Assignment - 1

LAKSHMI GAYATHRI GUDIPUDI - SM21MTECH11001

PROBLEM

Find the Area of Quadrilateral when four points are given

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

SOLUTION

Area of a Quadrilateral PQRS is

$$Area(\Delta PQR) + Area(\Delta PRS) \tag{2}$$

$$Area(\Delta PQR) = \frac{1}{2}\left[|(\mathbf{Q}-\mathbf{P})\mathbf{x}(\mathbf{Q}-\mathbf{R})]\right| \tag{3}$$

For two vectors a=$\begin{pmatrix}a1\\a2\end{pmatrix}$ and b=$\begin{pmatrix}b1\\b2\end{pmatrix}$

$$[|\mathbf{axb}]| = |a1b2 - a2b1| \tag{4}$$

$$Q - P = \begin{pmatrix}1\\4\end{pmatrix}$$

$$Q - R = \begin{pmatrix}6\\1\end{pmatrix}$$

$$Using Area(\Delta PQR) = \frac{1}{2}\left[|(\mathbf{Q}-\mathbf{P})\mathbf{x}(\mathbf{Q}-\mathbf{R})]\right| \tag{5}$$

$$= \frac{1}{2}|(-23)| \tag{6}$$

Similarly

$$Areaof(\Delta PRS) = \frac{1}{2}\left[|(\mathbf{S}-\mathbf{P})\mathbf{x}(\mathbf{S}-\mathbf{R})]\right| \tag{7}$$

$$S - P = \begin{pmatrix}-4\\-3\end{pmatrix}$$

$$S - R = \begin{pmatrix}1\\-6\end{pmatrix}$$

$$Using Areaof(\Delta PRS) = \frac{1}{2}\left[|(\mathbf{S}-\mathbf{P})\mathbf{x}(\mathbf{S}-\mathbf{R})|\right] = \frac{1}{2}|(27)| \tag{8}$$

So total area of Quadrilateral PQRS is

$$Area(\Delta PQR) + Area(\Delta PRS) \tag{9}$$

$$= \frac{1}{2}|(-23)| + \frac{1}{2}|(27)| \tag{10}$$

$$= (23 + 27)/2 \tag{11}$$

$$= 25 sq.units \tag{12}$$

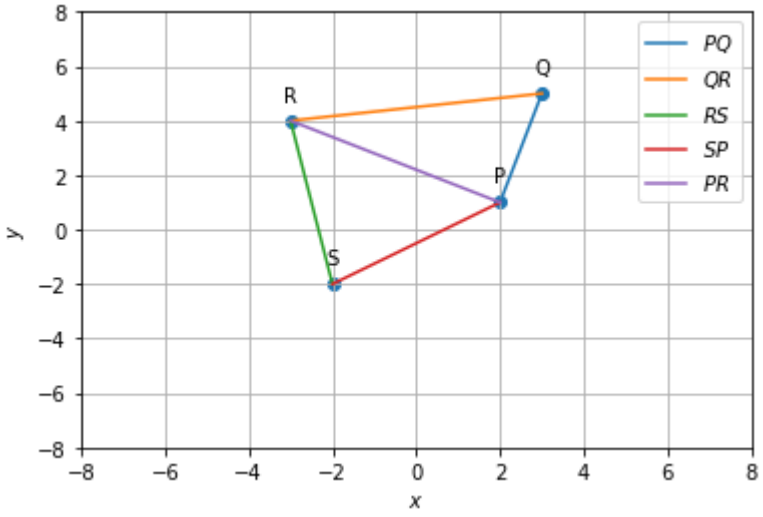

Fig. 1. Quadrilateral PQRS