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DEPARTMENT: PET. ENG.

ASSIGNMENT 2

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

let $u = e^{-0.5x}$ $v = (4-x)$

$du = -0.5e^{-0.5x}$ $dv = -1$

$f'(x) = (-1)e^{-0.5x} + (-0.5e^{-0.5x})(4-x)$

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

Initial guess value $x_0 = 0.5$

Using Newton-Raphson formula

$$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$$

$$f(x_0) = f(0.5) = e^{-0.5(0.5)} (4-0.5)^{-2} = 0.7258027407$$

$$f'(x_0) = f'(0.5) = -e^{-0.5(0.5)} - 0.5e^{-0.5(0.5)}(4-0.5) = -2.141702153$$

$$x_1 = x_0 - \frac{f(x_0)}{f'(x_0)} = 0.5 - \frac{0.7258027407}{-2.141702153} = 0.8388906061$$

$$f(x_1) = f(0.8388906061) = e^{-0.5(0.8388906061)} (4-0.8388906061)^{-2}$$

$$f(x_1) = 0.8849560003$$

$$f'(x_1) = f'(0.8388906061) = -e^{-0.5(0.8388906061)} - 0.5e^{-0.5(0.8388906061)}(4-0.8388906061)$$

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

$$x_2 = x_1 - \frac{f(x_1)}{f'(x_1)} = 0.8849560003$$

$$f(x_2) = 1.236575208 \times 10^{-3}$$

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

$$x_3 = x_2 - \frac{f(x_2)}{f'(x_2)} = 0.885708005$$

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

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

$$x_4 = x_3 - \frac{f(x_3)}{f'(x_3)} = 0.885708802$$

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

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

$$x_5 = x_4 - \frac{f(x_4)}{f'(x_4)} = 0.885708802$$

the values converge, therefore, 0.885708802 is the root of equation (1.1).