Assignment 5

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Download all python codes from

https://github.com/srikaran-p/EE3900/tree/main/Assignment5/codes

Download all latex codes from

https://github.com/srikaran-p/EE3900/tree/main/Assignment5

Problem

(Quadratic Forms Q2.19) Find the roots of $4x^2 + 3x + 5 = 0$.

Solution

The given equation can be written as,

$$\mathbf{x}^T \begin{pmatrix} 4 & 0 \\ 0 & 0 \end{pmatrix} \mathbf{x} + \begin{pmatrix} 3 & 0 \end{pmatrix} \mathbf{x} + 5 = 0 \tag{0.0.1}$$

where,

$$\mathbf{x} = \begin{pmatrix} x \\ 0 \end{pmatrix} \tag{0.0.2}$$

Substituting (0.0.2) in (0.0.1),

$$\begin{pmatrix} x \\ 0 \end{pmatrix}^T \begin{pmatrix} 4 & 0 \\ 0 & 0 \end{pmatrix} \begin{pmatrix} x \\ 0 \end{pmatrix} + \begin{pmatrix} 3 & 0 \end{pmatrix} \begin{pmatrix} x \\ 0 \end{pmatrix} + 5 = 0 \tag{0.0.3}$$

$$\implies 4x^2 + 3x + 5 = 0 \tag{0.0.4}$$

$$\implies \left(x - \begin{pmatrix} \frac{-3}{8} \\ \frac{\sqrt{71}}{8} \end{pmatrix}\right)\left(x - \begin{pmatrix} \frac{-3}{8} \\ \frac{-\sqrt{71}}{8} \end{pmatrix}\right) = 0 \tag{0.0.5}$$

$$\implies x = \begin{pmatrix} \frac{-3}{8} \\ \frac{\sqrt{71}}{8} \end{pmatrix}, \begin{pmatrix} \frac{-3}{8} \\ \frac{-\sqrt{71}}{8} \end{pmatrix} \tag{0.0.6}$$

From the figure, we can see that the function does not cross the x-axis, so, the quadratic equation has no real roots. The roots which we got are complex roots.

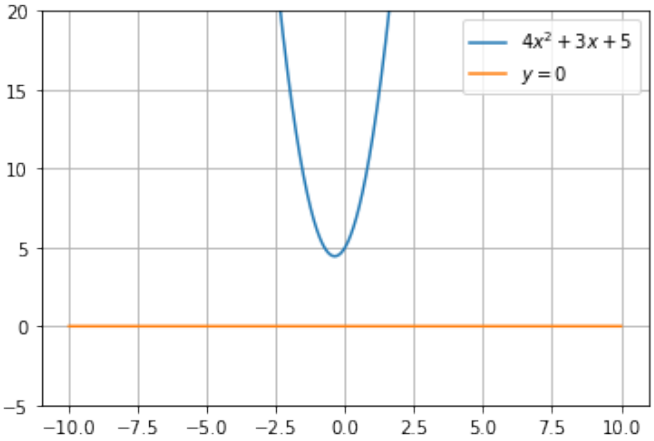

Fig. 0: Plot of the function