8 Monday, September 11

Theorem (Product Rule)**.**

$$\frac{d}{dx}[fg] = \frac{df}{dx}g + \frac{dg}{dx}f$$

Theorem (Quotient Rule)**.**

$$\frac{d}{dx}\left[\frac{f}{g}\right] = \frac{g\frac{df}{dx} - f\frac{dg}{dx}}{g^2}$$

Theorem (Derivatives of Trigonometric Functions)**.**

(1) $\dfrac{d}{dx}[\tan x] = \sec^2 x$

(2) $\dfrac{d}{dx}[\sec x] = \sec x \tan x$

(3) $\dfrac{d}{dx}[\cot x] = -\csc^2 x$

(4) $\dfrac{d}{dx}[\csc x] = -\csc x \cot x$

Example. Find the derivative.

(1) $y = (3 - x^2)(x^3 - x + 1)$

(2) $y = (x^2 + 1)\left(x + 5 + \dfrac{1}{x}\right)$

(3) $y = \csc x - 6\sqrt{x} + 7$

(4) $y = x^2 \cot x - \frac{1}{x^2}$

(5) $y = (\sec x + \tan x) \tan x$

(6) $y = (\sin x + \cos x) \sec x$

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

(8) $y = xe^x - e^x$

(9) $y = \left(x^2 - 2x + 2\right) e^x$

(10) $y = e^x \sin x + e^x \cos x$

(11) $y = x \sin x \cos x$

(12) $y = x^3 e^x \cos x$

Example. Find the equation for the tangent line at the following points.

(1) $y = (x-1)(x^2+x+1)$ at $c = 0$.

(2) $y = \left(x + \frac{1}{x}\right)\left(x - \frac{1}{x} + 1\right)$ at $c = 1$.

(3) $y = (9x^2 - 6x + 2)e^x$ at $c = 0$.

(4) $y = (1 + \sec x)\sin x$ at $c = \pi/4$.

(5) $y = 2e^x \tan x$ at $c = 0$.