

12.277

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Question : Two points $(4, p)$ and $(0, q)$ lie on a straight line having a slope of $3/4$. Find the value of $p - q$.

Solution :

| Points | Value |
|----------|--|
| A | $\begin{pmatrix} 4 \\ p \end{pmatrix}$ |
| B | $\begin{pmatrix} 0 \\ q \end{pmatrix}$ |

Table : Points

Let the equation of the line be

$$\mathbf{n}^\top \mathbf{x} = 1 \quad (1)$$

A and **B** lie on the Line

$$\mathbf{n}^\top \mathbf{A} = 1 \quad (2)$$

$$\mathbf{n}^\top \mathbf{B} = 1 \quad (3)$$

Stacking gives

$$\begin{pmatrix} \mathbf{A} & \mathbf{B} \end{pmatrix}^\top \mathbf{n} = \begin{pmatrix} 1 \\ 1 \end{pmatrix} \quad (4)$$

$$\begin{pmatrix} 4 & p \\ 0 & q \end{pmatrix} \mathbf{n} = \begin{pmatrix} 1 \\ 1 \end{pmatrix} \quad (5)$$

Using back substitution we get \mathbf{n} as

$$\mathbf{n} = \begin{pmatrix} \frac{q-p}{4q} \\ \frac{1}{q} \end{pmatrix} = \begin{pmatrix} \frac{q-p}{4} \\ 1 \end{pmatrix} \quad (6)$$

As the value of the slope of line is given in the question , we can write the normal vector as :

$$\mathbf{n} = \begin{pmatrix} -\frac{3}{4} \\ 1 \end{pmatrix} = \begin{pmatrix} \frac{q-p}{4} \\ 1 \end{pmatrix} \quad (7)$$

From the above equation we get :

$$p - q = 3 \quad (8)$$

Answer: $p - q = 3$

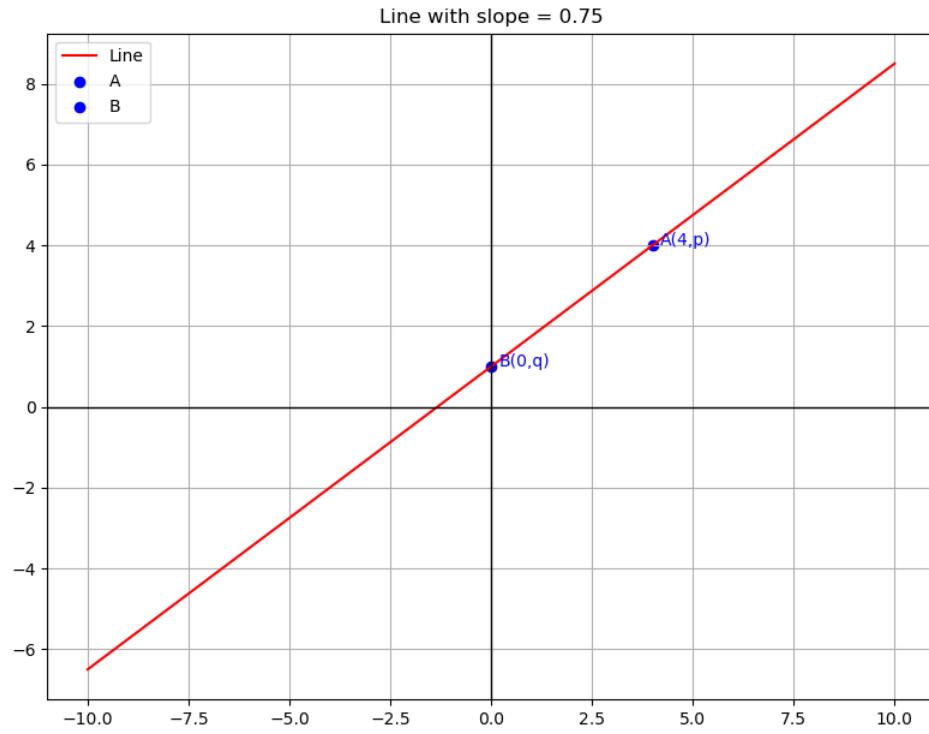


Fig : Line