

ASSIGNMENT 4

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Download all python codes from

<https://github.com/Y.Nagarano/Assignment4/tree/main/codes>

and latex-tikz codes from

<https://github.com/Y.Nagaranj/Assignment4/tree/main/Assignment4>

1 QUESTION No 2.19(QUAD FORMS)

Find the zeroes of the quadratic polynomial $x^2 - 3$ and verify the relationship between the zeros and coefficients.

2 SOLUTION

1) The vector form of equation is

$$y = x^2 - 3 \quad (2.0.1)$$

$$\mathbf{x}^T \begin{pmatrix} 1 & 0 \\ 0 & 0 \end{pmatrix} \mathbf{x} + \begin{pmatrix} 0 & 0 \end{pmatrix} \mathbf{x} - 3 = 0 \quad (2.0.2)$$

Thus

$$y = 0 \implies x^2 - 3 = 0 \quad (2.0.3)$$

$$x = \sqrt{3} \quad (2.0.4)$$

The roots are $\alpha = \sqrt{3}$ and $\beta = -\sqrt{3}$.

Compare given quadratic equation $x^2 - 3 = 0$ with $ux^2 + vx + f = 0$, we get

$u=1$, $v=0$, $f=-3$.

Sum of the roots

$$\alpha + \beta = \frac{-v}{u} = 0 \quad (2.0.5)$$

product of the roots

$$\alpha\beta = \frac{f}{u} = -3 \quad (2.0.6)$$

where u, v, f are parameters.

For $\mathbf{x} = \begin{pmatrix} \sqrt{3} \\ 0 \end{pmatrix}$ substitute in (2.0.2)

$$\begin{pmatrix} \sqrt{3} & 0 \end{pmatrix} \begin{pmatrix} 1 & 0 \\ 0 & 0 \end{pmatrix} \begin{pmatrix} \sqrt{3} \\ 0 \end{pmatrix} - 3 = 0 \quad (2.0.7)$$

For $\mathbf{x} = \begin{pmatrix} -\sqrt{3} \\ 0 \end{pmatrix}$ substitute in (2.0.2)

$$\begin{pmatrix} -\sqrt{3} & 0 \end{pmatrix} \begin{pmatrix} 1 & 0 \\ 0 & 0 \end{pmatrix} \begin{pmatrix} -\sqrt{3} \\ 0 \end{pmatrix} - 3 = 0 \quad (2.0.8)$$

Hence, $+\sqrt{3}$ and $-\sqrt{3}$ are zeros, which can be verified by figure

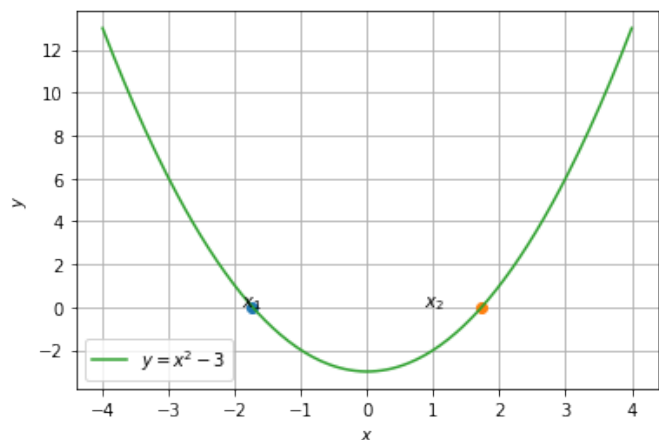


Fig. 2.1: roots of $x^2 - 3$.