# NCERT - 10.4.ex.4

EE224BTECH11044 - Muthyala koushik

## I. QUADRATIC EQUATIONS

**Question:** Find the roots of the quadratic equation $3x^2 - 2\sqrt{6}x + 2 = 0$

**Solution:** The given equation:

$$3x^2 - 2\sqrt{6}x + 2 = 3x^2 - \sqrt{6}x - \sqrt{6}x + 2 \tag{1}$$

$$= \sqrt{3}x\left(\sqrt{3}x - \sqrt{2}\right) - \sqrt{2}\left(\sqrt{3}x - \sqrt{2}\right) \tag{2}$$

$$= \left(\sqrt{3}x - \sqrt{2}\right)\left(\sqrt{3}x - \sqrt{2}\right) \tag{3}$$

So, the roots of the equation are the values of x for which

$$\left(\sqrt{3}x - \sqrt{2}\right)\left(\sqrt{3}x - \sqrt{2}\right) = 0 \tag{4}$$

$$\sqrt{3}x - \sqrt{2} = 0 \tag{5}$$

$$x = \sqrt{\frac{2}{3}} \tag{6}$$

Therefore, the roots of $3x^2 - 2\sqrt{6}x + 2 = 0$ are $\sqrt{\frac{2}{3}},\ \sqrt{\frac{2}{3}}$

**Solution by the method of Fixed point Iteration**

Rearrange the equation to $x = g(x)$

$$x = \frac{1}{3}\left(2\sqrt{6} - \frac{2}{x}\right) \tag{7}$$

This gives the iteration function:

$$g(x) = \frac{1}{3}\left(2\sqrt{6} - \frac{2}{x}\right) \tag{8}$$

Iteration: Use the formula repeatedly:

$$x_{n+1} = \frac{1}{3}\left(2\sqrt{6} - \frac{2}{x_n}\right) \tag{9}$$

Stop when $|x_{n+1} - x_n| < \epsilon$

Root: 0.8173993362392574, Iterations: 900

Actual Root:0.81649658092

**Solution by the Newton-Raphson method:** we have;

$$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)} \tag{10}$$

$$x_{n+1} = x_n - \frac{3x^2 - 2\sqrt{6}x + 2}{6x - 2\sqrt{6}x} \tag{11}$$

Iterating and updating the value of $x_n$, we can obtain the roots of the quadratic equation.

Newton-Raphson Root: 0.8164972809158475, Iterations: 18

Actual Root:0.81649658092

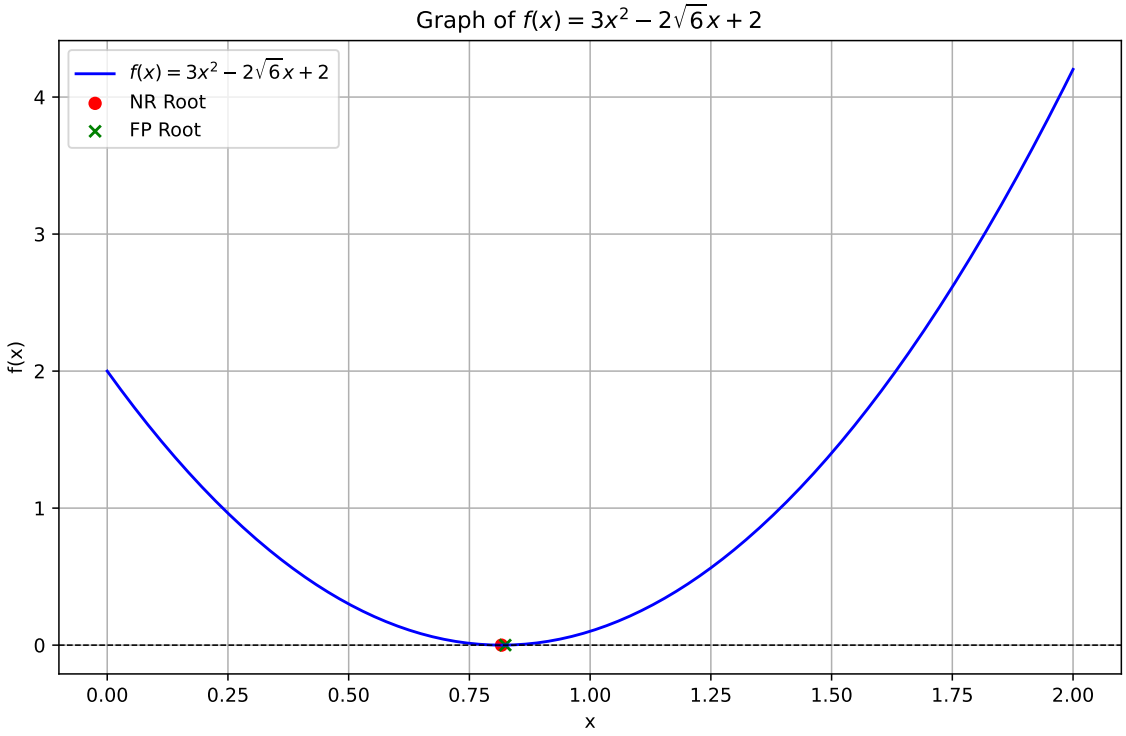


Fig. 0. Solution of given DE