

Section 12.3 The Tangent Line Problem

Objective: In this lesson you learned how to approximate slopes of tangent lines, use the limit definition of slope, and use derivatives to find slopes of graphs.

Course Number

Instructor

Date

I. Tangent Line to a Graph (Page 835)

To determine the rate at which a graph rises or falls at a single point, _____ you can find the slope of the tangent line at that point _____.

The **tangent line** to the graph of a function f at a point $P(x_1, y_1)$ is _____ the line that best approximates the slope of the graph at the point _____.

What you should learn

How to define the tangent line to a graph

II. Slope of a Graph (Page 836)

To visually approximate the slope of a graph at a point, _____ draw the tangent line to the graph at the point. Then approximate the slope of the tangent line by estimating the _____ change in the value of y for each unit change in x . This ratio approximates the slope of the graph at the point _____.

What you should learn

How to use a tangent line to approximate the slope of a graph at a point

III. Slope and the Limit Process (Pages 837–839)

A **secant line** to a graph is _____ a line through the point of tangency and a second point on the graph _____.

A **difference quotient** is _____ the ratio $[f(x+h) - f(x)]/h$ _____.

Give the definition of the slope of a graph.

The slope m of the graph of f at the point $(x, f(x))$ is equal to the slope of its tangent line at $(x, f(x))$ and is given by

$$m = \lim_{h \rightarrow 0} m_{\text{sec}} = \lim_{h \rightarrow 0} [f(x+h) - f(x)]/h, \text{ provided this limit exists.}$$

What you should learn

How to use the limit definition of slope to find exact slopes of graphs

Example 1: Use the limit process to find the slope of the graph of $f(x) = x^2 + 5$ at the point (3, 14).

This graph has a slope of 6 at the point (3, 14).

IV. The Derivative of a Function (Pages 840–841)

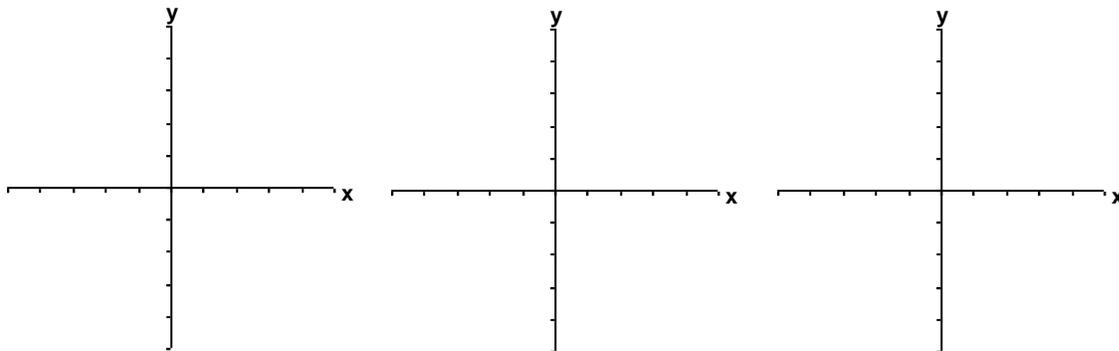
Give the formal definition of the **derivative**.

The derivative of f at x is given by $f'(x) = \lim_{h \rightarrow 0} [f(x+h) - f(x)]/h$, provided this limit exists.

What you should learn
How to find derivatives of functions and use derivatives to find slopes of graphs

The derivative $f'(x)$ is a formula for the slope of the tangent line to the graph of f at the point $(x, f(x))$.

Example 2: Find the derivative of $f(x) = 9 - 2x^2$.
 $f'(x) = -4x$



Homework Assignment

Page(s)

Exercises