WolframAlpha computational intelligence™

d(ln((1/(σ*sqrt(2π)))((e^(-(x1-μ)^2/(2σ^2))) + (e^(-(x2-μ)^2/(2σ^2))))))/ dσ   ⊗ ▤

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Derivative: [Approximate form]   [☑ Step-by-step solution]

$$\frac{\partial}{\partial \sigma}\left(\log\left(\frac{e^{-(x1-\mu)^2/(2\sigma^2)} + e^{-(x2-\mu)^2/(2\sigma^2)}}{\sigma \sqrt{2\pi}}\right)\right) =$$

$$\sqrt{2\pi}\,\sigma\left(\frac{\frac{(x1-\mu)^2\,e^{-(x1-\mu)^2/(2\sigma^2)}}{\sigma^3} + \frac{(x2-\mu)^2\,e^{-(x2-\mu)^2/(2\sigma^2)}}{\sigma^3}}{\sqrt{2\pi}\,\sigma} - \frac{e^{-(x1-\mu)^2/(2\sigma^2)} + e^{-(x2-\mu)^2/(2\sigma^2)}}{\sqrt{2\pi}\,\sigma^2}\right) \Big/ \left(e^{-(x1-\mu)^2/(2\sigma^2)} + e^{-(x2-\mu)^2/(2\sigma^2)}\right)$$

log(x) is the natural logarithm

Alternate forms: [More]

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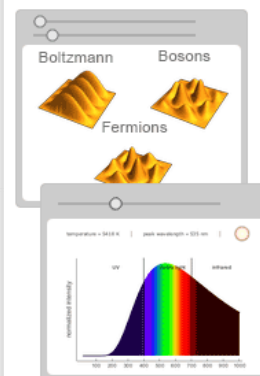
$$\frac{(\mu^2 - \sigma^2 + x1^2 - 2\mu\,x1)\,e^{(x2-\mu)^2/(2\sigma^2)} + e^{(x1-\mu)^2/(2\sigma^2)}(\mu^2 - \sigma^2 + x2^2 - 2\mu\,x2)}{\sigma^3\left(e^{(x1-\mu)^2/(2\sigma^2)} + e^{(x2-\mu)^2/(2\sigma^2)}\right)}$$

$$\left((x1^2 - 2\mu\,x1)\,e^{(x2-\mu)^2/(2\sigma^2)} + (x2^2 - 2\mu\,x2)\,e^{(x1-\mu)^2/(2\sigma^2)} + (\mu^2 - \sigma^2)\left(e^{(x1-\mu)^2/(2\sigma^2)} + e^{(x2-\mu)^2/(2\sigma^2)}\right)\right) \Big/ \left(\sigma^3\left(e^{(x1-\mu)^2/(2\sigma^2)} + e^{(x2-\mu)^2/(2\sigma^2)}\right)\right)$$

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

$$\frac{\frac{(x1-\mu)^2\,e^{-(x1-\mu)^2/(2\sigma^2)}}{\sigma^3} + \frac{(x2-\mu)^2\,e^{-(x2-\mu)^2/(2\sigma^2)}}{\sigma^3}}{e^{-(x1-\mu)^2/(2\sigma^2)} + e^{-(x2-\mu)^2/(2\sigma^2)}} - \frac{1}{\sigma}$$

Expanded form:

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

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

$$\frac{e^{-(x1-\mu)^2/(2\sigma^2)}}{\sigma\left(e^{-(x1-\mu)^2/(2\sigma^2)} + e^{-(x2-\mu)^2/(2\sigma^2)}\right)} - \frac{e^{-(x2-\mu)^2/(2\sigma^2)}}{\sigma\left(e^{-(x1-\mu)^2/(2\sigma^2)} + e^{-(x2-\mu)^2/(2\sigma^2)}\right)} -$$

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

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

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

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

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

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

$$\frac{1}{\sigma\sqrt{e^{(x1-\mu)^2/\sigma^2}}\left(\dfrac{1}{\sqrt{e^{(x1-\mu)^2/\sigma^2}}} + \dfrac{1}{\sqrt{e^{(x2-\mu)^2/\sigma^2}}}\right)} -$$

$$\frac{1}{\sigma\sqrt{e^{(x2-\mu)^2/\sigma^2}}\left(\dfrac{1}{\sqrt{e^{(x1-\mu)^2/\sigma^2}}} + \dfrac{1}{\sqrt{e^{(x2-\mu)^2/\sigma^2}}}\right)} -$$

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

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

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