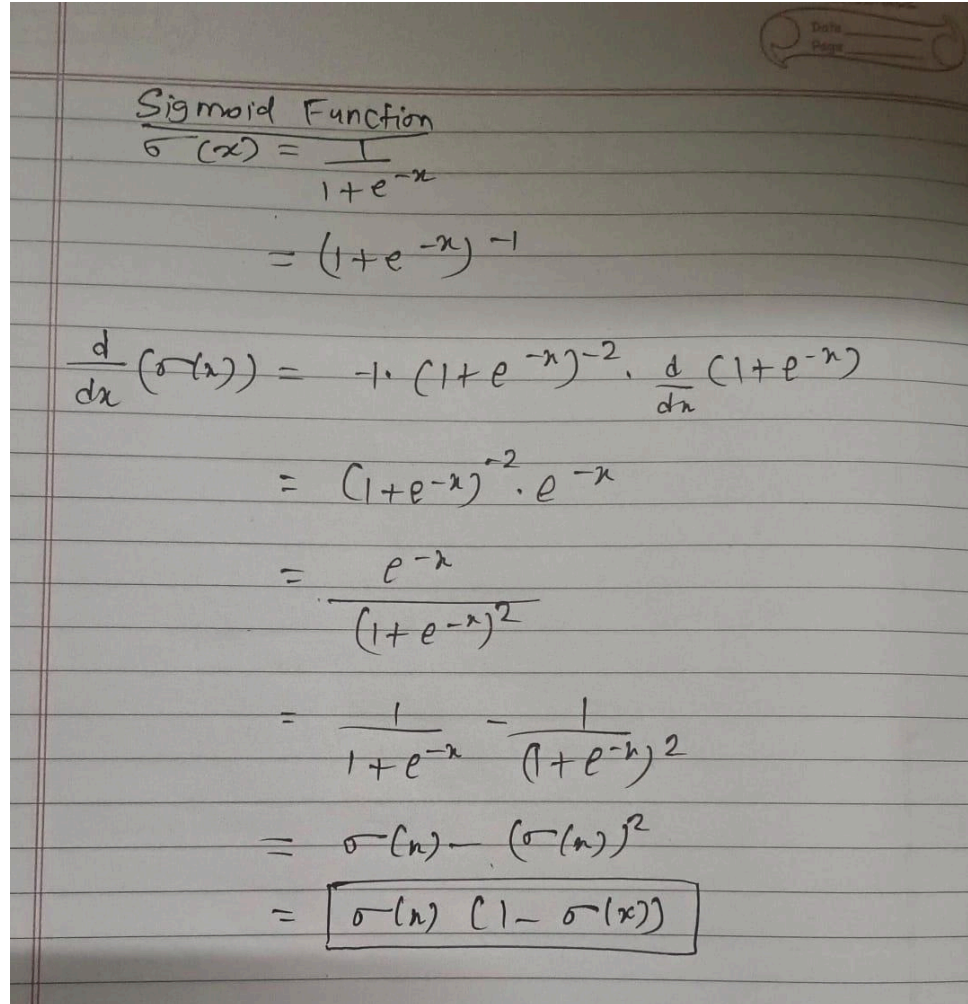


EE655 HW3

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Proof:



The image shows a handwritten proof on lined paper. At the top right, there is a small circular stamp with 'Date' and 'Page' labels. The text 'Sigmoid Function' is underlined. The proof starts with the definition of the sigmoid function, followed by its derivative using the chain rule. The final result is boxed.

$$\begin{aligned}\text{Sigmoid Function} \\ \sigma(x) &= \frac{1}{1+e^{-x}} \\ &= (1+e^{-x})^{-1} \\ \frac{d}{dx}(\sigma(x)) &= -1 \cdot (1+e^{-x})^{-2} \cdot \frac{d}{dx}(1+e^{-x}) \\ &= (1+e^{-x})^{-2} \cdot e^{-x} \\ &= \frac{e^{-x}}{(1+e^{-x})^2} \\ &= \frac{1}{1+e^{-x}} - \frac{1}{(1+e^{-x})^2} \\ &= \sigma(x) - (\sigma(x))^2 \\ &= \boxed{\sigma(x) (1 - \sigma(x))}\end{aligned}$$

Code:

```
import numpy as np
import matplotlib.pyplot as plt

def sigmo(x):
    return 1 / (1 + np.exp(-x))

def derivative(x):
    sigmoidx = sigmo(x)
    return sigmoidx * (1 - sigmoidx)

x_values = np.linspace(-10, 10, 800)

sigmoid_values = sigmo(x_values)
derivative_values = derivative(x_values)

plt.figure(figsize=(8, 5))
plt.plot(x_values, sigmoid_values, label="Sigmoid Function", color='blue')
plt.plot(x_values, derivative_values, label="Sigmoid Derivative", color='red', linestyle='dashed')
plt.legend()
plt.xlabel("x")
plt.ylabel("Value")
plt.title("Sigmoid Function and its Derivative")
plt.grid()
plt.show()
```

Output:

