4.13.38

Kavin B-EE25BTECH11033

September 08,2025

Question

Let PS be the median of the triangle with vertices $\mathbf{P}(2,2)$, $\mathbf{Q}(6,-1)$ and $\mathbf{R}(7,3)$. The equation of the line passing through $(1,-1)$ and parallel to PS is 2

1. $4x + 7y + 3 = 0$
2. $2x - 9y - 11 = 0$
3. $4x - 7y - 11 = 0$
4. $2x + 9y + 7 = 0$

Theoretical Solution

Given the points,

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

$\mathbf{S}$ is the midpoint of the line segment joining points $\mathbf{Q}$ and $\mathbf{R}$.
If $\mathbf{S}$ divides QR in the ratio $k : 1$,

Formulae

Section formula for a vector $\mathbf{S}$ which divides the line formed by vectors $\mathbf{Q}$ and $\mathbf{R}$ in the ratio $k : 1$ is given by

$$\mathbf{S} = \frac{k\mathbf{R} + \mathbf{Q}}{k+1} \tag{2}$$

where,

$$k = 1 \tag{3}$$

$$\mathbf{S} = \frac{\mathbf{R} + \mathbf{Q}}{2} \tag{4}$$

$$\implies \mathbf{S} = \begin{pmatrix} 13/2 \\ 1 \end{pmatrix} \tag{5}$$

The direction vector of line PS is given by,

$$\mathbf{m} = \mathbf{S} - \mathbf{P} \equiv \begin{pmatrix} 9/2 \\ -1 \end{pmatrix} \tag{6}$$

Therefore, the normal vector of the desired line is given by,

$$\mathbf{n} = \begin{pmatrix} 1 \\ 9/2 \end{pmatrix} \tag{7}$$

Theoretical Solution

$\therefore$ The equation of the line passing through $\begin{pmatrix} 1 \\ -1 \end{pmatrix}$ and parallel to PS is given by

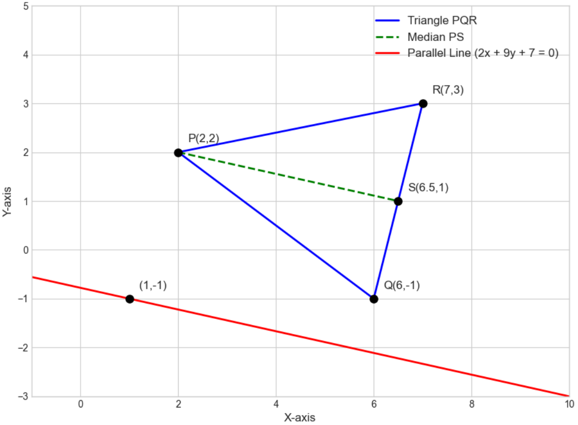
$$\mathbf{n}^\top \left(\mathbf{x} - \begin{pmatrix} 1 \\ -1 \end{pmatrix} \right) = 0 \tag{8}$$

$$\begin{pmatrix} 1 & 9/2 \end{pmatrix} \begin{pmatrix} x - 1 \\ y + 1 \end{pmatrix} = 0 \tag{9}$$

$$\implies x - 1 + \frac{9}{2}(y + 1) = 0 \tag{10}$$

$$\implies 2x + 9y + 7 = 0 \tag{11}$$

Plot



Triangle PQR
Median PS
Parallel Line (2x + 9y + 7 = 0)
R(7,3)
P(2,2)
S(6.5,1)
(1,-1)
Q(6,-1)
X-axis
Y-axis
0
2
4
6
8
10
5
4
3
2
1
0
−1
−2
−3