미분 공식

$y=c$ (c는 상수) $\Rightarrow$ $y'=0$

$y=x^n$ (n는 상수) $\Rightarrow$ $y'=nx^{n-1}$

$y=cf(x)$ (c는 상수) $\Rightarrow$ $y'=cf'(x)$

$y=f(x)\pm g(x)$ $\Rightarrow$ $y'=f'(x)\pm g'(x)$ (복부호 동순)

$y=f(x)g(x)$ $\Rightarrow$ $y'=f'(x)g(x)+f(x)g'(x)$

$y=f(x)g(x)h(x)$ $\Rightarrow$

$$y'=f'(x)g(x)h(x)+f(x)g'(x)h(x)+f(x)g(x)h'(x)$$

미분 공식

$$y = \frac{f(x)}{g(x)} \Rightarrow y' = \frac{f'(x)g(x) - f(x)g'(x)}{\{g(x)\}^2}$$

$(g(x) \neq 0)$에서 두 함수 $f(x)$, $g(x)$가 미분가능임)

$$y = f(g(x)) \Rightarrow y' = f'(g(x))g'(x)$$

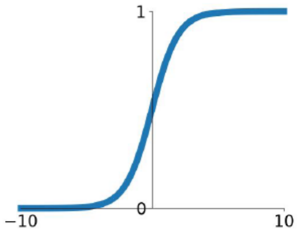
(단, $y = f(u)$, $u = g(x)$가 미분가능)

$y = \{f(x)\}^n$ (n은 정수) $\Rightarrow$ $y' = n\{f(x)\}^{n-1}f'(x)$

Sigmoid 함수 미분

Sigmoid

$$\sigma(x) = \frac{1}{1+e^{-x}}$$



$$Sigmoid \Rightarrow \quad F(x) = \frac{1}{(1+e^{-x})}$$

$$quotient\ rule \Rightarrow$$

$$F(x) = \frac{f(x)}{g(x)} \quad \Rightarrow Sigmoid : f(x) = 1 \ , \ g(x) = (1+e^{-x})$$

$$F'(x) = \frac{f'(x)g(x) - f(x)g'(x)}{g(x)^2}$$

$$f'(x) = 0$$

$$g'(x) = -e^{-x}$$

$$F'(x) = \frac{0 \cdot (1+e^{-x}) - 1 \cdot -e^{-x}}{(1+e^{-x})^2} = \frac{0 \cdot (1+e^{-x}) + e^{-x}}{(1+e^{-x})^2}$$

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

$$= \frac{1}{(1+e^{-x})}\left(1 - \frac{1}{(1+e^{-x})}\right)$$

$$= F(x)(1 - F(x))$$