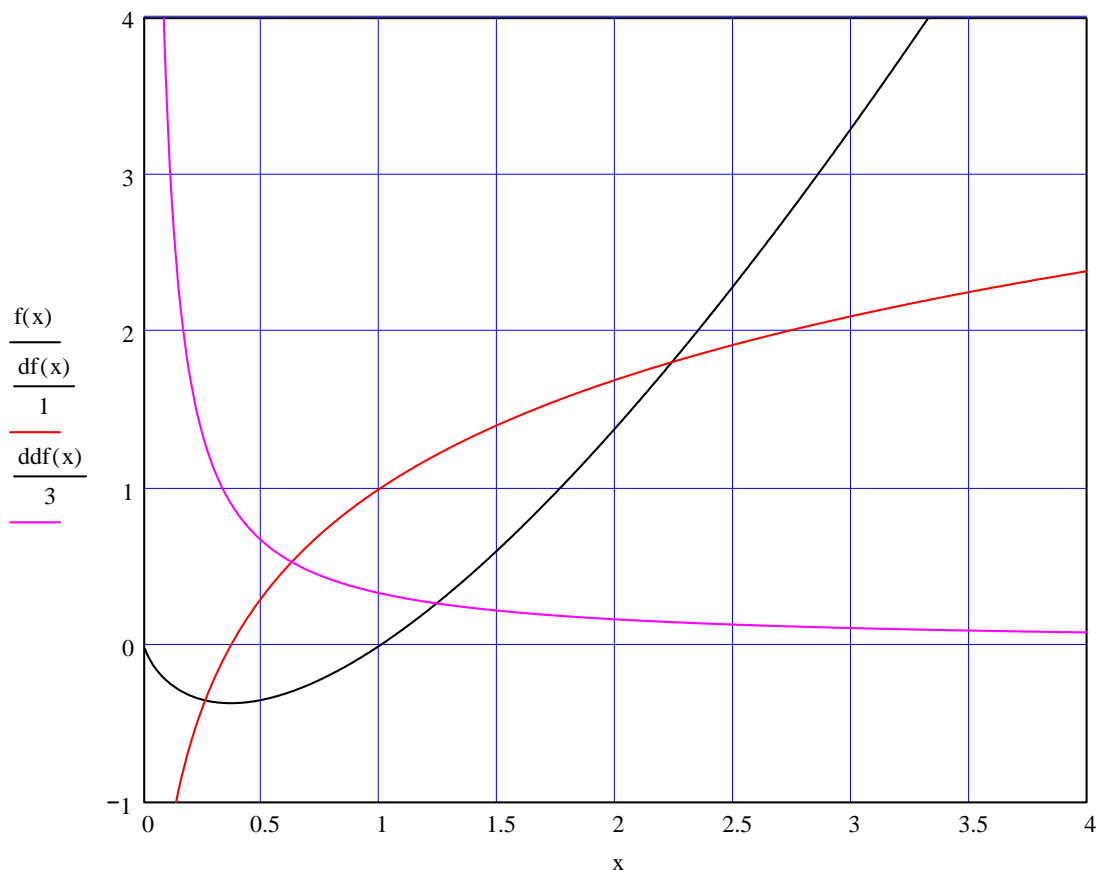


Alexey A Bykov, 20 oct 2008 boombook@yandex.ru

D6(1)

$$f(x) := x \cdot \ln(x) \quad df(x) := \frac{d}{dx}f(x) \quad ddfa(x) := \frac{d}{dx}df(x) \quad ddf(x) := \frac{d^2}{dx^2}f(x)$$

$$df(x) \rightarrow \ln(x) + 1 \quad ddf(x) \rightarrow \frac{1}{x}$$



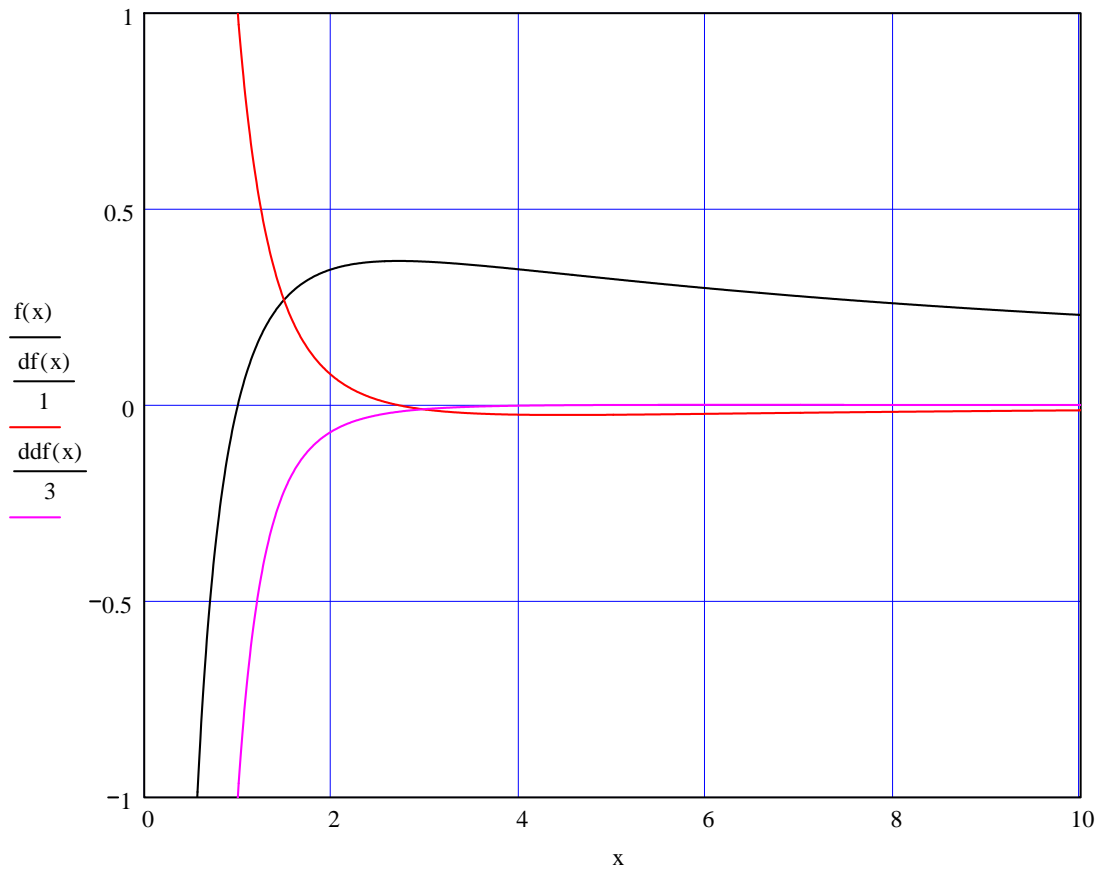
Given $df(x) = 0$ Find $x \rightarrow \exp(-1)$

$$x_a := e^{-1} \quad ddf(x_a) \rightarrow \frac{1}{\exp(-1)} = 2.718282$$

D6(2)

$$f(x) := \frac{\ln(x)}{x} \quad df(x) := \frac{d}{dx}f(x) \quad ddfa(x) := \frac{d}{dx}df(x) \quad ddf(x) := \frac{d^2}{dx^2}f(x)$$

$$df(x) \rightarrow \frac{1}{x^2} - \frac{\ln(x)}{x^2} \quad ddf(x) \rightarrow \frac{-3}{x^3} + 2 \cdot \frac{\ln(x)}{x^3}$$



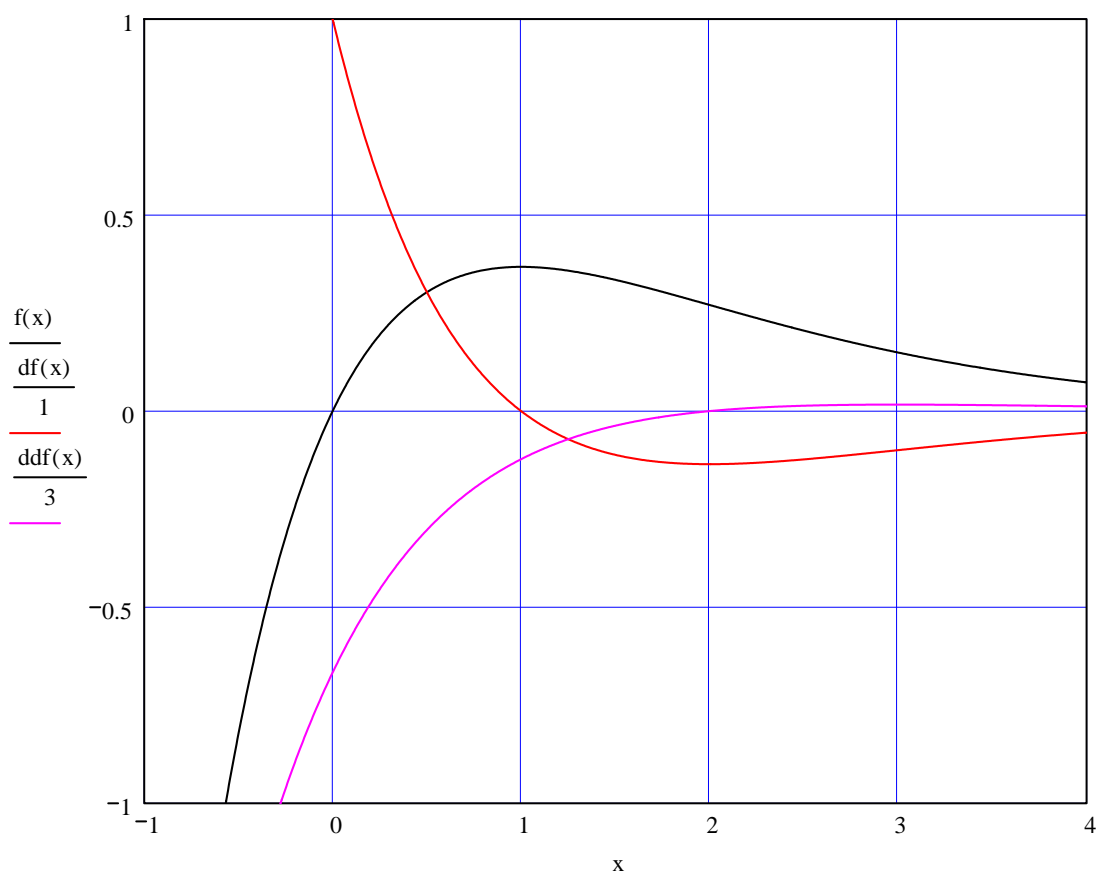
Given $df(x) = 0$ Find $x \rightarrow \exp(1)$

$$x_a := e^1 \quad ddf(x_a) \rightarrow \frac{-3}{\exp(1)^3} + 2 \cdot \frac{\ln(\exp(1))}{\exp(1)^3} = -0.049787 \quad \frac{1}{e^3} = 0.049787$$

D6(3)

$$f(x) := x \cdot e^{-x} \quad df(x) := \frac{d}{dx} f(x) \quad ddf(x) := \frac{d^2}{dx^2} f(x)$$

$$df(x) \rightarrow \exp(-x) - x \cdot \exp(-x) \quad ddf(x) \rightarrow -2 \cdot \exp(-x) + x \cdot \exp(-x)$$



Given $df(x) = 0$ Find $x \rightarrow 1$

$x_a := 0$ $ddf(x_a) \rightarrow -2 \cdot \exp(0) = -2$

Given $ddf(x) = 0$

$x_m := 2$ Find $x \rightarrow 2$

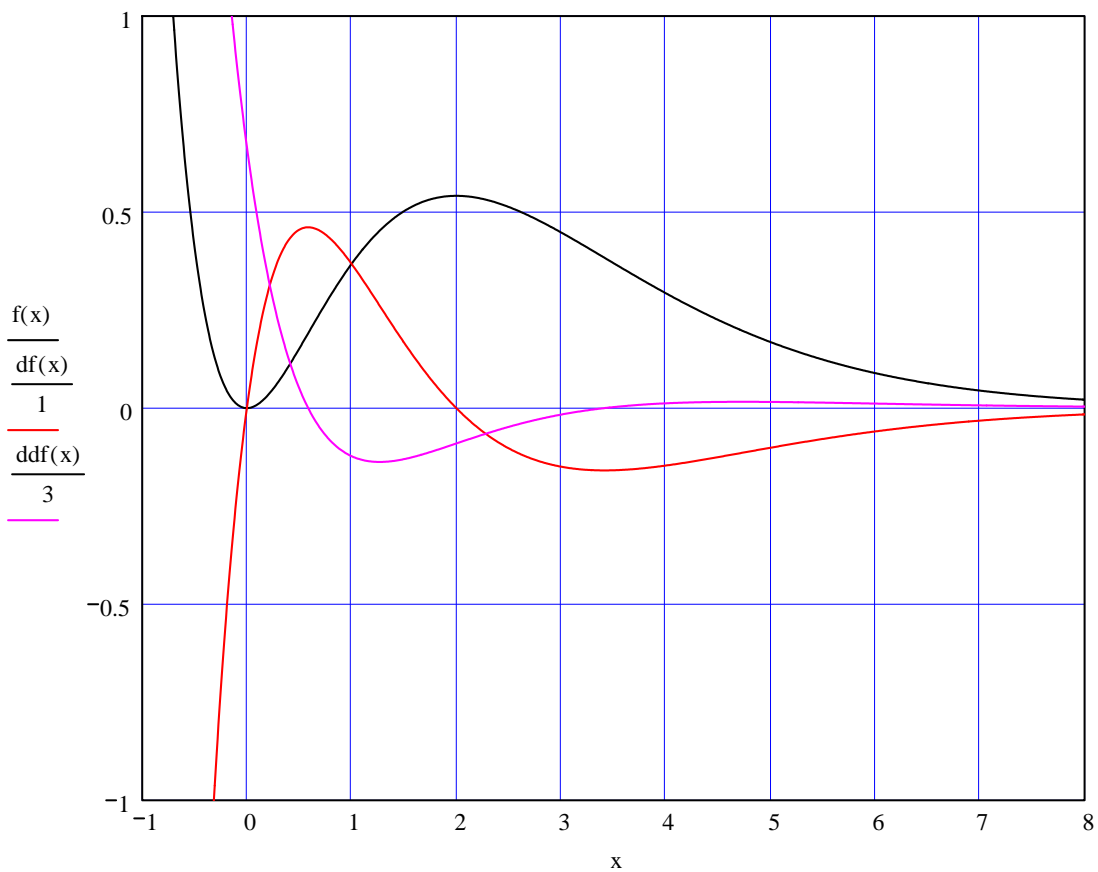
$df(x_m) \rightarrow -\exp(-2)$

$ddf(x_m) \rightarrow 0 = 0$

D6(4)

$$f(x) := x^2 \cdot e^{-x} \quad df(x) := \frac{d}{dx} f(x) \quad ddf(x) := \frac{d}{dx} df(x) \quad ddf(x) := \frac{d^2}{dx^2} f(x)$$

$$df(x) \rightarrow 2 \cdot x \cdot \exp(-x) - x^2 \cdot \exp(-x) \quad ddf(x) \rightarrow 2 \cdot \exp(-x) - 4 \cdot x \cdot \exp(-x) + x^2 \cdot \exp(-x)$$



Given $df(x) = 0$ Find(x) $\rightarrow (0 \ 2)$

$xa := 0$ $df(xa) \rightarrow 0$ $ddf(xa) \rightarrow 2 \cdot \exp(0) = 2$

$xa := 2$ $df(xa) \rightarrow 0$ $ddf(xa) \rightarrow -2 \cdot \exp(-2) = -0.270671$

Given $ddf(x) = 0$ Find(x) $\rightarrow \left(2 + 2^{\frac{1}{2}} \ 2 - 2^{\frac{1}{2}}\right)$

$xm := 2 + \sqrt{2}$

$df(xm) \rightarrow 2 \cdot \left(2 + 2^{\frac{1}{2}}\right) \cdot \exp\left(-2 - 2^{\frac{1}{2}}\right) - \left(2 + 2^{\frac{1}{2}}\right)^2 \cdot \exp\left(-2 - 2^{\frac{1}{2}}\right)$

$ddf(xm) \rightarrow 2 \cdot \exp\left(-2 - 2^{\frac{1}{2}}\right) - 4 \cdot \left(2 + 2^{\frac{1}{2}}\right) \cdot \exp\left(-2 - 2^{\frac{1}{2}}\right) + \left(2 + 2^{\frac{1}{2}}\right)^2 \cdot \exp\left(-2 - 2^{\frac{1}{2}}\right) = 0$

$xn := 2 - \sqrt{2}$

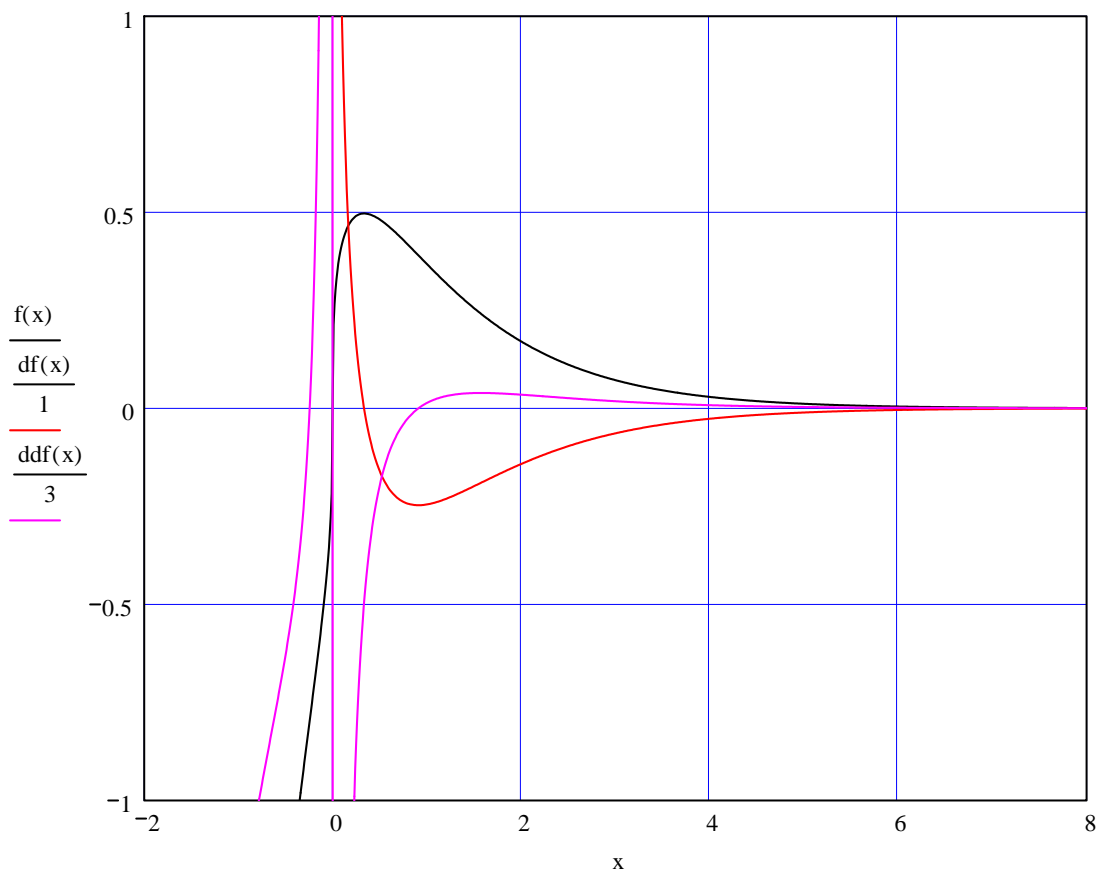
$df(xn) \rightarrow 2 \cdot \left(2 - 2^{\frac{1}{2}}\right) \cdot \exp\left(-2 + 2^{\frac{1}{2}}\right) - \left(2 - 2^{\frac{1}{2}}\right)^2 \cdot \exp\left(-2 + 2^{\frac{1}{2}}\right)$

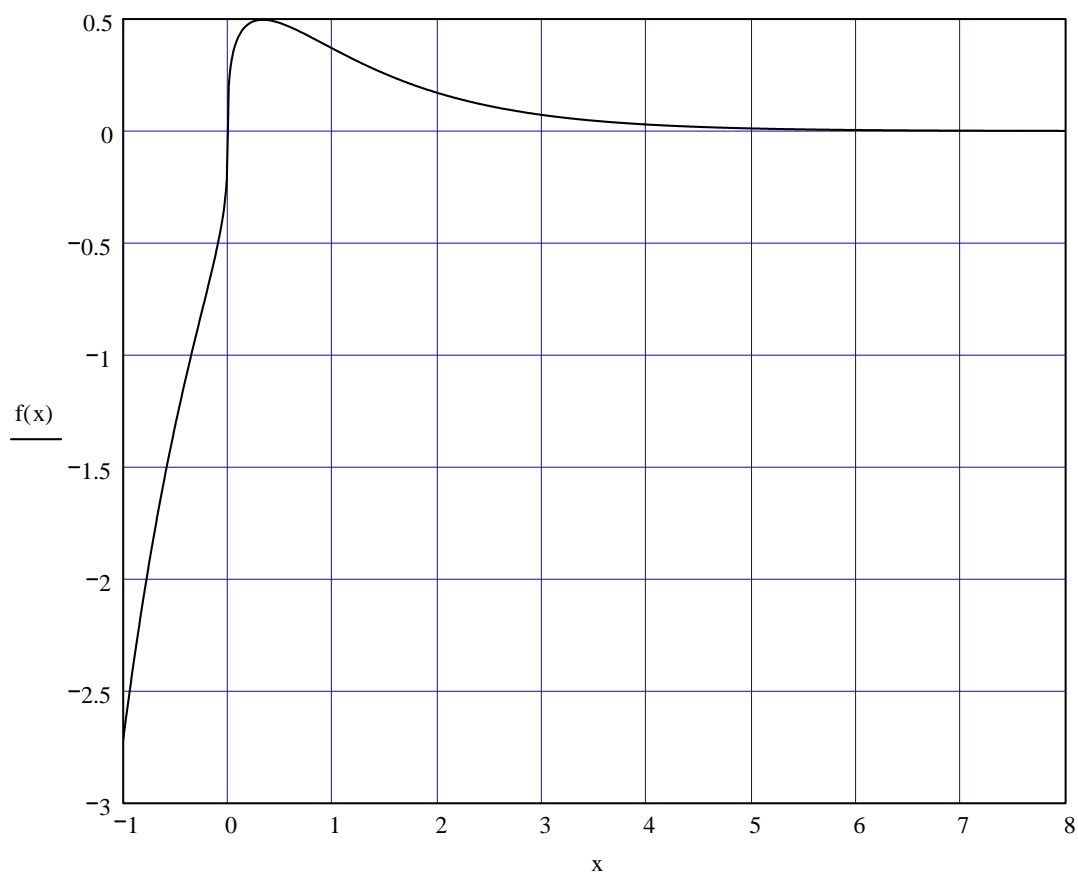
$$ddf(x) \rightarrow 2 \cdot \exp\left(-2 + 2 \frac{1}{2}\right) - 4 \cdot \left(2 - 2 \frac{1}{2}\right) \cdot \exp\left(-2 + 2 \frac{1}{2}\right) + \left(2 - 2 \frac{1}{2}\right)^2 \cdot \exp\left(-2 + 2 \frac{1}{2}\right) = 0$$

D6(4)

$$f(x) := \sqrt[3]{x} \cdot e^{-x} \quad df(x) := \frac{d}{dx} f(x) \quad ddf(x) := \frac{d}{dx} df(x) \quad ddf(x) := \frac{d^2}{dx^2} f(x)$$

$$df(x) \rightarrow \frac{1}{3 \cdot x^{\frac{2}{3}}} \cdot \exp(-x) - x^{\frac{1}{3}} \cdot \exp(-x) \quad ddf(x) \rightarrow \frac{-2}{9 \cdot x^{\frac{5}{3}}} \cdot \exp(-x) - \frac{2}{3 \cdot x^{\frac{2}{3}}} \cdot \exp(-x) + x^{\frac{1}{3}} \cdot \exp(-x)$$





Given $df(x) = 0$ Find(x) $\rightarrow \frac{1}{3}$

$xa := \frac{1}{3}$ $df(xa) \rightarrow 0$ $ddf(xa) \rightarrow -3^{\frac{2}{3}} \cdot \exp\left(\frac{-1}{3}\right) = -1.490445$

$xa := 2$ $df(xa) \rightarrow \frac{-5}{6} \cdot 2^{\frac{1}{3}} \cdot \exp(-2)$ $ddf(xa) \rightarrow \frac{11}{18} \cdot 2^{\frac{1}{3}} \cdot \exp(-2) = 0.104202$

Given $ddf(x) = 0$ Find(x) $\rightarrow \left(\frac{1}{3} + \frac{1}{3} \cdot 3^{\frac{1}{2}} \quad \frac{1}{3} - \frac{1}{3} \cdot 3^{\frac{1}{2}} \right)$

$xm := \frac{1 + \sqrt{3}}{3}$

$df(xm) \rightarrow \frac{1}{\frac{2}{3}} \cdot \exp\left(\frac{-1}{3} - \frac{1}{3} \cdot 3^{\frac{1}{2}}\right) - \left(\frac{1}{3} + \frac{1}{3} \cdot 3^{\frac{1}{2}}\right)^{\frac{1}{3}} \cdot \exp\left(\frac{-1}{3} - \frac{1}{3} \cdot 3^{\frac{1}{2}}\right)$
 $3 \cdot \left(\frac{1}{3} + \frac{1}{3} \cdot 3^{\frac{1}{2}}\right)^3$

$$\text{ddf}(xm) \rightarrow \frac{-2}{\frac{5}{\frac{1}{3}}} \cdot \exp\left(\frac{-1}{3} - \frac{1}{3} \cdot 3^{\frac{1}{2}}\right) - \frac{2}{\frac{2}{\frac{1}{3}}} \cdot \exp\left(\frac{-1}{3} - \frac{1}{3} \cdot 3^{\frac{1}{2}}\right) + \left(\frac{1}{3} + \frac{1}{3} \cdot 3^{\frac{1}{2}}\right)^{\frac{1}{3}} \cdot \exp\left(\frac{-1}{3} - \frac{1}{3} \cdot 3^{\frac{1}{2}}\right) \\ 9 \cdot \left(\frac{1}{3} + \frac{1}{3} \cdot 3^{\frac{1}{2}}\right)^{\frac{1}{3}} \quad 3 \cdot \left(\frac{1}{3} + \frac{1}{3} \cdot 3^{\frac{1}{2}}\right)^{\frac{1}{3}}$$

$$xn := \frac{1 - \sqrt{3}}{3}$$

$$\text{df}(xn) \rightarrow \frac{1}{\frac{2}{\frac{1}{3}}} \cdot \exp\left(\frac{-1}{3} + \frac{1}{3} \cdot 3^{\frac{1}{2}}\right) - \left(\frac{1}{3} - \frac{1}{3} \cdot 3^{\frac{1}{2}}\right)^{\frac{1}{3}} \cdot \exp\left(\frac{-1}{3} + \frac{1}{3} \cdot 3^{\frac{1}{2}}\right) \\ 3 \cdot \left(\frac{1}{3} - \frac{1}{3} \cdot 3^{\frac{1}{2}}\right)^{\frac{1}{3}}$$

$$\text{ddf}(xn) \rightarrow \frac{-2}{\frac{5}{\frac{1}{3}}} \cdot \exp\left(\frac{-1}{3} + \frac{1}{3} \cdot 3^{\frac{1}{2}}\right) - \frac{2}{\frac{2}{\frac{1}{3}}} \cdot \exp\left(\frac{-1}{3} + \frac{1}{3} \cdot 3^{\frac{1}{2}}\right) + \left(\frac{1}{3} - \frac{1}{3} \cdot 3^{\frac{1}{2}}\right)^{\frac{1}{3}} \cdot \exp\left(\frac{-1}{3} + \frac{1}{3} \cdot 3^{\frac{1}{2}}\right) \\ 9 \cdot \left(\frac{1}{3} - \frac{1}{3} \cdot 3^{\frac{1}{2}}\right)^{\frac{1}{3}} \quad 3 \cdot \left(\frac{1}{3} - \frac{1}{3} \cdot 3^{\frac{1}{2}}\right)^{\frac{1}{3}}$$

$$\left. \frac{1}{2} \right) = 0$$

$$\left. \frac{1}{2} \right) = 0$$