$f(x) = 2\sin(2x) + 2x$

$[0,4]$

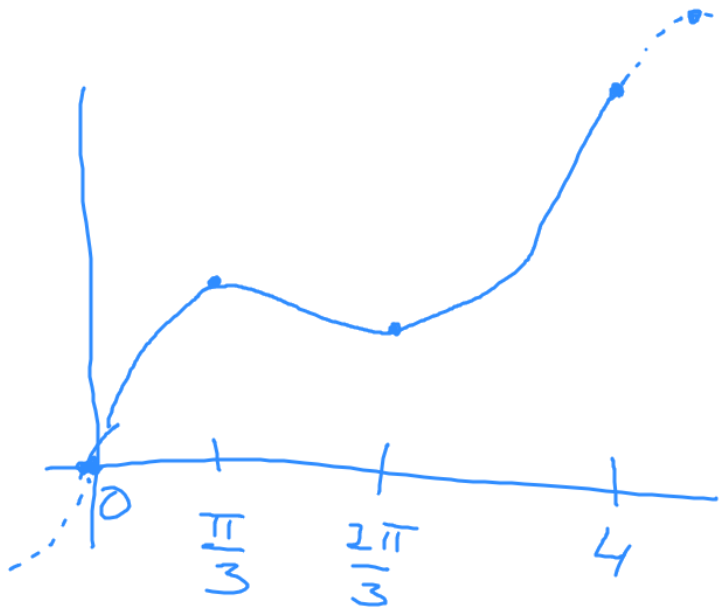
$f'(x) = 4\cos(2x) + 2 = 0$

$$\cos(2x) = -\frac{1}{2}$$

$$2x = \pm\frac{2\pi}{3} + 2k\pi$$

$$x = \pm\frac{\pi}{3} + k\pi$$

$$\frac{\pi}{3}, \quad \frac{2\pi}{3}$$



$$f\left(\frac{\pi}{3}\right) = \sqrt{3} + \frac{2\pi}{3} > f\left(\frac{2\pi}{3}\right) = -\sqrt{3} + \frac{4\pi}{3}$$

$f(x) = x^2 e^{-x}$ $\mathbb{R}$

$\lim_{x \to \infty} f(x) = 0$

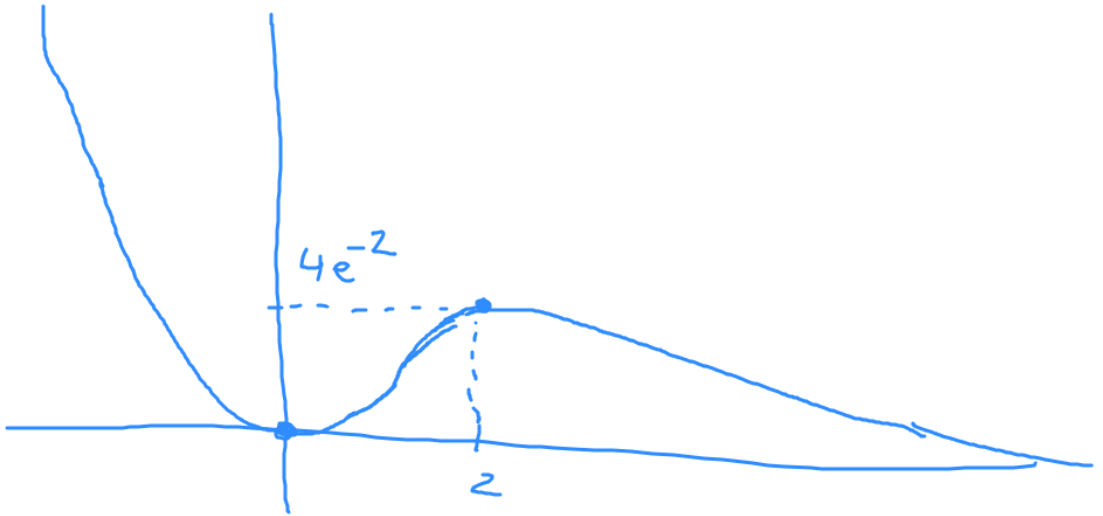
$\lim_{x \to -\infty} f(x) = \infty$

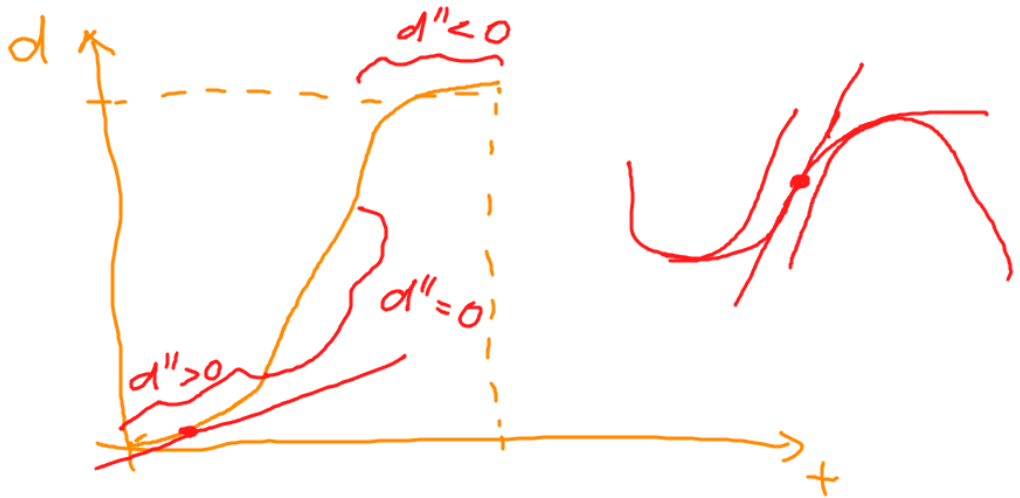
$f'(x) = 2xe^{-x} - x^2 e^{-x} =$

$= x(2-x)e^{-x} = 0$

$x = \begin{cases} 2 \\ 0 \end{cases}$

$f(0) = 0 \qquad f(2) = 4e^{-2} > 0$





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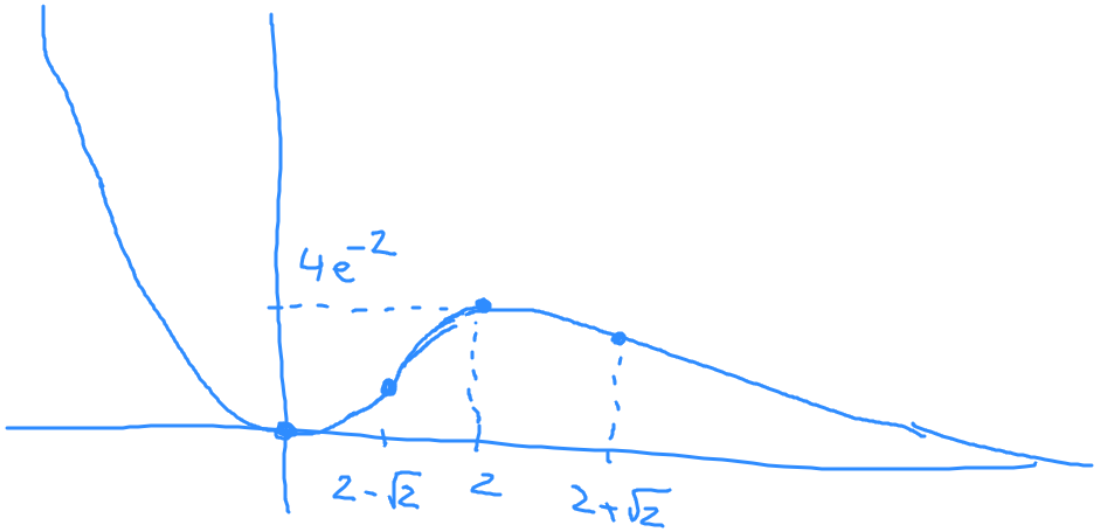


$f''(x) = 2e^{-x} - 2xe^{-x} - 2xe^{-x} + x^2 e^{-x}$

$= (2 - 4x + x^2)e^{-x} = 0$

$x_{12} = \frac{4 \pm \sqrt{16-8}}{2} = 2 \pm \sqrt{2}$

a)

$p = 120000N - 30000N$

$p' = 90000 > 0$

b) $p = 120000\sqrt{N} - 30000N$

$p' = \frac{120000}{2\sqrt{N}} - 30000 = 0$

$\frac{2}{\sqrt{N}} - 1 = 0$

$N = 4$

$p'' = \left(\frac{60\,000}{\sqrt{N}}\right)' = -30\,000\, N^{-\frac{3}{2}} < 0$

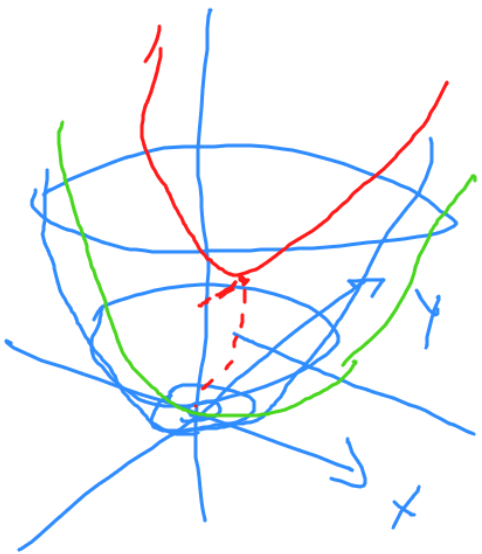
c) $p = 120000\, N^{\frac{3}{5}} - 30\,000N - 200000$

$p' = \frac{3}{5} 120000\, N^{-\frac{2}{5}} - 30000 = 0$

$\frac{12}{5} N^{-\frac{2}{5}} = 1 \qquad N = \frac{28}{25}\sqrt{\frac{3}{5}} \approx 9$

$f_x(x,y) = 2x + 0$

$f(x,y) = x^2 + y^2$



$$C = 2\pi r h \cdot 1 + \pi r^2 2 \cdot 3$$

$$\pi r^2 h = V \Rightarrow h = \frac{V}{\pi r^2}$$

$$C = \frac{2V}{r} + 6\pi r^2$$

$$\frac{dC}{dr} = -\frac{2V}{r^2} + 12\pi r = 0$$

$$2V = 12\pi r^3$$

$$\sqrt[3]{\frac{V}{6\pi}} = r \Rightarrow h = \dots$$