addition, subtraction, multiplication, division

If \( \lim_{x \to c} f(x) \) exists and \( \lim_{x \to c} g(x) \) exists, then

1. \( \lim_{x \to c} (f(x) + g(x)) = \lim_{x \to c} f(x) + \lim_{x \to c} g(x) \)

2. \( \lim_{x \to c} (f(x) - g(x)) = \lim_{x \to c} f(x) - \lim_{x \to c} g(x) \)

3. \( \lim_{x \to c} k \cdot f(x) = k \cdot \lim_{x \to c} f(x) \) for any constant \( k \)

4. \( \lim_{x \to c} (f(x) \cdot g(x)) = \lim_{x \to c} f(x) \cdot \lim_{x \to c} g(x) \)

5. if \( \lim_{x \to c} g(x) \neq 0 \) then

\[
\lim_{x \to c} \frac{f(x)}{g(x)} = \frac{\lim_{x \to c} f(x)}{\lim_{x \to c} g(x)}
\]
6. If \( \lim_{x \to a} g(x) = c \) and \( \lim_{u \to c} f(u) = L \), then

\[
\lim_{x \to a} f(g(x)) = L
\]
Laws for combining continuous functions

If \( f \) and \( g \) are functions that are continuous at \( x = c \), then

1. \( f + g \) is continuous at \( x = c \).

2. \( f - g \) is continuous at \( x = c \).

3. \( kf \) is continuous at \( x = c \), where \( k \) is any constant.

4. \( f \cdot g \) is continuous at \( x = c \).

5. if \( g(c) \neq 0 \) then \( \frac{f}{g} \) is continuous at \( x = c \).
Composition of continuous functions is continuous

6. If the function \( g \) is continuous at \( x = a \) and the function \( f \) is continuous at \( g(a) \), then the composition

\[
f \circ g,
\]

that is, the function defined by \( f(g(x)) \), is continuous at \( x = a \).