

Balance chemical reactions like a pro.

Unlock Step-by-Step

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$$\frac{d}{d\sigma} \left(\ln \left(\frac{1}{\sigma \sqrt{2\pi}} \right) \left(e^{-(x_1-\mu)^2/(2\sigma^2)} + e^{-(x_2-\mu)^2/(2\sigma^2)} \right) \right)$$

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 Examples

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Derivative:

Approximate form

☒ Step-by-step solution

$$\frac{\partial}{\partial \sigma} \left(\log \left(\frac{e^{-(x_1-\mu)^2/(2\sigma^2)} + e^{-(x_2-\mu)^2/(2\sigma^2)}}{\sigma \sqrt{2\pi}} \right) \right) = \frac{\sqrt{2\pi} \sigma \left(\frac{(x_1-\mu)^2 e^{-(x_1-\mu)^2/(2\sigma^2)}}{\sigma^3} + \frac{(x_2-\mu)^2 e^{-(x_2-\mu)^2/(2\sigma^2)}}{\sigma^3} - \frac{e^{-(x_1-\mu)^2/(2\sigma^2)} + e^{-(x_2-\mu)^2/(2\sigma^2)}}{\sqrt{2\pi} \sigma^2} \right)}{e^{-(x_1-\mu)^2/(2\sigma^2)} + e^{-(x_2-\mu)^2/(2\sigma^2)}}$$

$\log(x)$ is the natural logarithm

Alternate forms:

More

$$\frac{\mu^2 - \sigma^2 + x_1^2 - 2\mu x_1}{\sigma^3} - \frac{(x_1 - x_2) e^{(x_1-\mu)^2/(2\sigma^2)} (-2\mu + x_1 + x_2)}{\sigma^3 (e^{(x_1-\mu)^2/(2\sigma^2)} + e^{(x_2-\mu)^2/(2\sigma^2)})}$$

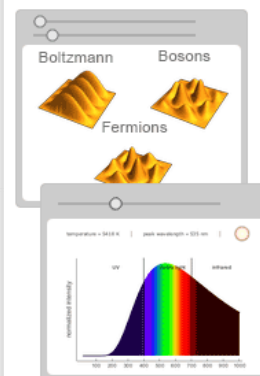
$$\frac{(\mu^2 - \sigma^2 + x_1^2 - 2\mu x_1) e^{(x_2-\mu)^2/(2\sigma^2)} + e^{(x_1-\mu)^2/(2\sigma^2)} (\mu^2 - \sigma^2 + x_2^2 - 2\mu x_2)}{\sigma^3 (e^{(x_1-\mu)^2/(2\sigma^2)} + e^{(x_2-\mu)^2/(2\sigma^2)})}$$

$$\left((x_1^2 - 2\mu x_1) e^{(x_2-\mu)^2/(2\sigma^2)} + (x_2^2 - 2\mu x_2) e^{(x_1-\mu)^2/(2\sigma^2)} + (\mu^2 - \sigma^2) (e^{(x_1-\mu)^2/(2\sigma^2)} + e^{(x_2-\mu)^2/(2\sigma^2)}) \right) / \left(\sigma^3 (e^{(x_1-\mu)^2/(2\sigma^2)} + e^{(x_2-\mu)^2/(2\sigma^2)}) \right)$$

Alternate form assuming x_1, x_2, μ , and σ are positive:

$$\frac{\frac{(x_1-\mu)^2 e^{-(x_1-\mu)^2/(2\sigma^2)}}{\sigma^3} + \frac{(x_2-\mu)^2 e^{-(x_2-\mu)^2/(2\sigma^2)}}{\sigma^3}}{e^{-(x_1-\mu)^2/(2\sigma^2)} + e^{-(x_2-\mu)^2/(2\sigma^2)}} - \frac{1}{\sigma}$$

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Expanded form:

$$\begin{aligned} & \frac{x1^2 e^{-(x1-\mu)^2/(2\sigma^2)}}{\sigma^3 \left(e^{-(x1-\mu)^2/(2\sigma^2)} + e^{-(x2-\mu)^2/(2\sigma^2)} \right)} + \frac{x2^2 e^{-(x2-\mu)^2/(2\sigma^2)}}{\sigma^3 \left(e^{-(x1-\mu)^2/(2\sigma^2)} + e^{-(x2-\mu)^2/(2\sigma^2)} \right)} + \\ & \frac{\mu^2 e^{-(x1-\mu)^2/(2\sigma^2)}}{\sigma^3 \left(e^{-(x1-\mu)^2/(2\sigma^2)} + e^{-(x2-\mu)^2/(2\sigma^2)} \right)} + \frac{\mu^2 e^{-(x2-\mu)^2/(2\sigma^2)}}{\sigma^3 \left(e^{-(x1-\mu)^2/(2\sigma^2)} + e^{-(x2-\mu)^2/(2\sigma^2)} \right)} - \\ & \frac{e^{-(x1-\mu)^2/(2\sigma^2)}}{\sigma \left(e^{-(x1-\mu)^2/(2\sigma^2)} + e^{-(x2-\mu)^2/(2\sigma^2)} \right)} - \frac{e^{-(x2-\mu)^2/(2\sigma^2)}}{\sigma \left(e^{-(x1-\mu)^2/(2\sigma^2)} + e^{-(x2-\mu)^2/(2\sigma^2)} \right)} - \\ & \frac{2\mu x1 e^{-(x1-\mu)^2/(2\sigma^2)}}{\sigma^3 \left(e^{-(x1-\mu)^2/(2\sigma^2)} + e^{-(x2-\mu)^2/(2\sigma^2)} \right)} - \frac{2\mu x2 e^{-(x2-\mu)^2/(2\sigma^2)}}{\sigma^3 \left(e^{-(x1-\mu)^2/(2\sigma^2)} + e^{-(x2-\mu)^2/(2\sigma^2)} \right)} \end{aligned}$$

Alternate form assuming x1, x2, μ, and σ are real:

$$\begin{aligned} & \frac{x1^2}{\sigma^3 \sqrt{e^{(x1-\mu)^2/\sigma^2}} \left(\frac{1}{\sqrt{e^{(x1-\mu)^2/\sigma^2}}} + \frac{1}{\sqrt{e^{(x2-\mu)^2/\sigma^2}}} \right)} + \\ & \frac{x2^2}{\sigma^3 \sqrt{e^{(x2-\mu)^2/\sigma^2}} \left(\frac{1}{\sqrt{e^{(x1-\mu)^2/\sigma^2}}} + \frac{1}{\sqrt{e^{(x2-\mu)^2/\sigma^2}}} \right)} + \\ & \frac{\mu^2}{\sigma^3 \sqrt{e^{(x1-\mu)^2/\sigma^2}} \left(\frac{1}{\sqrt{e^{(x1-\mu)^2/\sigma^2}}} + \frac{1}{\sqrt{e^{(x2-\mu)^2/\sigma^2}}} \right)} + \\ & \frac{\mu^2}{\sigma^3 \sqrt{e^{(x2-\mu)^2/\sigma^2}} \left(\frac{1}{\sqrt{e^{(x1-\mu)^2/\sigma^2}}} + \frac{1}{\sqrt{e^{(x2-\mu)^2/\sigma^2}}} \right)} - \\ & \frac{1}{\sigma \sqrt{e^{(x1-\mu)^2/\sigma^2}} \left(\frac{1}{\sqrt{e^{(x1-\mu)^2/\sigma^2}}} + \frac{1}{\sqrt{e^{(x2-\mu)^2/\sigma^2}}} \right)} - \\ & \frac{1}{\sigma \sqrt{e^{(x2-\mu)^2/\sigma^2}} \left(\frac{1}{\sqrt{e^{(x1-\mu)^2/\sigma^2}}} + \frac{1}{\sqrt{e^{(x2-\mu)^2/\sigma^2}}} \right)} - \\ & \frac{2\mu x1}{\sigma^3 \sqrt{e^{(x1-\mu)^2/\sigma^2}} \left(\frac{1}{\sqrt{e^{(x1-\mu)^2/\sigma^2}}} + \frac{1}{\sqrt{e^{(x2-\mu)^2/\sigma^2}}} \right)} - \\ & \frac{2\mu x2}{\sigma^3 \sqrt{e^{(x2-\mu)^2/\sigma^2}} \left(\frac{1}{\sqrt{e^{(x1-\mu)^2/\sigma^2}}} + \frac{1}{\sqrt{e^{(x2-\mu)^2/\sigma^2}}} \right)} \end{aligned}$$

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