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) For a general polynomial equation of degree 2.

$$p(x,y) = Ax^2 + Bxy + cy^2 + Dx + Ey + F = 0 \tag{2.0.1}$$

The vector form is

$$\mathbf{x}^T \begin{pmatrix} A & \frac{B}{2} \\ \frac{B}{2} & C \end{pmatrix} + \begin{pmatrix} D & E \end{pmatrix} \mathbf{x} + F = 0 \tag{2.0.2}$$

$$\mathbf{x}^T \begin{pmatrix} 1 & 0 \\ 0 & 0 \end{pmatrix} \mathbf{x} + \begin{pmatrix} 0 & 0 \end{pmatrix} \mathbf{x} - 3 = 0 \tag{2.0.3}$$

Thus

$$y = 0 \implies x^2 - 3 = 0 \tag{2.0.4}$$

For $\mathbf{x} = \begin{pmatrix} \sqrt{3} \\ 0 \end{pmatrix}$

$$\begin{pmatrix} \sqrt{3} & 0 \end{pmatrix} \begin{pmatrix} 1 & 0 \\ 0 & 0 \end{pmatrix} \begin{pmatrix} \sqrt{3} \\ 0 \end{pmatrix} + \begin{pmatrix} 0 & 0 \end{pmatrix} \begin{pmatrix} \sqrt{3} \\ 0 \end{pmatrix} - 3 = 0 \tag{2.0.5}$$

For $\mathbf{x} = \begin{pmatrix} -\sqrt{3} \\ 0 \end{pmatrix}$

$$\begin{pmatrix} -\sqrt{3} & 0 \end{pmatrix} \begin{pmatrix} 1 & 0 \\ 0 & 0 \end{pmatrix} \begin{pmatrix} -\sqrt{3} \\ 0 \end{pmatrix} + \begin{pmatrix} 0 & 0 \end{pmatrix} \begin{pmatrix} -\sqrt{3} \\ 0 \end{pmatrix} - 3 = 0 \tag{2.0.6}$$

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

Verifying the relationship between the zero's and the coefficients .

The roots of given quadratic equation is $\sqrt{3}$ and $-\sqrt{3}$.

$x^2 - 3 = 0$ compare with $vx^2 + ux + f = 0$. Where u ,v , f are parameters. v = 1 , u = 0 , f = -3

Sum of the roots

$$\alpha + \beta = \frac{-u}{v} = 0 \tag{2.0.7}$$

Product of the roots

$$\alpha\beta = \frac{f}{v} = -3 \tag{2.0.8}$$

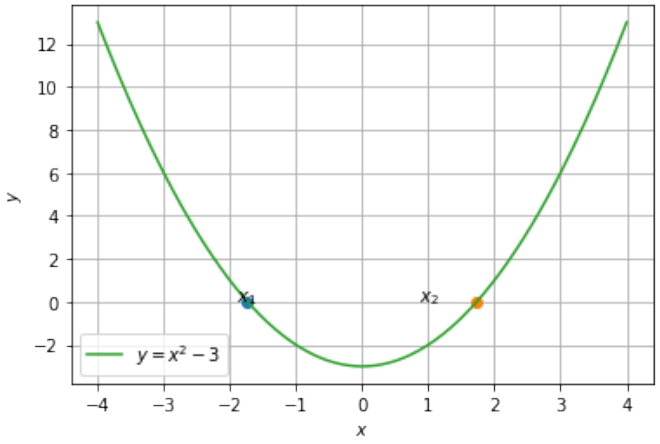

Fig. 2.1: roots of $x^2 - 3$.