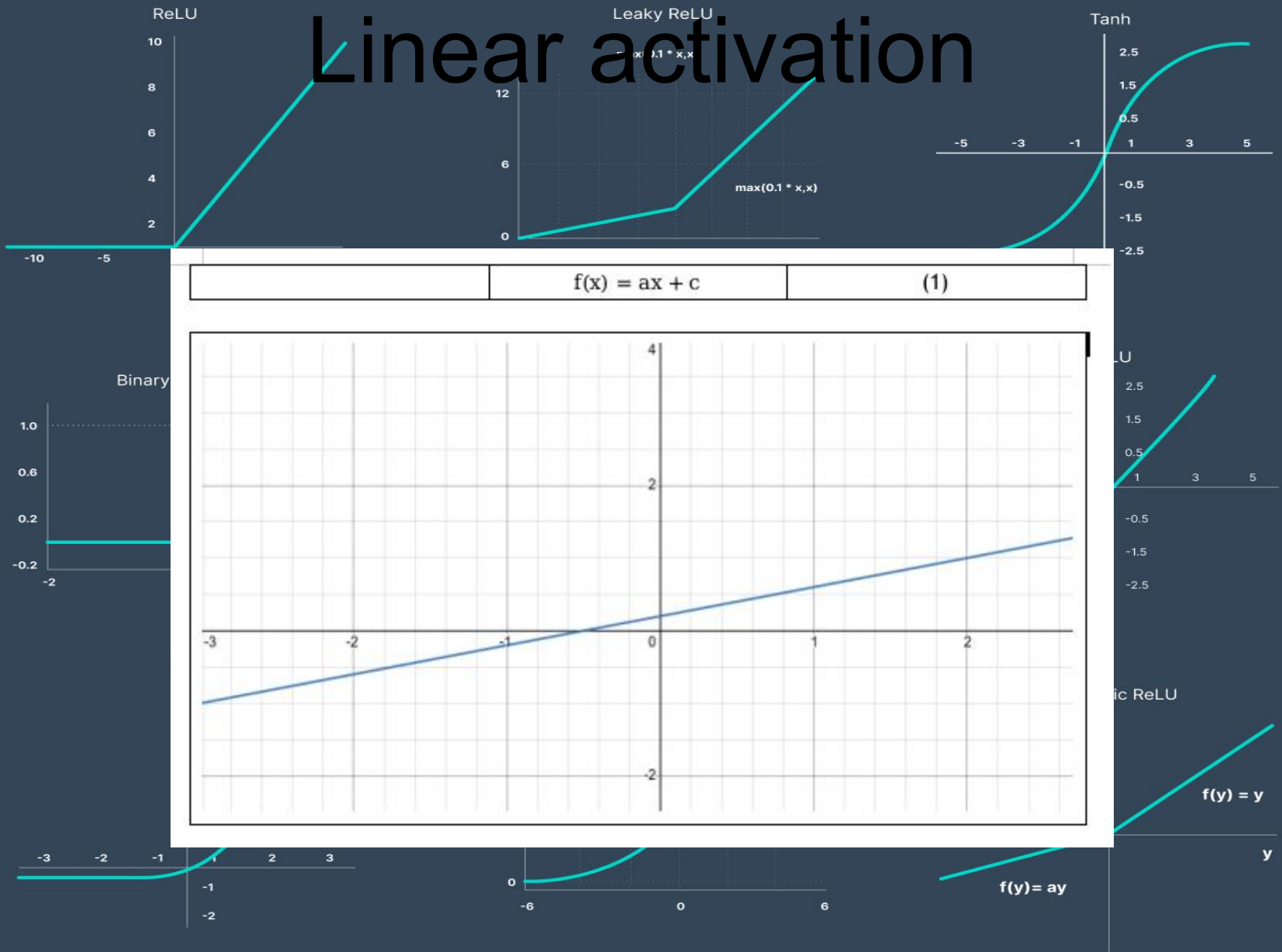


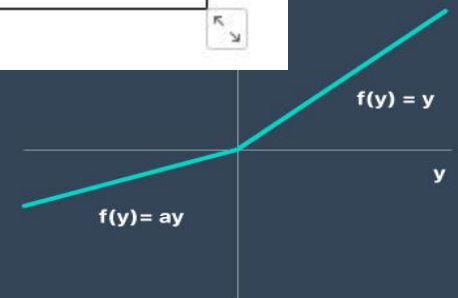
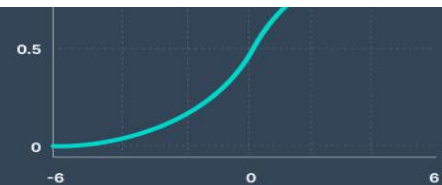
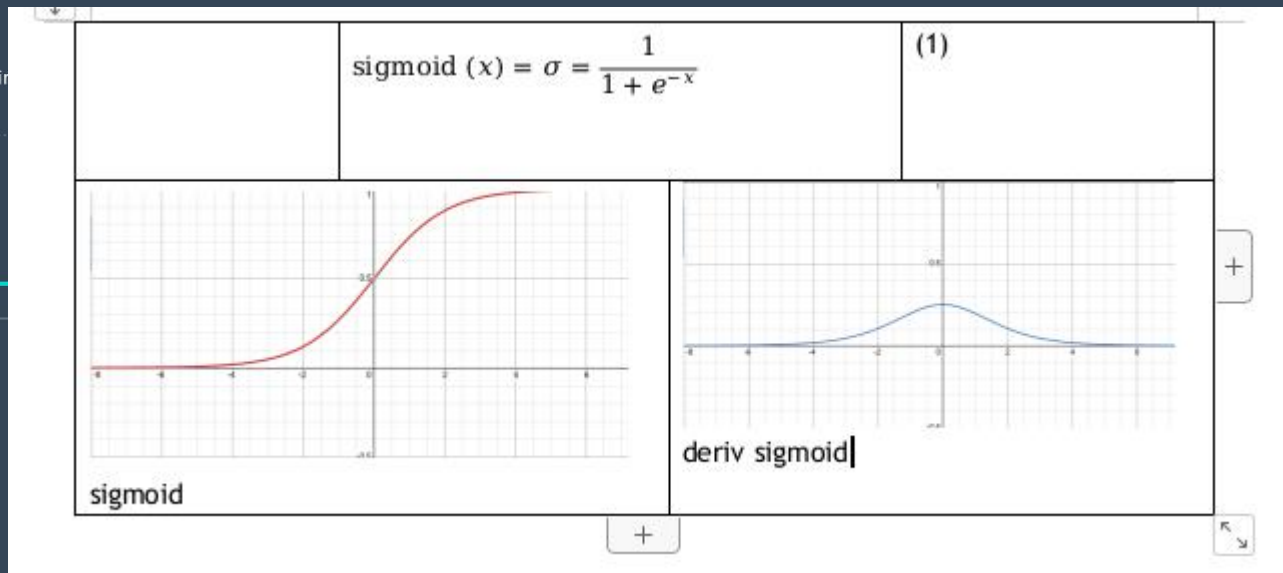
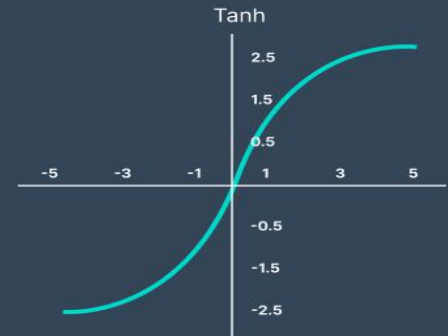
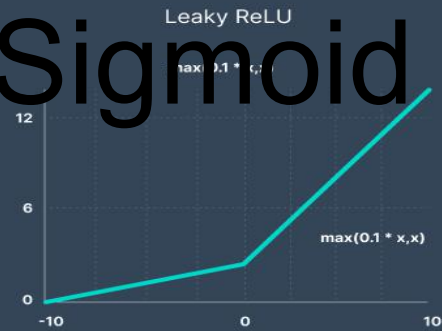
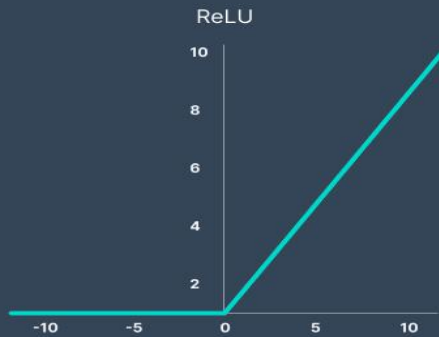
Activation functions

mag.eng Martin Kaloev

Linear activation



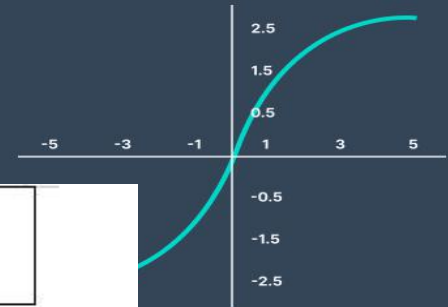
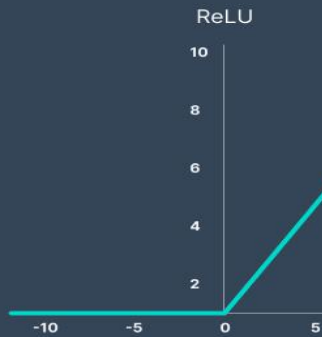
Sigmoid



Relu

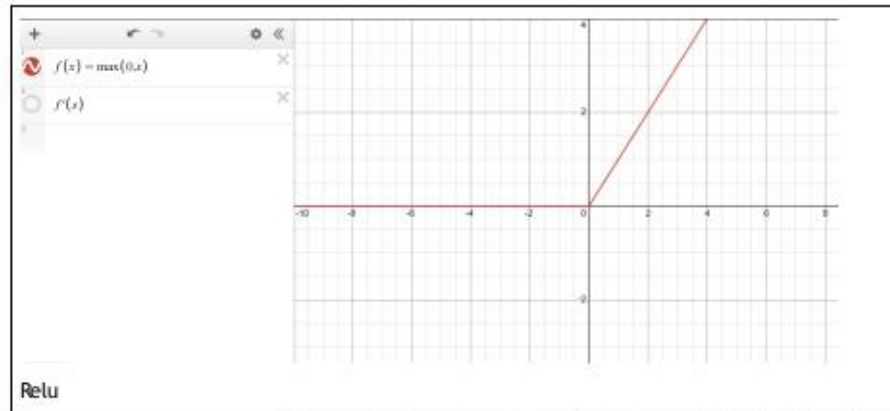
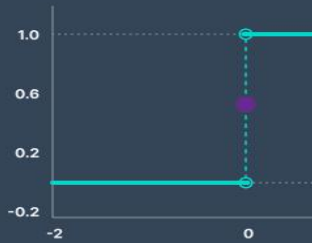
Leaky ReLU

Tanh

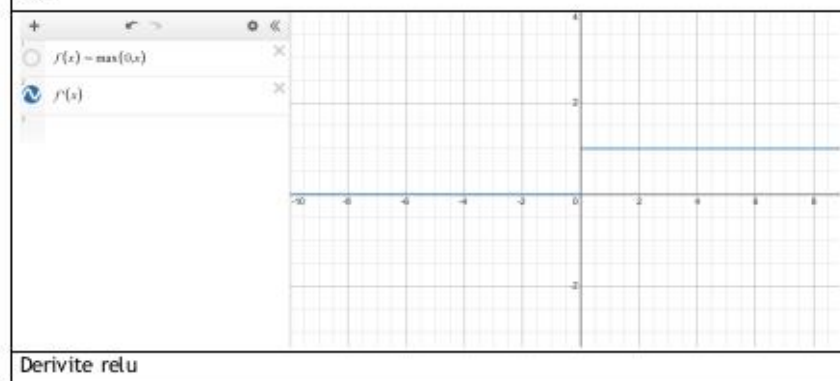


$$\text{Relu}(z) = \begin{cases} z, & z > 0 \\ 0, & \text{otherwise} \end{cases} \quad (1)$$

Binary Step Function

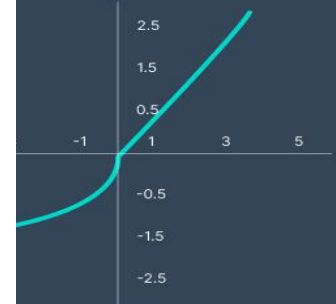


Relu

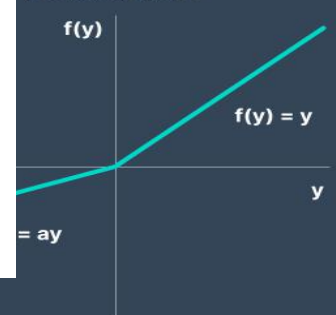


Derivate relu

SELU



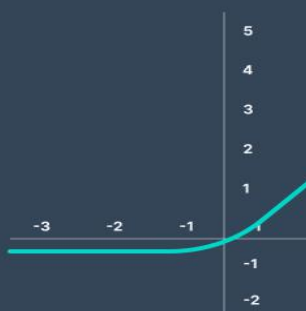
Parametric ReLU



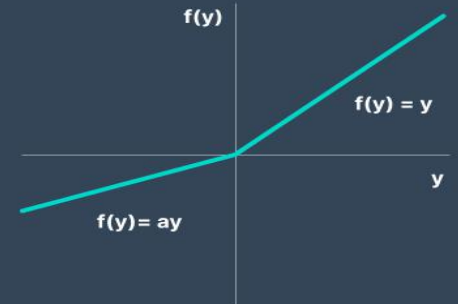
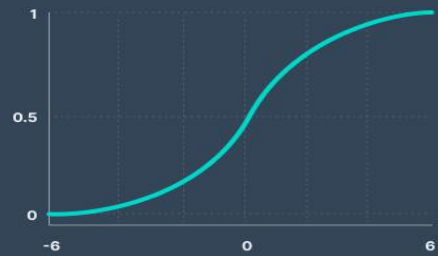
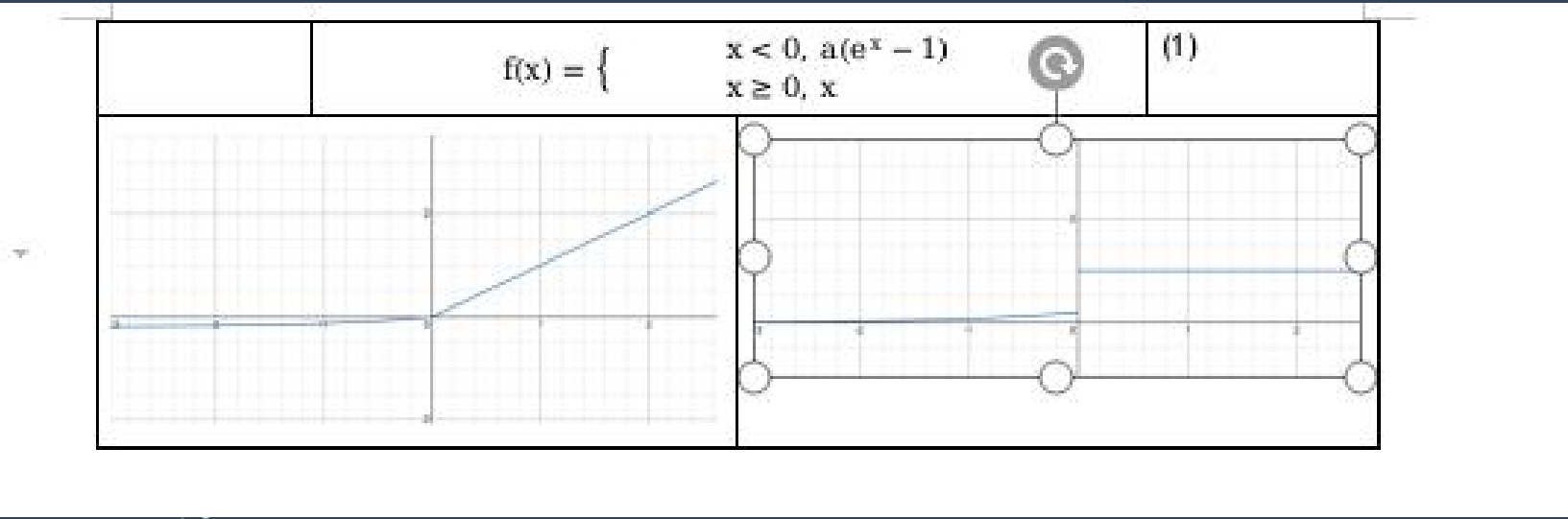
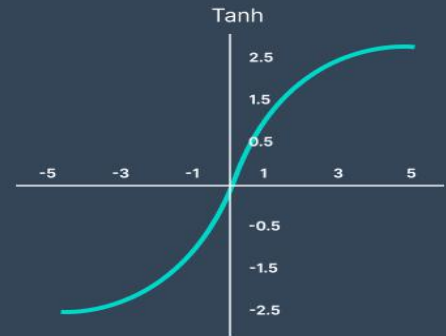
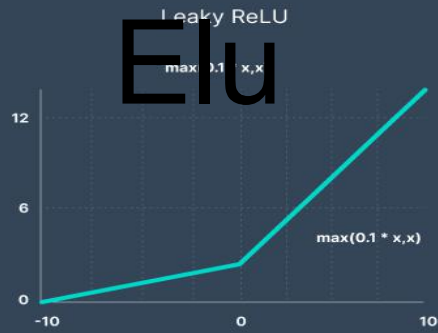
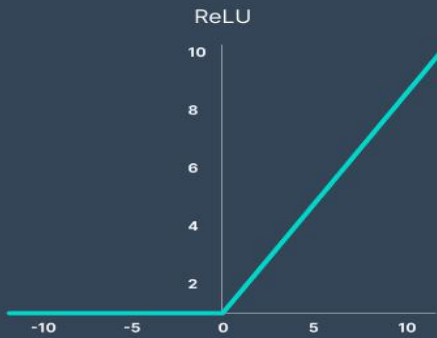
$f(y) = y$

$= ay$

ELU

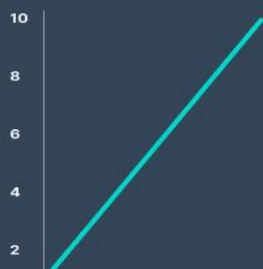


Elu

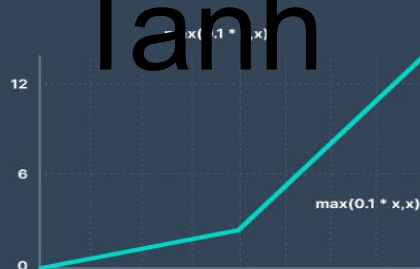


Tanh

ReLU



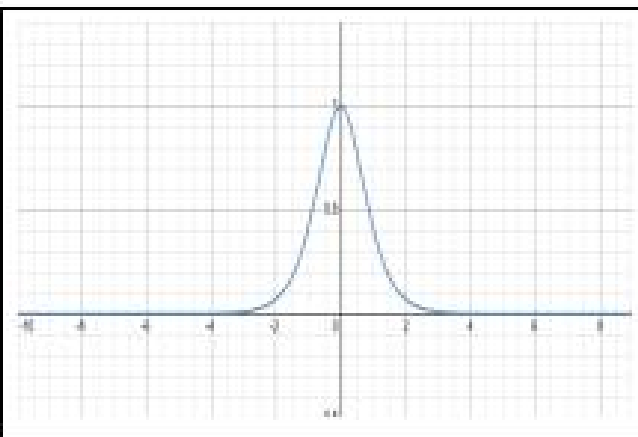
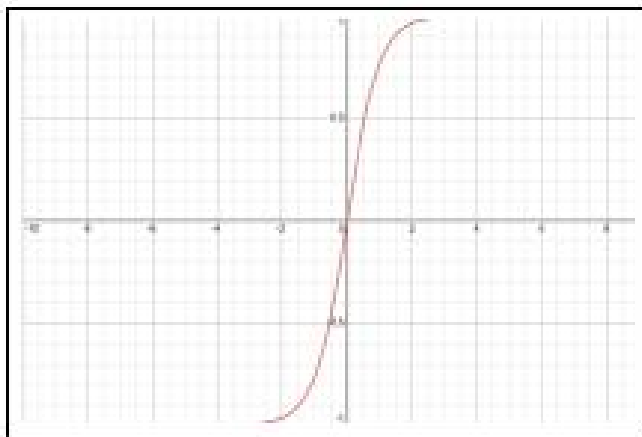
Leaky ReLU



Tanh



$$f(x) = \tanh(x) = \frac{e^x - e^{-x}}{e^x + e^{-x}} \quad (1)$$



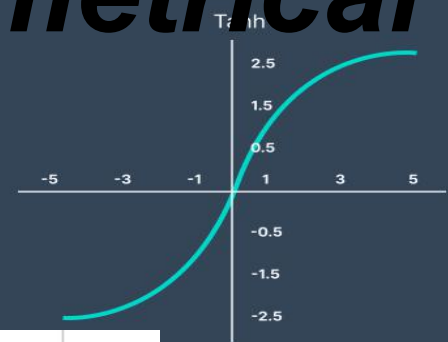
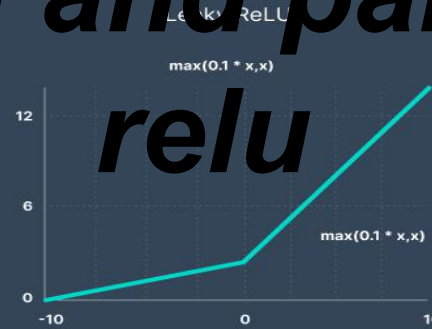
5

) = y

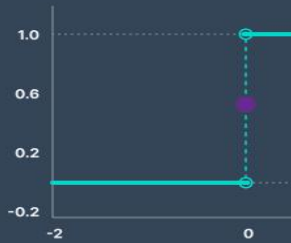
y

f(y) = ay

Leaky relu and parametrical relu



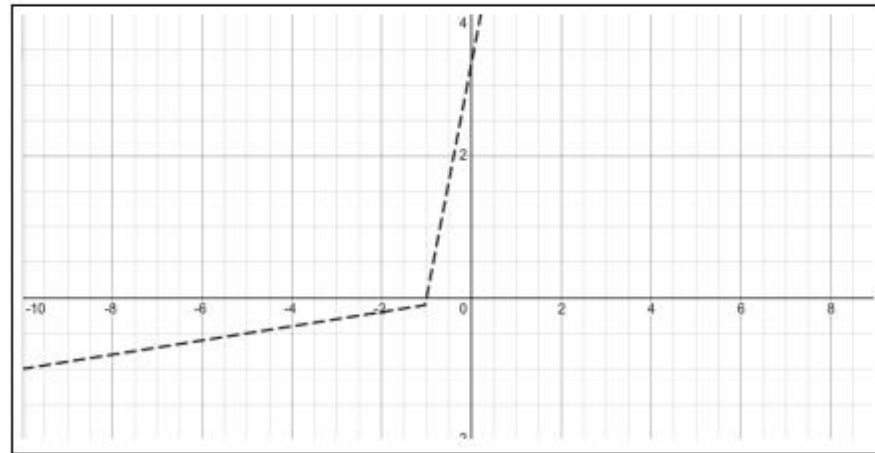
Binary Step Function



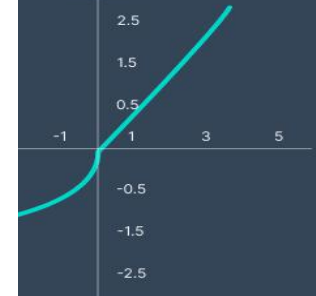
ELU



$a = 0.1; f(x) = \begin{cases} x, & x > 0 \\ a \cdot x, & x \leq 0 \end{cases}$	(1) leaky relu
$a = ?; f(x) = \begin{cases} x, & x > 0 \\ a \cdot x, & x \leq 0 \end{cases}$	(2) paramet. relu

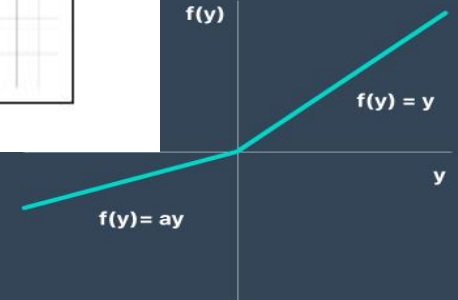


SELU

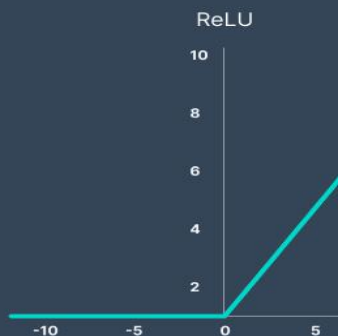


parametric ReLU

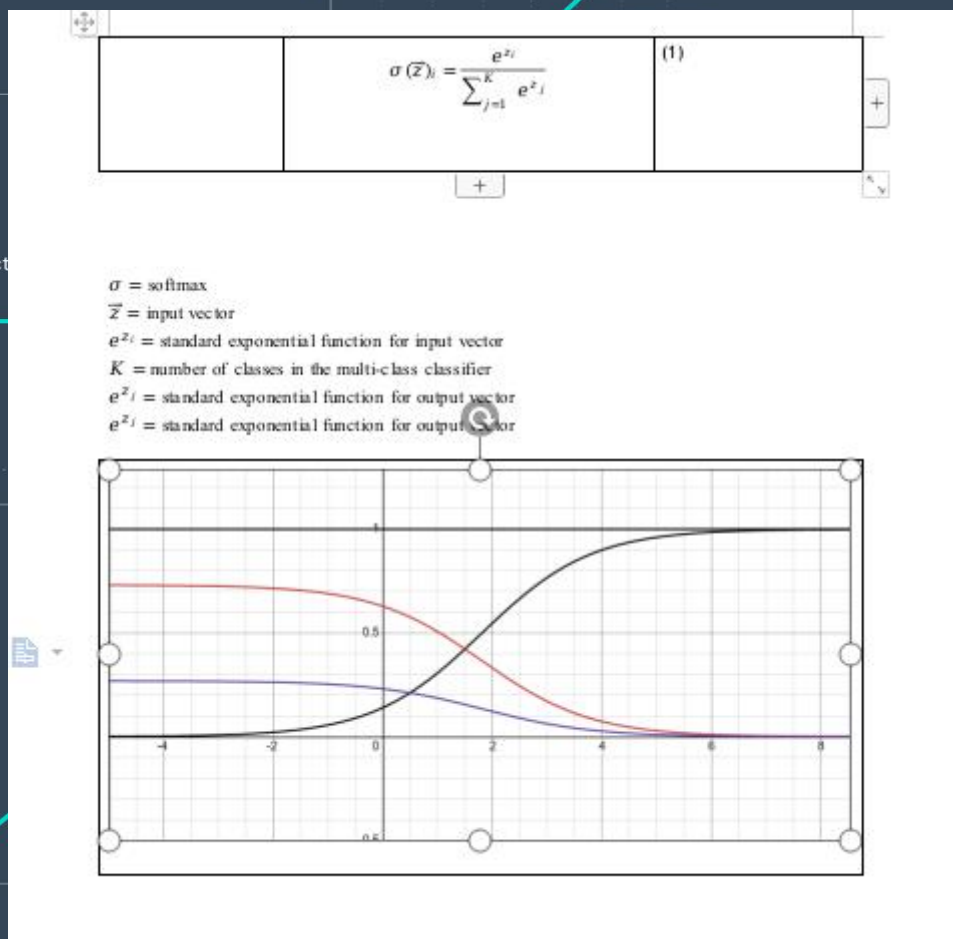
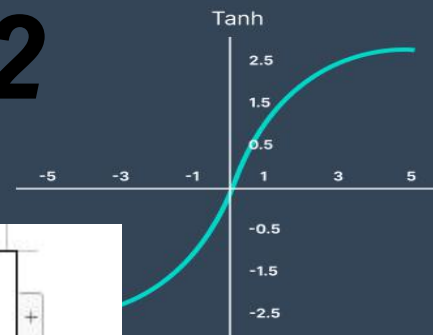
f(y)



Softmax 1 of 2



Leaky ReLU



Softmax 2 of 2

ReLU

10
8
6
4

Leaky ReLU

12
6

$\max(0.1 * x, x)$

Tanh

2.5
1.5
0.5
-0.5

-5 -3 -1 1 3 5

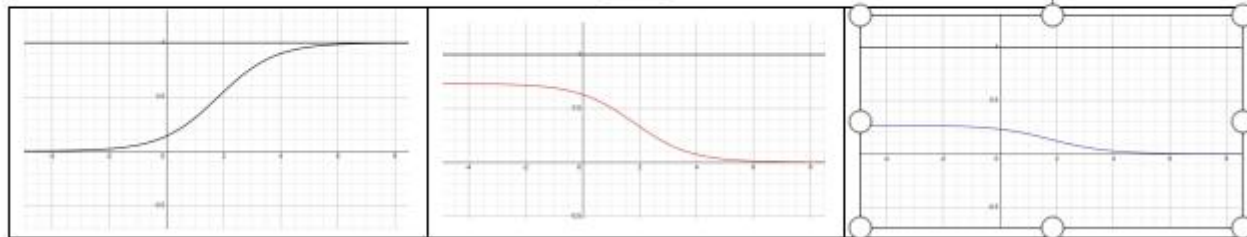
-10 -5

1.0
0.6
0.2
-0.2
-2

-3 -2

	$\sigma(\vec{z})_i = \frac{e^{z_i}}{\sum_{j=1}^K e^{z_j}}$	(1.0)
	$f(\varepsilon = 3) = \frac{e^{z_{1,2,3..}}}{1 + e^{z_1} + e^{z_2} + e^{z_3}}$	(1.1)
	$f(z, \text{ only for } z_1) = \frac{e^{z_1}}{1 + e^{z_1} + (e^{z_2} = 0) + (e^{z_3} = 0)}$	(1.2)
	$\frac{e^{z_1}}{1 + e^z} \Leftrightarrow \frac{1}{1 + e^{-z}}$	(1.3)

+



$f(y) = y$

y

-2

-6

0

6