Section 3.5: Basic Differentiation Properties

Definition: The derivative is a function that will give the instantaneous rate of change for any value of a in the domain of $f(x)$ where $f(x)$ is differentiable at $x = a$.

The common ways of denoting the derivative is $f'(x)$, y', or $\dfrac{dy}{dx}$

Derivatives of constants

Basic Power Rule

$y = x^n$

Procedural Rules

$y = cf(x)$, where c is a constant.

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

Example: Find the derivatives of these functions.

A) $y = 3x^5$

B) $B(x) = 3 + x^5$

C) $C(x) = x^7 + 3x^2 - 6x + 8$

D) $K(x) = 3x^{1.4} + 7x^{-3} + 5^6$

E) $J(x) = \sqrt{x} + \sqrt[3]{x^4} + \dfrac{1}{x^5}$

F) $F(x) = \dfrac{1}{x} + \dfrac{3}{4x^3} + 7x + \pi^2$

G) $G(x) = (x^2 + 4)(x - 6)$

H) $H(x) = (x^4 + 6)\sqrt{x}$

I) $y = \dfrac{5x^2 + 3x + 7}{x^2}$

J) $y = \dfrac{7x^3 + 16}{\sqrt{x^3}}$

Example: Find the equation of the tangent line at $x = 3$ for $y = 5x^4 + 2x^2 + 7$

Example: Find the values of x where the tangent line is horizontal for $y = 1.5x^4 + 3x^3 - 30x^2 + e^5$

Example: Find the values of x where the tangent lines to $f(x)$ are parallel to $y = 5x + 7$

$f(x) = x^3 - 7x^2 + 30$

Example: Find the values of x where this function has rate of change of 0.

$y = ax^2 + bx + c$

Example: The total sales of a company (in millions of dollars) x months from now are given by

$S(x) = 0.015x^4 + 0.4x^3 + 3.4x^2 + 10x - 3$

Find $S(3)$ and $S'(3)$. Explain what these computations mean in context of the problem.