

CHEN.3170 Applied Engineering Problem Solving

A Short Quiz on

Finding the Real Roots of Nonlinear Equations

Newton's method for finding roots of nonlinear equations is a 1-point iteration method, where the next estimate of the root is given by

$$x_{i+1} = x_i - \frac{f(x_i)}{f'(x_i)}$$

- a. Starting with the Taylor series for $f(x_{i+1})$ or from a graphical representation, **formally derive** the above formula for updating the next estimate of the root. Explain your logic here.

- b. Use **Newton's Method** to estimate the root of $f(x) = 0$ with $x_1 = 2.0$, where

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

Be systematic and show each of the steps involved. Continue your calculations until $|f(x)| < 0.01$.

Note that specific calculations, not a generic program, are required here. Create a summary table that organizes the intermediate results for each iteration.

Note that my interest here is in evaluating your understanding of the solution methodology, not the specific answer to this root finding problem. Thus, an answer without a clear demonstration of the proper iteration process is not worth much! Be systematic in your work...