



İZMİR  
KÂTİP ÇELEBİ  
UNIVERSITY

— 2010 —

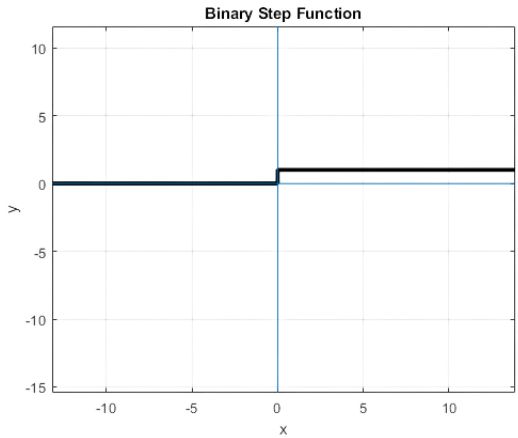
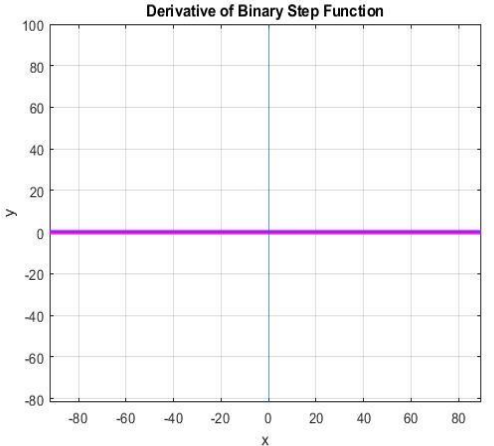
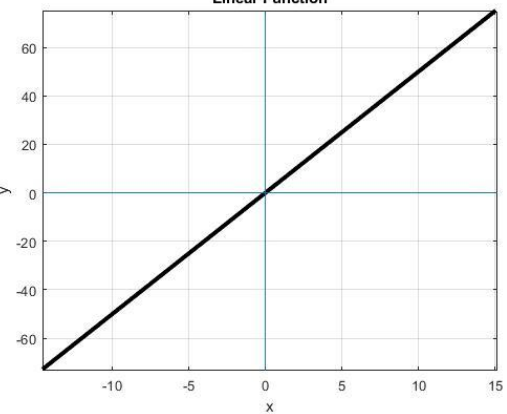
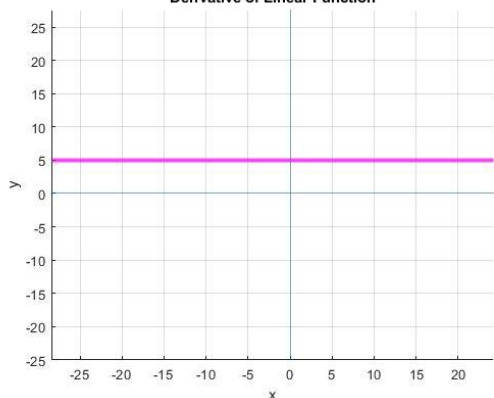
INTRODUCTION TO MACHINE LEARNING

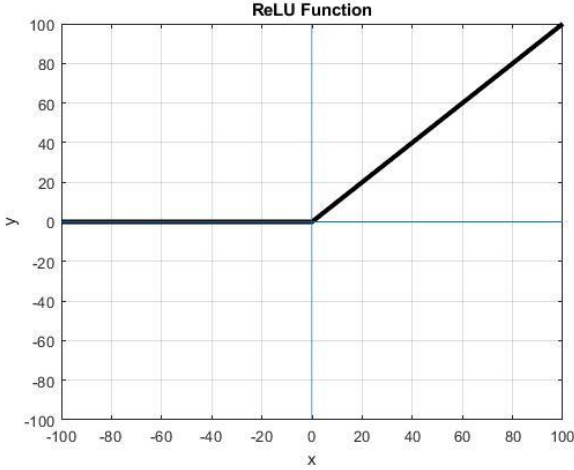
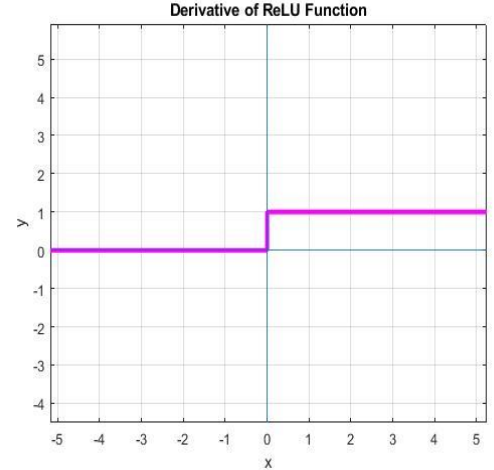
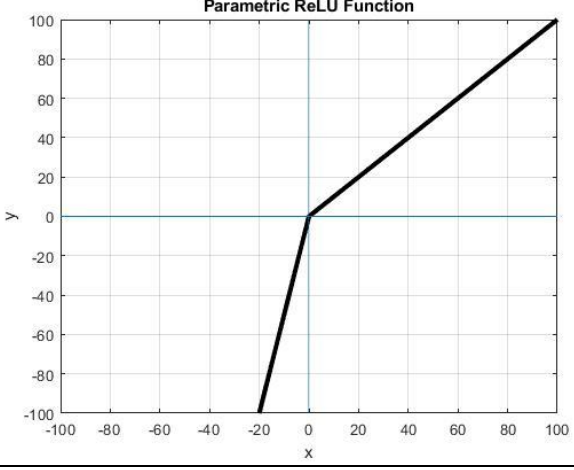
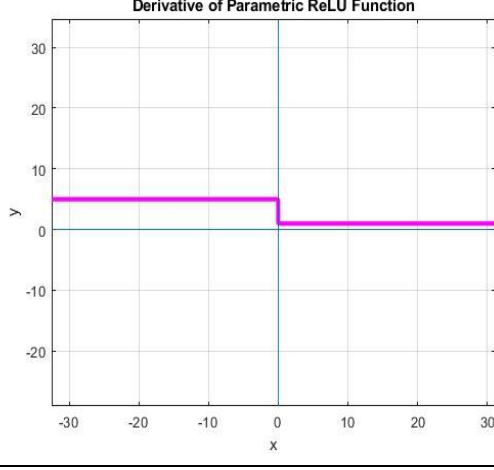
HOMEWORK 2

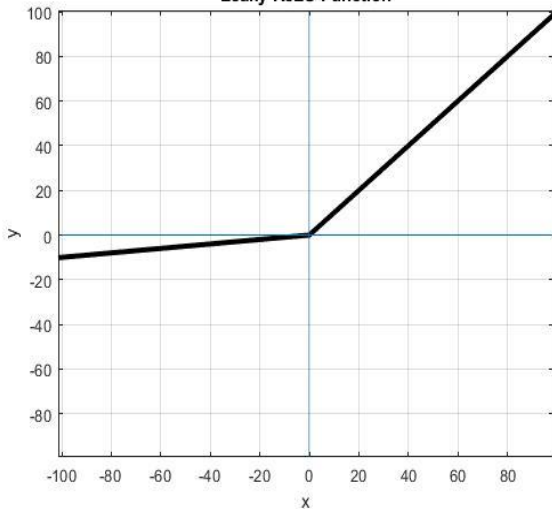
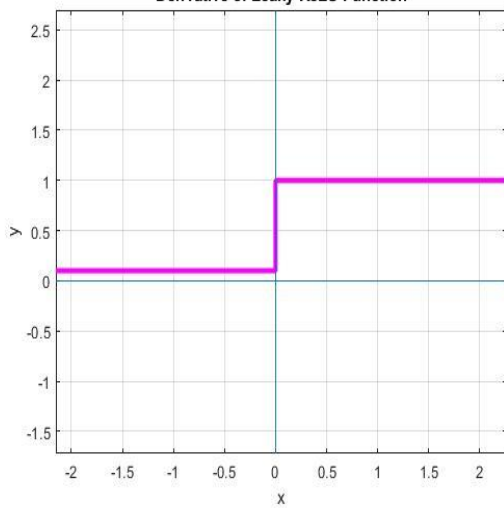
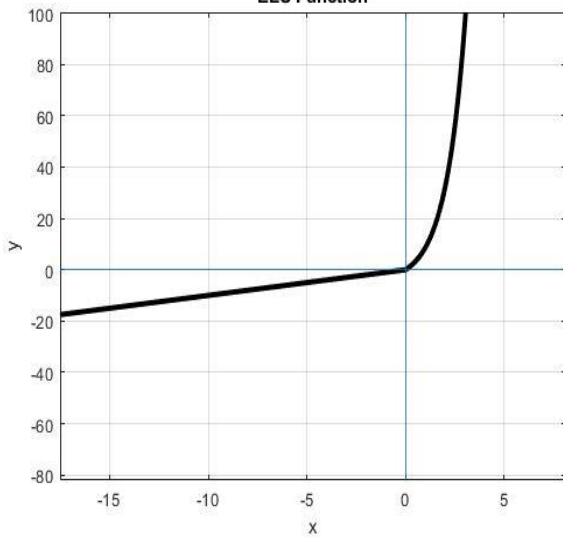
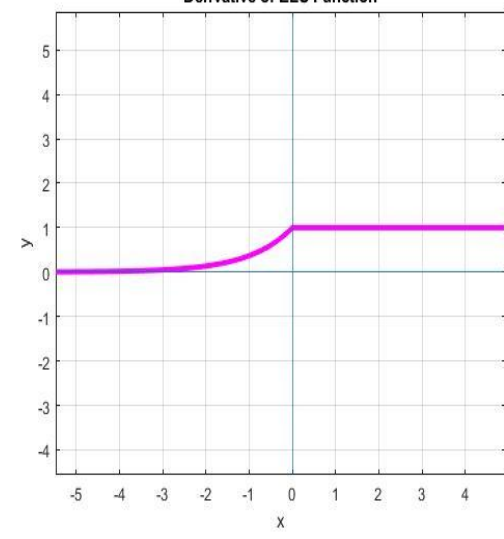
HALİME ÖZGE KABAK

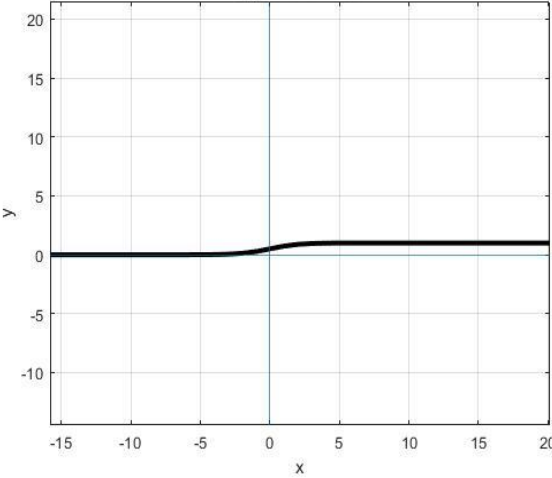
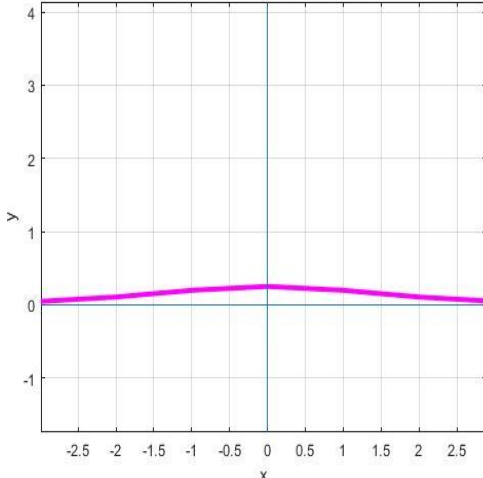
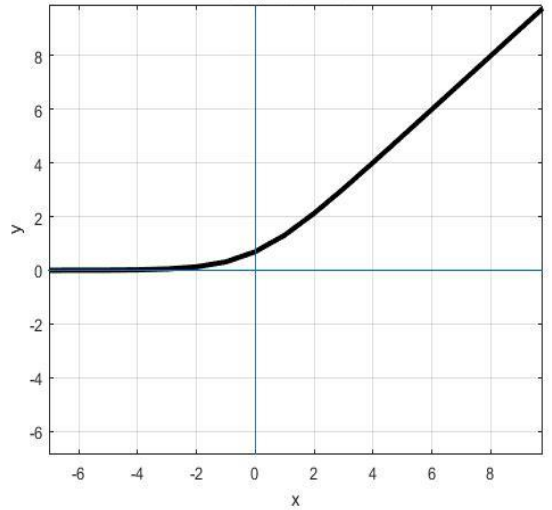
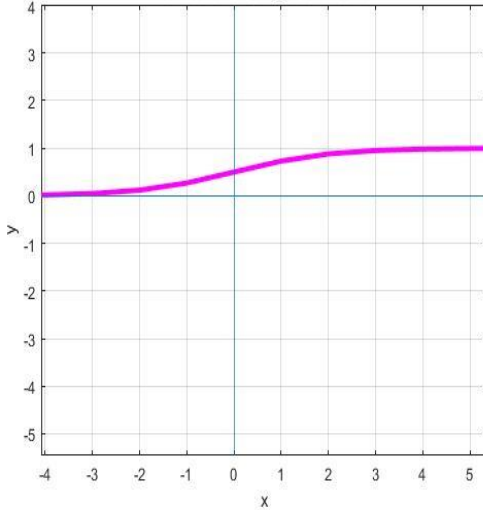
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➤ I plotted 10 different activation functions and their derivatives using MATLAB.

Name of the Functions	$f(x)$	Figure of $f(x)$	$f'(x)$	Figure of $f'(x)$
Binary Step	$f(x) = \begin{cases} 0, & x < 0 \\ 1, & x \geq 0 \end{cases}$	 <p>Binary Step Function</p>	$f'(x)=0$	 <p>Derivative of Binary Step Function</p>
Linear	$f(x)=ax$ (I used a as 5)	 <p>Linear Function</p>	$f'(x)=a$	 <p>Derivative of Linear Function</p>

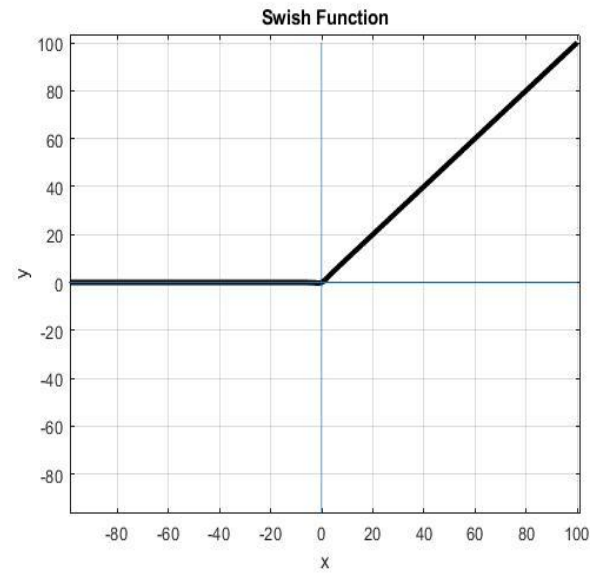
ReLU	$f(x) = \begin{cases} 0, & x < 0 \\ x, & x \geq 0 \end{cases}$	<p>ReLU Function</p> 	$f'(x) = \begin{cases} 0, & x < 0 \\ 1, & x \geq 0 \end{cases}$	<p>Derivative of ReLU Function</p> 
Parametric ReLU	$f(x) = \begin{cases} ax, & x < 0 \\ x, & x \geq 0 \end{cases}$ <p>(I used a as 5)</p>	<p>Parametric ReLU Function</p> 	$f'(x) = \begin{cases} a, & x < 0 \\ 1, & x \geq 0 \end{cases}$	<p>Derivative of Parametric ReLU Function</p> 

Leaky ReLU	$f(x) = \begin{cases} 0.1x, & x < 0 \\ x, & x \geq 0 \end{cases}$	<p>Leaky ReLU Function</p> 	$f'(x) = \begin{cases} 0.1, & x < 0 \\ 1, & x \geq 0 \end{cases}$	<p>Derivative of Leaky ReLU Function</p> 
ELU	$f(x) = \begin{cases} x, & x < 0 \\ az, & x \geq 0 \end{cases}$ <p> <math>z = (e^x - 1)</math>  (I used a as 5) </p>	<p>ELU Function</p> 	$f'(x) = \begin{cases} a + az, & x < 0 \\ 1, & x \geq 0 \end{cases}$ <p> <math>z = (e^x - 1)</math>  (I used a as 1) </p>	<p>Derivative of ELU Function</p> 

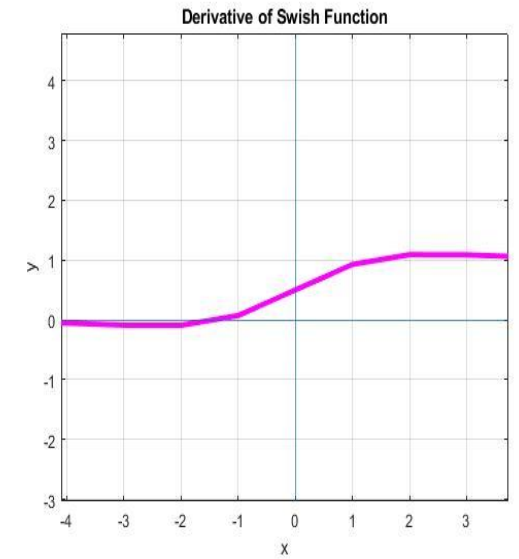
Sigmoid	$f(x) = \frac{1}{(1 + e^{-x})}$	<p style="text-align: center;">Sigmoid Function</p>  <p>The graph shows the Sigmoid Function, which is an S-shaped curve. It is plotted on a coordinate system with x ranging from -15 to 20 and y ranging from -10 to 20. The curve starts near y=0 for negative x, passes through the point (0, 1), and approaches y=1 as x increases. The curve is symmetric about the point (0, 1).</p>	$f'(x) = \frac{e^{-x}}{(1 + e^{-x})^2}$	<p style="text-align: center;">Derivative of Sigmoid Function</p>  <p>The graph shows the derivative of the Sigmoid Function. It is plotted on a coordinate system with x ranging from -2.5 to 2.5 and y ranging from -1 to 4. The curve is a bell-shaped curve that is symmetric about the point (0, 0.25). It starts near y=0 for negative x and approaches y=0 as x increases.</p>
Softplus	$f(x) = \log(1 + e^x)$	<p style="text-align: center;">Softplus Function</p>  <p>The graph shows the Softplus Function, which is a smooth, increasing curve. It is plotted on a coordinate system with x ranging from -6 to 8 and y ranging from -6 to 8. The curve starts near y=0 for negative x and increases rapidly as x increases, approaching a straight line with a slope of 1 for large positive x.</p>	$f'(x) = \frac{e^x}{(1 + e^x)}$	<p style="text-align: center;">Derivative of Softplus Function</p>  <p>The graph shows the derivative of the Softplus Function. It is plotted on a coordinate system with x ranging from -4 to 5 and y ranging from -5 to 4. The curve is a smooth, increasing curve that starts near y=0 for negative x and approaches y=1 as x increases.</p>

Swish

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

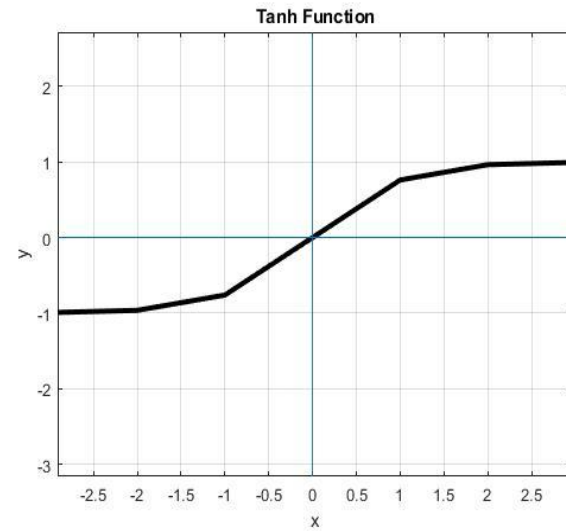


$$f'(x) = \left( \frac{1}{(1+e^{-x})} + \frac{xe^{-x}}{(1+e^{-x})^2} \right)$$



Tanh

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



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

