

CHAPTER - 4

Quadratic Equations

EE24BTECH11061 - Rohith Sai

EXERCISE : 4.2

4.1) Find the roots of the following equation $2x^2 - x + \frac{1}{8} = 0$

Solution:

First, we simplify the given equation:

$$2x^2 - x + \frac{1}{8} = 0 \quad (1)$$

$$\implies 16x^2 - 8x + 1 = 0 \quad (2)$$

NEWTON'S METHOD

Newton's Method is given by the update formula:

$$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)} \quad (3)$$

where:

$$f(x) = 16x^2 - 8x + 1 \quad \text{and} \quad f'(x) = 32x - 8 \quad (4)$$

The update equation becomes:

$$x_{n+1} = x_n - \frac{16x_n^2 - 8x_n + 1}{32x_n - 8} \quad (5)$$

Using an initial guess $x_0 = 0.5$, we observe that x_n converges at the 18th iteration to:

$$x = 0.25 \quad (6)$$

SECANT METHOD

Alternatively, we can use the Secant Method, which avoids the derivative:

$$x_{n+1} = x_n + f(x_n) \frac{x_n - x_{n-1}}{f(x_n) - f(x_{n-1})} \quad (7)$$

Taking initial guesses $x_0 = 0.5$ and $x_1 = 0.4$, we observe that x_n converges at the 25th iteration to:

$$x = 0.25 \quad (8)$$

The graph below shows the equation and the root of the equation

