

## Assignment 2

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Mechatronics

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### Solution

$$a) f(x) = p^{-0.5x} (4-x) - 2$$

$$f'(x) =$$

$$\text{let } U = p^{-0.5x} \quad V = (4-x)$$

$$dU = -0.5 p^{-0.5x} \quad dV = (-1)$$

$$du = f'(x) = p^{-0.5x} - 0.5 p^{-0.5x} (4-x)$$

$$x_0 = 0.5 \quad \{\text{initial guess}\}$$

$$\text{Newton-Raphson's formula: } x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$$

$$f(x_0) = f(0.5) = 0.7258027407$$

$$f'(x_0) = f'(0.5) = -2.141702153$$

$$\text{root}_1 \Rightarrow x_1 = x_0 - \frac{f(x_0)}{f'(x_0)} = 0.8388906081$$

$$f(x_1) = 0.07814929779$$

$$f'(x_1) = -1.696486032$$

$$\text{root}_2 \Rightarrow x_2 = x_1 - \frac{f(x_1)}{f'(x_1)} = 0.8849360003$$

$$f(x_2) = 1.236575203 \times 10^{-3}$$

$$f'(x_2) = -1.643060762$$

$$\text{root}_3 \Rightarrow x_3 = x_2 - \frac{f(x_2)}{f'(x_2)} = 0.8857086054$$

$$f(x_3) = 3.23583557 \times 10^{-7}$$

$$f'(x_3) = -1.642200929$$

$$\text{root}_4 \Rightarrow x_4 = x_3 - \frac{f(x_3)}{f'(x_3)} = 0.8857088024$$

$$f(x_4) = 7.845 \times 10^{-12}$$

$$f'(x_4) = -1.642200704$$

$$x_5 = x_4 - \frac{f(x_4)}{f'(x_4)} = 0.88570880211$$

$\therefore 0.88508802$  is the root of eqn (1.1)