

$$\text{OUT}(1-\text{OUT}) \\ = \text{OUT} - \text{OUT}^2, \text{ Let NET} = X,$$

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

$$F'(X) = \frac{\partial(\text{OUT})}{\partial(X)} = \frac{\partial}{\partial x} \left(\frac{1}{1+e^x} \right) = \frac{\frac{\partial}{\partial x}(1)(1+e^x) - (1)\left(\frac{\partial}{\partial x}(1+e^x)\right)}{(1+e^x)^2}$$

$$= 0 - \frac{\frac{\partial}{\partial x}(1+e^x)(1)}{(1+e^x)^2} = \frac{e^x}{1+e^x} = \text{OUT}(1-\text{OUT}) \checkmark$$

What is going to be the output for small vs large value of NET?

For NET $\rightarrow -\infty$

$$\lim_{\text{NET} \rightarrow -\infty} \left(\frac{1}{1+e^{-\text{NET}}} \right) = \frac{1/e^{-\text{NET}}}{1/e^{-\text{NET}} + 1} \approx \frac{0}{1+0} = \underline{\underline{0}}$$

$$\text{For NET} \rightarrow 0 \quad \frac{1}{e^0 + 1} = \underline{\underline{1/2}}$$

$$\text{For NET} \rightarrow \infty \quad \frac{1}{1+e^{\infty}} = \frac{1}{1+0} = \underline{\underline{1}}$$

F can be any bounded differentiable function
Ex, $F = \sin x$