

10.4.4.4

EE24BTECH11029 - J SHRETHAN REDDY

Question: Is the following situation possible? If so, determine their present ages. The sum of the ages of two friends is 20 years. Four years ago, the product of their ages in years was 48.

Solution

Lets take present age of two friends as x, y

$$x + y = 20 \quad (0.1)$$

$$y = 20 - x \quad (0.2)$$

$$(x - 4)(y - 4) = 48 \quad (0.3)$$

equation (0.2) in (0.3)

$$(x - 4)(16 - x) = 48 \quad (0.4)$$

$$16x - x^2 - 64 + 4x = 48 \quad (0.5)$$

$$x^2 - 20x + 112 = 0 \quad (0.6)$$

we get roots are

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \quad (0.7)$$

$$= \frac{20 \pm \sqrt{400 - 448}}{2} \quad (0.8)$$

$$= 10 \pm 2\sqrt{3}j \quad (0.9)$$

Computational Solution

Newton-Raphson iterative method:

$$f(x) = x^2 - 20x + 112 \quad (0.10)$$

$$f'(x) = 2x - 20 \quad (0.11)$$

Difference equation,

$$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)} \quad (0.12)$$

$$x_{n+1} = x_n - \frac{x_n^2 - 20x_n + 112}{2x_n - 20} \quad (0.13)$$

$$x_{n+1} = \frac{x_n^2 - 112}{2x_n - 20} \quad (0.14)$$

Picking two initial guesses,

$$x_0 = 0 + i \text{ converges to } 0.0 + 3.464101615137755j \quad (0.15)$$

$$x_0 = 0 - i \text{ converges to } 0.0 - 3.464101615137755j \quad (0.16)$$