Section 3.2

I. Rules for Differentiation: Direct Consequences of Algebraic Rules for Limits

<u>Limits</u>	Derivatives
Limit of a Constant Function	Derivative of a Constant Function
y = f(x) = k	y = f(x) = k
$\lim_{x \to c} k = k$	y' = f'(x) = 0
Limit of the Identity Function	Derivative of the Identity Function
y = f(x) = x	y = f(x) = x
$\lim_{x \to c} x = c$	y' = f'(x) = 1
	Derivative of the Power Function
	$y = f(x) = x^n$
	$y' = f'(x) = nx^{n-1}$
Limit of a Constant Times a Function	Derivative a Constant Times a Function
y = kf(x)	y = kf(x)
$\lim_{x \to c} kf(x) = k \lim_{x \to c} f(x)$	$y' = \left(kf(x)\right)' = kf'(x)$
Limit of a Sum of Functions	Derivative of a Sum of Functions

 $y = f(x) + g(x) \qquad \qquad y = f(x) + g(x)$ 

$$\lim_{x \to c} \left[ f(x) + g(x) \right] = \lim_{x \to c} f(x) + \lim_{x \to c} g(x) \qquad y' = \left( f(x) + g(x) \right)' = f'(x) + g'(x)$$

Limit of a Difference of Functions Derivative of a Difference of Functions

$$y = f(x) - g(x) \qquad y = f(x) - g(x)$$
$$\lim_{x \to c} [f(x) - g(x)] = \lim_{x \to c} f(x) - \lim_{x \to c} g(x) \qquad y' = (f(x) - g(x))' = f'(x) - g'(x)$$

Examples

## II. Rules for Differentiation: Modified Consequences of Algebraic Rules for Limits

<u>Limits</u>

## Derivatives

Limit of a Product of Functions Derivative of a Product of Functions

$$y = f(x)g(x)$$
  $y = f(x)g(x)$ 

$$\lim_{x \to c} \left[ f(x)g(x) \right] = \left( \lim_{x \to c} f(x) \right) \left( \lim_{x \to c} g(x) \right)$$

$$y' = (f(x)g(x))' = f(x)g'(x) + f'(x)g(x)$$

Limit of a Quotient of Functions

Derivative of a Quotient of Functions

$$y = \frac{f(x)}{g(x)} \qquad \qquad y = \frac{f(x)}{g(x)}$$

Examples

## III. Tangent Lines

Examples

## IV. Higher Order Derivatives

a. Notation