Derivative Basics

Basic Derivatives

$\frac{d}{dx}\left[\, mx + b \,\right] = m$ $\qquad$ $\frac{d}{dx}\left[\, c\,f \,\right] = c\,f'$

$\frac{d}{dx}\left[\, x^n \,\right] = n\,x^{n-1}$ $\qquad$ $\frac{d}{dx}\left[\, f + g \,\right] = f' + g'$

Tangent Lines

The tangent line to $y = f(x)$ at $x = a$ is

$$y \;=\; f(a) \;+\; f'(a)\,(x - a)$$

1. (Algebra of Exponents) Simplify the expressions below to the form $x^{m/n}$

A. $\sqrt[3]{x^4}$

B. $\dfrac{1}{\sqrt[3]{x^4}}$

C. $\sqrt[3]{x^4}\,\sqrt{x^3}$

D. $\dfrac{\sqrt[3]{x^4}}{\sqrt{x^3}}$

E. $\left(\sqrt[3]{x^4}\right)^2$

F. $\sqrt[4]{\sqrt[3]{x^4}}$

2. (Basic Derivatives) Calculate the derivative of the given functions.

A. $f(x) = 2$

B. $y = 19x$

C. $y = x^2 + 3x + 2$

D. $g(x) = 4x^2 \;-\; 2x \;+\; 3$

E. $g(x) = 3x^{1/2}$

F. $f(x) = 5x^{-1/2}$

G. $h(x) = 5\sqrt[3]{x^2}$

H. $f(x) = \dfrac{5}{\sqrt[3]{x^2}}$

G. $s = 8t^{3/4} \;+\; 2t^{-2}$

J. $h(x) = \sqrt{x} \;+\; \dfrac{1}{\sqrt{x}}$

3. (Simplify and Compute) Simplify the expressions below, then compute their derivative.

A. $f(x) = x(x+1)$

B. $f(x) = \sqrt{x}\left(\sqrt{x}+3\right)$

C. $f(x) = \dfrac{x^2+3}{x}$

D. $f(x) = \dfrac{x+2}{\sqrt{x}}$

D. $f(x) = \left(\dfrac{2}{x}+x\right)\left(\dfrac{3}{x^2}+x^2\right)$

F. $f(x) = \left(\dfrac{2}{\sqrt{x}}+\sqrt[3]{x}\right)\left(\dfrac{3}{\sqrt[3]{x^2}}+x\right)$

4. (Slopes) Find the derivative and calculate the slope of the tangent line at the given point.

(A) Slope of $y = \dfrac{4}{\sqrt{x}}$ at $x = 4$.

(B) Slope of $y = 3x^{2/3}$ at $x = 8$.

3. (Tangent Line) Find the equation of the tangent line at the given point.

(A) Tangent line to $y = f(x)$ at $x = 2$ if

- $f(2) = 3$
- $f'(2) = 4$

(B) Tangent line to $y = \sqrt[3]{x}$ at $x = 8$.