Assignment 3

Teja Vardhan Shannu

August 2024

Problem Statement

A line intersects the Y-axis and the X-axis at the points $P\,(0, b)$ and $Q\,(c, 0)$ respectively. If $(2, -5)$ is the midpoint of PQ, find the coordinates of P and Q.

Problem Data

Point	**Coordinates**
P	$\begin{pmatrix} 0 \\ b \end{pmatrix}$
Q	$\begin{pmatrix} c \\ 0 \end{pmatrix}$
M	$\begin{pmatrix} 2 \\ -5 \end{pmatrix}$

Midpoint Formula

Let the coordinates of points P and Q be:

$$\mathbf{P} = \begin{pmatrix} 0 \\ b \end{pmatrix}, \quad \mathbf{Q} = \begin{pmatrix} c \\ 0 \end{pmatrix}$$

The midpoint M is given by:

$$\mathbf{M} = \begin{pmatrix} 2 \\ -5 \end{pmatrix}$$

The midpoint formula states:

$$\mathbf{M} = \frac{1}{2}(\mathbf{P} + \mathbf{Q})$$

Applying the Midpoint Formula

Substitute **P**, **Q**, and **M**:

$$\frac{1}{2}\left(\begin{pmatrix}0\\b\end{pmatrix}+\begin{pmatrix}c\\0\end{pmatrix}\right)=\begin{pmatrix}2\\-5\end{pmatrix}$$

Simplify to get:

$$\frac{1}{2}\begin{pmatrix}c\\b\end{pmatrix}=\begin{pmatrix}2\\-5\end{pmatrix}$$

Multiplying both sides by 2:

$$\begin{pmatrix}c\\b\end{pmatrix}=\begin{pmatrix}4\\-10\end{pmatrix}$$

Final Answer

Thus, the coordinates of P and Q are:

$$\mathbf{P} = \begin{pmatrix} 0 \\ -10 \end{pmatrix}, \quad \mathbf{Q} = \begin{pmatrix} 4 \\ 0 \end{pmatrix}$$

Graphical Representation