5.3 Compute the derivative $f'(x)$ of the function

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

where $\mu, \sigma \in \mathbb{R}$ are constants.

Solution.

Using Chain rule,

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

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

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