

Chapter 11 Limits and an Introduction to Calculus

Course Number

Instructor

Date

Section 11.1 Introduction to Limits

Objective: In this lesson you learned how to estimate limits and use properties and operations of limits.

I. The Limit Concept and Definition of Limit (Pages 780–782)

Define **limit**.

What you should learn
How to use the definition of a limit to estimate limits

Describe how to estimate the limit $\lim_{x \rightarrow -2} \frac{x^2 + 4x + 4}{x + 2}$ numerically.

The existence or nonexistence of $f(x)$ when $x = c$ has no bearing on the existence of . . .

II. Limits That Fail to Exist (Pages 783–784)

The limit of $f(x)$ as $x \rightarrow c$ does not exist if any of the following conditions is true:

- 1.
- 2.
- 3.

What you should learn
How to determine whether limits of functions exist

Give an example of a limit that does not exist.

III. Properties of Limits and Direct Substitution

(Pages 785–787)

Let b and c be real numbers and let n be a positive integer. Complete each of the following properties of limits.

1. $\lim_{x \rightarrow c} b =$ _____

2. $\lim_{x \rightarrow c} x =$ _____

3. $\lim_{x \rightarrow c} x^n =$ _____

4. $\lim_{x \rightarrow c} \sqrt[n]{x} =$ _____

Let b and c be real numbers, let n be a positive integer, and let f and g be functions with the following limits.

$$\lim_{x \rightarrow c} f(x) = L \quad \text{and} \quad \lim_{x \rightarrow c} g(x) = K$$

Complete each of the following statements about operations with limits.

1. Scalar multiple: $\lim_{x \rightarrow c} [b f(x)] =$ _____

2. Sum or difference: $\lim_{x \rightarrow c} [f(x) \pm g(x)] =$ _____

3. Product: $\lim_{x \rightarrow c} [f(x) \cdot g(x)] =$ _____

4. Quotient: $\lim_{x \rightarrow c} \frac{f(x)}{g(x)} =$ _____

5. Power: $\lim_{x \rightarrow c} [f(x)]^n =$ _____

Example 1: Find the limit: $\lim_{x \rightarrow 4} 3x^2$.

What you should learn
How to use properties of limits and direct substitution to evaluate limits

If p is a polynomial function and c is a real number, then

$$\lim_{x \rightarrow c} p(x) = \underline{\hspace{2cm}}.$$

If r is a rational function given by $r(x) = p(x)/q(x)$, and c is a real number such that $q(c) \neq 0$, then

$$\lim_{x \rightarrow c} r(x) = \underline{\hspace{2cm}}.$$

Example 2: Find the limit: $\lim_{x \rightarrow 2} \frac{4 - x^2}{x}$.

Additional notes

Additional notes**Homework Assignment**

Page(s)

Exercises