

4.13.38

Kavin B-EE25BTECH11033

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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,

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

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

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

$$\mathbf{S} = \frac{k\mathbf{R} + \mathbf{Q}}{k + 1} \quad (2)$$

Theoretical Solution

where,

$$k = 1 \quad (3)$$

$$\mathbf{S} = \frac{\mathbf{R} + \mathbf{Q}}{2} \quad (4)$$

$$\Rightarrow \mathbf{S} = \begin{pmatrix} 13/2 \\ 1 \end{pmatrix} \quad (5)$$

The direction vector of line PS is given by,

$$\mathbf{d} = \mathbf{S} - \mathbf{P} \equiv \begin{pmatrix} 9/2 \\ -1 \end{pmatrix} \quad (6)$$

Theoretical Solution

The slope of the line is given by,

$$\mathbf{m} = \begin{pmatrix} 1 \\ \mathbf{d} \end{pmatrix} = \begin{pmatrix} -1 \\ 9/2 \end{pmatrix} \quad (7)$$

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

$$\mathbf{n} = \begin{pmatrix} \mathbf{m} \\ -1 \end{pmatrix} \quad (8)$$

$$\implies \mathbf{n} = \begin{pmatrix} 1 \\ 9/2 \end{pmatrix} \quad (9)$$

Theoretical Solution

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

$$\mathbf{n}^\top \left(\mathbf{x} - \begin{pmatrix} 1 \\ -1 \end{pmatrix} \right) = 0 \quad (10)$$

$$\begin{pmatrix} 1 & 9/2 \end{pmatrix} \begin{pmatrix} x-1 \\ y+1 \end{pmatrix} = 0 \quad (11)$$

$$\implies x - 1 + \frac{9}{2}(y + 1) = 0 \quad (12)$$

$$\implies 2x + 9y + 7 = 0 \quad (13)$$

Plot

