

ASSIGNMENT 3

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Download all python codes from

<https://github.com/Dishank422/EE3900/blob/main/assignment3/codes>

and latex-tikz codes from

<https://github.com/Dishank422/EE3900/blob/main/assignment3/Assignment3.tex>

1 CONSTRUCTIONS Q2.4

Construct a quadrilateral ABCD such that BC = 4.5, AC = 5.5, CD = 5, BD = 7 and AD = 5.5.

2 SOLUTION

Lemma 2.1. For quadrilateral ABCD with length of three sides(PQ, QR, RS) and two diagonals(PR, QS) given, the following co-ordinates sufficiently represent the quadrilateral:

$$\mathbf{P} = \begin{pmatrix} p_1 \\ p_2 \end{pmatrix} \quad (2.0.1)$$

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

$$\mathbf{R} = \begin{pmatrix} QR \\ 0 \end{pmatrix} \quad (2.0.3)$$

$$\mathbf{S} = \begin{pmatrix} s_1 \\ s_2 \end{pmatrix} \quad (2.0.4)$$

$$\text{where } p_1 = \frac{PQ^2 + QR^2 - PR^2}{2 \times QR} \quad (2.0.5)$$

$$p_2 = \sqrt{(PQ^2 - p_1^2)} \quad (2.0.6)$$

$$s_1 = \frac{SQ^2 + QR^2 - SR^2}{2 \times QR} \quad (2.0.7)$$

$$s_2 = \sqrt{(SQ^2 - s_1^2)} \quad (2.0.8)$$

Proof.

$$\text{Let } \mathbf{Q} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \mathbf{R} = \begin{pmatrix} QR \\ 0 \end{pmatrix} \quad (2.0.9)$$

$$\mathbf{P} = \begin{pmatrix} p_1 \\ p_2 \end{pmatrix}, \mathbf{S} = \begin{pmatrix} s_1 \\ s_2 \end{pmatrix} \quad (2.0.10)$$

Using results from problem 1.3 from the manual,

$$p_1 = \frac{PQ^2 + QR^2 - PR^2}{2 \times QR} \quad (2.0.11)$$

$$p_2 = \sqrt{(PQ^2 - p_1^2)} \quad (2.0.12)$$

$$s_1 = \frac{SQ^2 + QR^2 - SR^2}{2 \times QR} \quad (2.0.13)$$

$$s_2 = \sqrt{(SQ^2 - s_1^2)} \quad (2.0.14)$$

□

In our problem, **C** and **D** correspond to **Q** and **R** in the lemma.

$$\Rightarrow \mathbf{B} = \begin{pmatrix} -0.375 \\ 4.48 \end{pmatrix} \quad (2.0.15)$$

$$\mathbf{C} = \begin{pmatrix} 0 \\ 0 \end{pmatrix} \quad (2.0.16)$$

$$\mathbf{D} = \begin{pmatrix} 5 \\ 0 \end{pmatrix} \quad (2.0.17)$$

$$\mathbf{A} = \begin{pmatrix} 2.5 \\ 4.9 \end{pmatrix} \quad (2.0.18)$$

Note: Computations for the above can be found in codes/AB.py

Using the co-ordinates of the vertices as found, the following quadrilateral is plotted.

