

BASICS OF PROGRAMMING

ASSIGNMENT - 1

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CHAPTER II EX-II Q.9-II

Find the Area of Quadrilateral when four points are given

$$\mathbf{P} = \begin{pmatrix} 2 \\ 1 \end{pmatrix}, \mathbf{Q} = \begin{pmatrix} 3 \\ 5 \end{pmatrix}, \mathbf{R} = \begin{pmatrix} -3 \\ 4 \end{pmatrix}, \mathbf{S} = \begin{pmatrix} -2 \\ -2 \end{pmatrix} \quad (1)$$

SOLUTION

Area of a Quadrilateral PQRS=

$$\text{Area}(\triangle PQR) + \text{Area}(\triangle PRS) = \quad (2)$$

$$\frac{1}{2} \|(\mathbf{Q} - \mathbf{P}) \times (\mathbf{Q} - \mathbf{R})\| + \frac{1}{2} \|(\mathbf{S} - \mathbf{P}) \times (\mathbf{S} - \mathbf{R})\| \quad (3)$$

For two vectors

$$\mathbf{a} = \begin{pmatrix} a_1 \\ a_2 \end{pmatrix}, \mathbf{b} = \begin{pmatrix} b_1 \\ b_2 \end{pmatrix} \quad (4)$$

$$\|\mathbf{a} \times \mathbf{b}\| = |a_1 b_2 - a_2 b_1| \quad (5)$$

$$\mathbf{Q} - \mathbf{P} = \begin{pmatrix} 1 \\ 4 \end{pmatrix} \quad (6)$$

$$\mathbf{Q} - \mathbf{R} = \begin{pmatrix} 6 \\ 1 \end{pmatrix} \quad (7)$$

$$\mathbf{S} - \mathbf{P} = \begin{pmatrix} -4 \\ -3 \end{pmatrix} \quad (8)$$

$$\mathbf{S} - \mathbf{R} = \begin{pmatrix} 1 \\ -6 \end{pmatrix} \quad (9)$$

Using equation (5)

$$\frac{1}{2} \|(\mathbf{Q} - \mathbf{P}) \times (\mathbf{Q} - \mathbf{R})\| = \frac{1}{2} |(-23)| = 11.5 \quad (10)$$

$$\frac{1}{2} \|(\mathbf{S} - \mathbf{P}) \times (\mathbf{S} - \mathbf{R})\| = \frac{1}{2} |(27)| = 13.5 \quad (11)$$

Substituting values from eq (10) and (11) in equation (3), We get

$$\text{Area} = 11.5 + 13.5 \quad (12)$$

$$= 25 \text{sq.units} \quad (13)$$

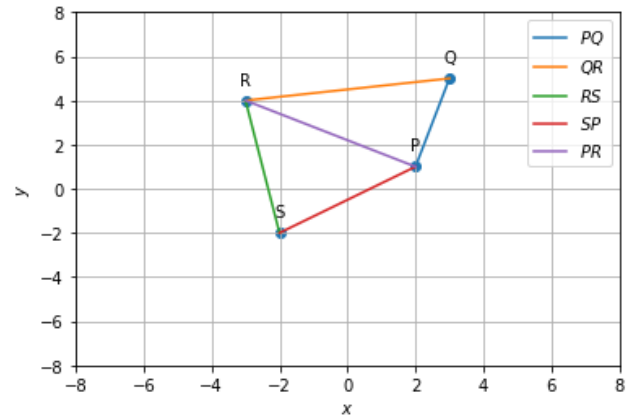


Fig. 0: Quadrilateral PQRS