Line Assignment

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Problem Statement **- Let PS be the median of the triangle with vertices P(2, 2), Q(6,-1) and R(7, 3). The equation of the line passing through (1,-1) and parallel to PS is :**

Solution

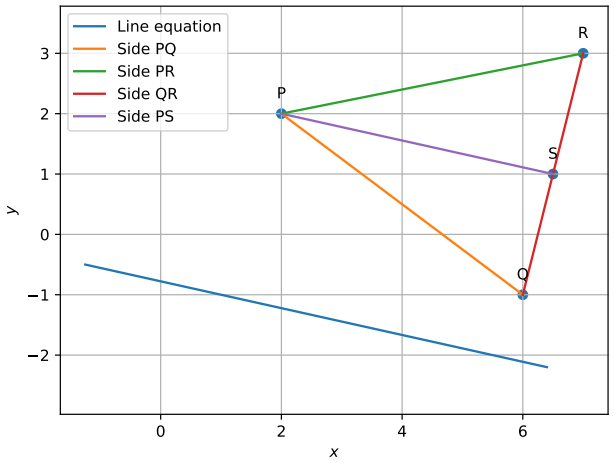

Figure 1:

Construction

The input parameters of figure

Symbol	value	Description
P	(2,2)	Point P in ΔPQR
Q	(6,-1)	Point Q in ΔPQR
R	(7,3)	Point R in ΔPQR
S	(13/2,1)	median of ΔPQR
A	(1,-1)	Point on the line equation

Table 1:

Proof:

Given vector points of ΔPQR

$$\mathbf{P} = \begin{pmatrix} 2 \\ 2 \end{pmatrix}, \mathbf{Q} = \begin{pmatrix} 6 \\ -1 \end{pmatrix}, \mathbf{R} = \begin{pmatrix} 7 \\ 3 \end{pmatrix} \tag{1}$$

PS is the median of ΔPQR . So **S** is the midpoint between vector points **Q** and **R** .

$$\mathbf{S} = \frac{\mathbf{Q} + \mathbf{R}}{2}$$

$$\mathbf{S} = \frac{\begin{pmatrix} 6 \\ -1 \end{pmatrix} + \begin{pmatrix} 7 \\ 3 \end{pmatrix}}{2}$$

$$\mathbf{S} = \begin{pmatrix} 6.5 \\ 1 \end{pmatrix} \tag{2}$$

Directional vector **m** between vector points **P** and **S**

$$\mathbf{m} = \mathbf{S} - \mathbf{P}$$

$$\mathbf{m} = \begin{pmatrix} 6.5 \\ 1 \end{pmatrix} - \begin{pmatrix} 2 \\ 2 \end{pmatrix}$$

$$\mathbf{m} = \begin{pmatrix} 4.5 \\ -1 \end{pmatrix} \tag{3}$$

Normal vector of this directional vector is

$$\mathbf{n} = \begin{pmatrix} 1 \\ 4.5 \end{pmatrix} \tag{4}$$

The required line is parallel to vector **PS** and passes through the vector point $\mathbf{A} = \begin{pmatrix} 1 \\ -1 \end{pmatrix}$

$$\mathbf{n^T}(\mathbf{X} - \mathbf{P}) = 0$$

$$(1\ 4.5)\left(\begin{pmatrix} x \\ y \end{pmatrix} - \begin{pmatrix} 1 \\ -1 \end{pmatrix}\right) = 0$$

$$(1\ 4.5)\begin{pmatrix} x \\ y \end{pmatrix} = -3.5 \tag{5}$$