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Mechatronics

$$1) \quad f(x) = e^{-0.5x} (4-x) - 2$$

$$f'(x) = -2e^{-0.5x} + 0.5e^{-0.5x} x$$

$$x_{i+1} = x_i - \frac{e^{-0.5x_i} (4-x_i) - 2}{-2e^{-0.5x_i} + 0.5e^{-0.5x_i} x_i}$$

$$x_1 = \frac{0.5 - e^{-0.5(0.5)} (4-0.5) - 2}{-2e^{-0.5(0.5)} + 0.5e^{-0.5(0.5)} \cdot 0.5}$$

$$= 0.838820606$$

$$\text{err}_1 = \left| \frac{0.838890606 - 0.5}{0.838820606} \right| \times 100 = 40.3974$$

$$x_2 = 0.838890606 - \frac{e^{-0.5(0.838890606)} (4-0.838890606) - 2}{-2e^{-0.5(0.838890606)} + 0.5e^{-0.5(0.838890606)} \cdot 0.838890606}$$

$$= 0.8849559$$

$$\text{err}_2 = \left| \frac{0.8849559424 - 0.838890606}{0.8849559424} \right| \times 100 \Rightarrow 5.205381$$

$$x_3 = 0.8849559424 - \frac{e^{-0.5(0.8849559424)} (4-0.8849559424) - 2}{-2e^{-0.5(0.8849559424)} + 0.5e^{-0.5(0.8849559424)} \cdot 0.8849559424}$$

$$= 0.8857083124$$

$$\text{err}_3 = \left| \frac{0.8857083124 - 0.8849559424}{0.8857083124} \right| \times 100 = 0.08494562866$$

$$x_4 = 0.8857083124 - \frac{e^{-0.5(0.8857083124)} (4-0.8857083124) - 2}{-2e^{-0.5(0.8857083124)} + 0.5e^{-0.5(0.8857083124)} \cdot 0.8857083124}$$

$$= 0.885708802$$

$$\text{err}_4 = \left| \frac{0.885708802 - 0.8857083124}{0.885708802} \right| \times 100$$

$$= 5.522 \times 10^{-5}$$

