Product Rule – $\frac{d}{dx}\left(f(x)g(x)\right) = f(x)g'(x) + f'(x)g(x)$

$(FS)' = FS' + SF'$ $\qquad = f(x)\left(\frac{d}{dx}g(x)\right) + \left(\frac{d}{dx}f(x)\right)g(x)$

$$\frac{d}{dx}\left(f(x)g(x)\right) = \lim_{h\to 0}\left(\frac{f(x+h)g(x+h) - f(x)g(x) + f(x+h)g(x) - f(x+h)g(x)}{h}\right)$$

$$= \lim_{h\to 0}\left(\frac{f(x+h)g(x+h) - f(x+h)g(x) + f(x+h)g(x) - f(x)g(x)}{h}\right)$$

$$= \lim_{h\to 0}\left(\frac{f(x+h)\left(g(x+h) - g(x)\right) + g(x)\left(f(x+h) - f(x)\right)}{h}\right)$$

$$= f(x) \quad g'(x) \quad + g(x) \quad f'(x)$$

Quotient Rule – $\frac{d}{dx}\left(\frac{f(x)}{g(x)}\right) = \frac{g(x)f'(x) - f(x)g'(x)}{(g(x))^2}$

$$= \frac{g(x)\frac{d}{dx}f(x) - f(x)\frac{d}{dx}g(x)}{(g(x))^2}$$

$$\left(\frac{T}{B}\right)' = \frac{BT' - TB'}{B^2}$$

$$\frac{d}{dx}\left(\frac{Hi}{Lo}\right) = \frac{Lo\, dHi - Hi\, dLo}{Lo^2}$$

$\frac{d}{dx}(c) = 0$

$\frac{d}{dx}(x^n) = nx^{n-1}$

$\frac{d}{dx}(e^x) = e^x$

$\frac{d}{dx}(b^x) = \ln(b)\, b^x$

$\frac{d}{dx}(cf(x)) = c\, f'(x)$

$\frac{d}{dx}\left(f(x) \pm g(x)\right) = f'(x) \pm g'(x)$

$\frac{d}{dx}\left(f(x)g(x)\right) = f(x)g'(x) + g(x)f'(x)$

$\frac{d}{dx}\left(\frac{f(x)}{g(x)}\right) = \frac{g(x)f'(x) - f(x)g'(x)}{(g(x))^2}$

Product Rule

$$\frac{d}{dx}\left(f(x)g(x)\right) = f(x)g'(x) + f'(x)g(x)$$

$$(FS)' = FS' + SF'$$

$$= f(x)\left(\frac{d}{dx}g(x)\right) + \left(\frac{d}{dx}f(x)\right)g(x)$$

$$\frac{d}{dx}\left(f(x)g(x)\right) = \lim_{h\to 0}\left(\frac{f(x+h)g(x+h) - f(x)g(x) + f(x+h)g(x) - f(x+h)g(x)}{h}\right)$$

$$= \lim_{h\to 0}\left(\frac{f(x+h)g(x+h) - f(x+h)g(x) + f(x+h)g(x) - f(x)g(x)}{h}\right)$$

$$= \lim_{h\to 0}\left(\frac{f(x+h)\left(g(x+h) - g(x)\right) + g(x)\left(f(x+h) - f(x)\right)}{h}\right)$$

$$= f(x) \quad g'(x) \quad + g(x) \quad f'(x)$$

Quotient Rule

$$\frac{d}{dx}\left(\frac{f(x)}{g(x)}\right) = \frac{g(x)f'(x) - f(x)g'(x)}{(g(x))^2}$$

$$= \frac{g(x)\frac{d}{dx}f(x) - f(x)\frac{d}{dx}g(x)}{(g(x))^2}$$

$$\left(\frac{T}{B}\right)' = \frac{BT' - TB'}{B^2}$$

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$$\frac{d}{dx}(cf(x)) = c f'(x)$$

$$\frac{d}{dx}\left(f(x) \pm g(x)\right) = f'(x) \pm g'(x)$$

$$\frac{d}{dx}\left(f(x)g(x)\right) = f(x)g'(x) + g(x)f'(x)$$

$$\frac{d}{dx}\left(\frac{f(x)}{g(x)}\right) = \frac{g(x)f'(x) - f(x)g'(x)}{(g(x))^2}$$

$$f(x) = x^2 = x \cdot x$$

$$f'(x) = x(1) + x(1) = 2x$$

$$f(x) = x^2 e^x$$

$$f'(x) = 2xe^x + x^2 e^x$$

$$f(x) = \frac{2x^5}{x-1}$$

$$f'(x) = \frac{(x-1)(10x^4) - 2x^5(1-0)}{(x-1)^2} = \frac{10x^5 - 10x^4 - 2x^5}{(x-1)^2} = \frac{8x^5 - 10x^4}{(x-1)^2}$$

$$f(x) = \frac{4\sqrt{x}}{4^x} = \frac{4x^{1/2}}{4^x}$$

$$f'(x) = \frac{4^x\left(4 \cdot \frac{1}{2} x^{-1/2}\right) - 4x^{1/2}\ln(4)4^x}{(4^x)^2} = \frac{4^x(2x^{-1/2}) - 4x^{1/2}\ln(4)4^x}{4^{2x}}$$

$$= \frac{4^x\left(2x^{-1/2} - 4x^{1/2}\ln(4)\right)}{4^{2x}} = \frac{2x^{-1/2} - 4x^{1/2}\ln(4)}{4^x}$$

$$f(x) = \frac{x^2+x}{x} = \frac{x^2}{x} + \frac{x}{x} = x+1$$

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

$$f(t) = \frac{5+t^2}{te^t}$$

$$f'(t) = \frac{te^t(2t) - (5+t^2)(te^t+e^t)}{(te^t)^2} = \frac{2t^2e^t - 5te^t - 5e^t - t^3e^t - t^2e^t}{t^2e^{2t}}$$

$$= \frac{e^t(2t^2 - 5t - 5 - t^3 - t^2)}{t^2e^{2t}} = \frac{t^2 - 5t - 5 - t^3}{t^2e^t}$$