

Homework 1

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Problem 1

$$f(x) = \exp\left(-\frac{1}{2\sigma^2}(x - \mu)^2\right)$$

$$f'(x) = (\exp(-\frac{1}{2\sigma^2}(x - \mu)^2))'$$

Applying Chain Rule and $(\exp(x))' = \exp(x)$:

$$f'(x) = \exp(-\frac{1}{2\sigma^2}(x - \mu)^2)(-\frac{1}{2\sigma^2}(x - \mu)^2)'$$

Applying Constant Rule:

$$f'(x) = \exp(-\frac{1}{2\sigma^2}(x - \mu)^2) \cdot -\frac{1}{2\sigma^2}((x - \mu)^2)'$$

Applying Chain Rule and $(x^2)' = 2x$:

$$f'(x) = \exp(-\frac{1}{2\sigma^2}(x - \mu)^2) \cdot -\frac{1}{2\sigma^2} \cdot 2(x - \mu)(x - \mu)'$$

Applying Sum Rule

$$f'(x) = \exp(-\frac{1}{2\sigma^2}(x - \mu)^2) \cdot -\frac{1}{2\sigma^2} \cdot 2(x - \mu)(x' + (-\mu)')$$

Applying Constant Rule and $(x)' = 1$:

$$f'(x) = \exp(-\frac{1}{2\sigma^2}(x - \mu)^2) \cdot -\frac{1}{2\sigma^2} \cdot 2(x - \mu)(1 + 0)$$

$$f'(x) = \exp(-\frac{1}{2\sigma^2}(x - \mu)^2) \cdot -\frac{1}{2\sigma^2} \cdot 2(x - \mu)$$