Basic Differentiation Rules

Basic Properties of Derivatives

$\frac{dy}{dx}Cf(x) = C\frac{dy}{dx}f(x)$ where C is any constant.

$\frac{dy}{dx}[f(x) \pm g(x)] = \frac{dy}{dx}f(x) \pm \frac{dy}{dx}g(x)$

BASIC RULES

If $f(x) = 5$ what is $f'(x)$?

$\frac{dy}{dx}C = 0$ where C is any constant.

If $f(x) = 5x$ what is $f'(x)$?

$\frac{dy}{dx}Cx = C$ where C is any constant

Examine the list of functions and derivatives(found using the limit def'n of derivative) to develop a pattern!

$f(x) = 5x^2$ $\quad$ $f'(x) = 10x$

$f(x) = -2x^3$ $\quad$ $f'(x) = -6x^2$

$f(x) = 1/2\,x^6$ $\quad$ $f'(x) = 3x^5$

$f(x) = -100x^9$ $\quad$ $f'(x) = -900x^8$

The Power Rule (the BIGEEEEEEEE…….)

$$\frac{dy}{dx}x^n = nx^{n-1}$$

Note: can only be used for singular powers of x being added or subtracted together

Find the derivatives for each function

EX) $f(x) = x^3 - 2x^2 + 5x + 10$

EX) $f(x) = \frac{x^3 - 2x + 4}{x^2}$

EX) $f(x) = \frac{\sqrt{x}}{3} - 2x^2$

EX) $f(x) = (3x - 5)^2$

Horizontal Tangent Line: a tangent line drawn to a point where the slope is ZERO!

EX) Find the ordered pairs on the graph of $y = x^4 - 3x^2 + 2$ where horizontal tangent lines exist. NO CALCULATOR ALLOWED!

Derivatives of Sine and Cosine

$$\frac{dy}{dx}\sin x = \cos x \qquad \frac{dy}{dx}\cos x = -\sin x$$

EX) Find the equation of the line drawn tangent to $y = -2\sin x$ at $x = \frac{3\pi}{4}$.

AP EXAMPLES

Find each limit using derivatives.

A) $\lim_{\Delta x \to 0} \frac{\cos(x+\Delta x) - \cos x}{\Delta x}$

B) $\lim_{\Delta x \to 0} \frac{2(3+\Delta x)^3 - 2(3)^3}{\Delta x}$