## The Laws of Limits

Given a constant c and two functions f(x) and g(x) such that both  $\lim_{x\to a} f(x)$  and  $\lim_{x\to a} g(x)$  exist, then the following conclusions can be drawn:

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

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

3. 
$$\lim_{x \to a} (cf(x)) = c \lim_{x \to a} f(x)$$

4. 
$$\lim_{x \to a} (f(x)g(x)) = \lim_{x \to a} f(x) \lim_{x \to a} g(x)$$

5. 
$$\lim_{x \to a} \left( \frac{f(x)}{g(x)} \right) = \frac{\lim_{x \to a} f(x)}{\lim_{x \to a} g(x)}$$
 Note:  $\lim_{x \to a} g(x) \neq 0$ .

6. 
$$\lim_{x \to a} [f(x)]^n = \left[\lim_{x \to a} f(x)\right]^n$$

7. 
$$\lim_{x \to a} c = c$$

8. 
$$\lim_{x \to a} x = a$$

$$9. \quad \lim_{x \to a} x^n = a^n$$

10. 
$$\lim_{x \to a} \sqrt[n]{x} = \sqrt[n]{a}$$
 Note: If *n* is even, we assume  $a \ge 0$ .

11. 
$$\lim_{x \to a} \sqrt[n]{f(x)} = \sqrt[n]{\lim_{x \to a} f(x)}$$
 Note: If *n* is even, we assume  $\lim_{x \to a} f(x) \ge 0$ .