

Assignment 5

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Download all python codes from

<https://github.com/tanmaygoyal258/EE3900-Linear-Systems-and-Signal-processing/blob/main/Assignment5/code.py>

Download all latex codes from

<https://github.com/tanmaygoyal258/EE3900-Linear-Systems-and-Signal-processing/blob/main/Assignment5/main.tex>

1 PROBLEM

(Quadratic Forms/Q.2.23) Solve $\sqrt{5}x^2 + x + \sqrt{5} = 0$

2 SOLUTION

Let $y = \sqrt{5}x^2 + x + \sqrt{5} = 0$.

Then, y can be represented in the vector form as:

$$y = \mathbf{x}^T \begin{pmatrix} \sqrt{5} & 0 \\ 0 & 0 \end{pmatrix} \mathbf{x} + (1 \ 0) \mathbf{x} + \sqrt{5} \quad (2.0.1)$$

where

$$\mathbf{x} = \begin{pmatrix} x \\ 0 \end{pmatrix} \quad (2.0.2)$$

Substituting $y = 0$, we get:

$$\mathbf{x}^T \begin{pmatrix} \sqrt{5} & 0 \\ 0 & 0 \end{pmatrix} \mathbf{x} + (1 \ 0) \mathbf{x} + \sqrt{5} = 0 \quad (2.0.3)$$

$$\sqrt{5}x^2 + x + \sqrt{5} = 0 \quad (2.0.4)$$

$$\left(x - \left(\frac{-1}{2\sqrt{5}} \right) \right) \left(x - \left(\frac{-1}{2\sqrt{5}} \right) \right) = 0 \quad (2.0.5)$$

$$x = \left(\frac{-1}{2\sqrt{5}} \right), \left(\frac{-1}{2\sqrt{5}} \right) \quad (2.0.6)$$

$$x = \begin{pmatrix} -0.223 \\ 0.974 \end{pmatrix}, \begin{pmatrix} -0.223 \\ -0.974 \end{pmatrix} \quad (2.0.7)$$

The roots can be verified using the python code. As we can see from the graph, $\sqrt{5}x^2 + x + \sqrt{5} = 0$ does not intersect the x-axis anywhere, and hence has no real roots.

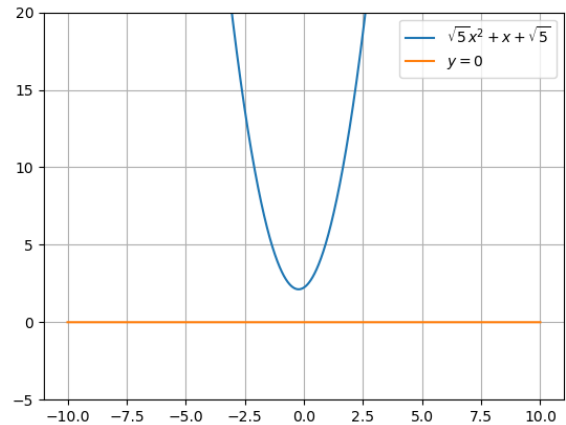


Fig. 0: Graph of $\sqrt{5}x^2 + x + \sqrt{5} = 0$