9/12/18

$f(x) = 5x^{14} + 3x^3 + 2x^2 + 7x - 15 + \frac{1}{x} \rightarrow x^{-1}$

Find $f'(x)$. $\cancel{\lim_{h \to 0} \frac{f(x+h) - f(x)}{h}}$ nope $f'(x) = 5 \cdot 14x^{13} + 3 \cdot 3x^2 + 2 \cdot 2x^1 + 7 - x^{-2}$

Derivative Rules

power rule $\frac{d}{dx}(x^n) = n \cdot x^{n-1}$

EX1 Find the derivative.

A. $f(x) = x^9$

$f'(x) = 9x^8$

B. $f(x) = 2x^3 + 5x^2 + 9$

$f'(x) = 2 \cdot 3x^2 + 5 \cdot 2 \cdot x^1 + 0 = 6x^2 + 10x$

C. $y = 2x^{3/2} + 4x^1$

$y' = 2 \cdot \frac{3}{2} x^{1/2} + 4 \cdot 1x^0 = 3x^{1/2} + 4$

D. $f(x) = x^2 - \frac{1}{x^3} \rightarrow x^{-3}$

$f'(x) = 2 \cdot x^1 - -3x^{-4} = 2x + \frac{3}{x^4}$

E. $g(x) = 5^x$

$g'(x) = 5^x \cdot \ln 5$

F. $y = 7e^x + 8 - \sqrt[3]{x} \rightarrow x^{1/3}$

$y' = 7e^x + 0 - \frac{1}{3}x^{-2/3} = 7e^x - \frac{1}{3x^{2/3}}$

G. $y = (3t-1)^2 = (3t-1)(3t-1) = 9t^2 - 6t + 1$

$y' = 18t - 6$

H. $y = \frac{6x^{7/2}}{x^1} = 6x^{5/2}$

$y' = 6 \cdot \frac{5}{2}x^{3/2} = 15x^{3/2}$

<u>Product Rule</u> – use when we have 2 functions of x being multiplied

$y = p \cdot q$

$y' = p \cdot q' + q \cdot p'$

<u>EX2</u> Find the deriv.

A. $f(x) = x^3 \cdot \sin x$

$f'(x) = (x^3)(\cos x) + (\sin x)(3x^2)$

B. $g(x) = (7x^9 + 2x^3 + 4x^2 + 1)(6x^2 - 8x^3 + 2 + 7x)$

$g'(x) = (7x^9 + 2x^3 + 4x^2 + 1)(12x - 24x^2 + 7) + (6x^2 - 8x^3 + 2 + 7x) \cdot (63x^8 + 6x^2 + 8x)$

C. $f(x) = 2\sec x \tan x$

$$f'(x) = 2\left[(\sec x)(\sec^2 x) + (\tan x)(\sec x \tan x)\right]$$

$$= 2\sec^3 x + 2\sec x \tan^2 x$$

D. $h(x) = x^2 \cos x + \underline{7x \sin x}$

$$h'(x) = (x^2)(-\sin x) + (\cos x)(2x) + (7x)(\cos x) + (\sin x)(7)$$

$$= -x^2 \sin x + 9x\cos x + 7\sin x$$

<u>Quotient Rule</u> - use when we have 2 functions of x divided

$$y = \frac{p}{q} \quad \frac{hi}{lo}$$

$$y' = \frac{q \cdot p' - p \cdot q'}{q^2} \qquad \frac{lo \cdot d(hi) - hi \cdot d(lo)}{lo \cdot lo}$$

<u>EX 3</u> Find y'

A. $y = \dfrac{5x^3 - 2x^2 + 7x}{x^2 + 3}$

$$y' = \frac{(x^2+3)(15x^2 - 4x + 7) - (5x^3 - 2x^2 + 7x)(2x)}{(x^2+3)^2}$$

B. $y = \dfrac{\cos x}{1-\sin x}$

$$y' = \frac{(1-\sin x)(-\sin x) - (\cos x)(-\cos x)}{(1-\sin x)^2}$$

$$= \frac{-\sin x + \underbrace{\sin^2 x + \cos^2 x}_{\to 1}}{(1-\sin x)^2}$$

$$= \frac{\cancel{1-\sin x}}{(1-\sin x)^{\cancel{2}\,1}} = \frac{1}{1-\sin x}$$