5.8.3

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Question

5 pencils and 7 pens together cost ₹50, whereas 7 pencils and 5 pens together cost ₹46. Find the cost of one pencil and that of one pen.

Solution

Let the cost of one pencil be x and the cost of one pen be y (both in rupees). From the first statement, 5 pencils and 7 pens cost ₹50:

$$5x + 7y = 50$$

From the second statement, 7 pencils and 5 pens cost ₹46:

$$7x + 5y = 46$$

Thus, the word problem is converted into a system of linear equations:

$$\begin{cases} 5x + 7y = 50 \\ 7x + 5y = 46 \end{cases}$$

Forming the augmented matrix,

$$\left(\begin{array}{cc|c} 5 & 7 & 50 \\ 7 & 5 & 46 \end{array}\right)$$

Perform row operations to reduce to row echelon form:

$$\left(\begin{array}{cc|c} 5 & 7 & 50 \\ 7 & 5 & 46 \end{array}\right) \xrightarrow{R_2 \to R_2 - \frac{7}{5}R_1} \left(\begin{array}{cc|c} 5 & 7 & 50 \\ 0 & -4.8 & -24 \end{array}\right)$$

From the second row:

$$-4.8y = -24 \implies y = 5$$

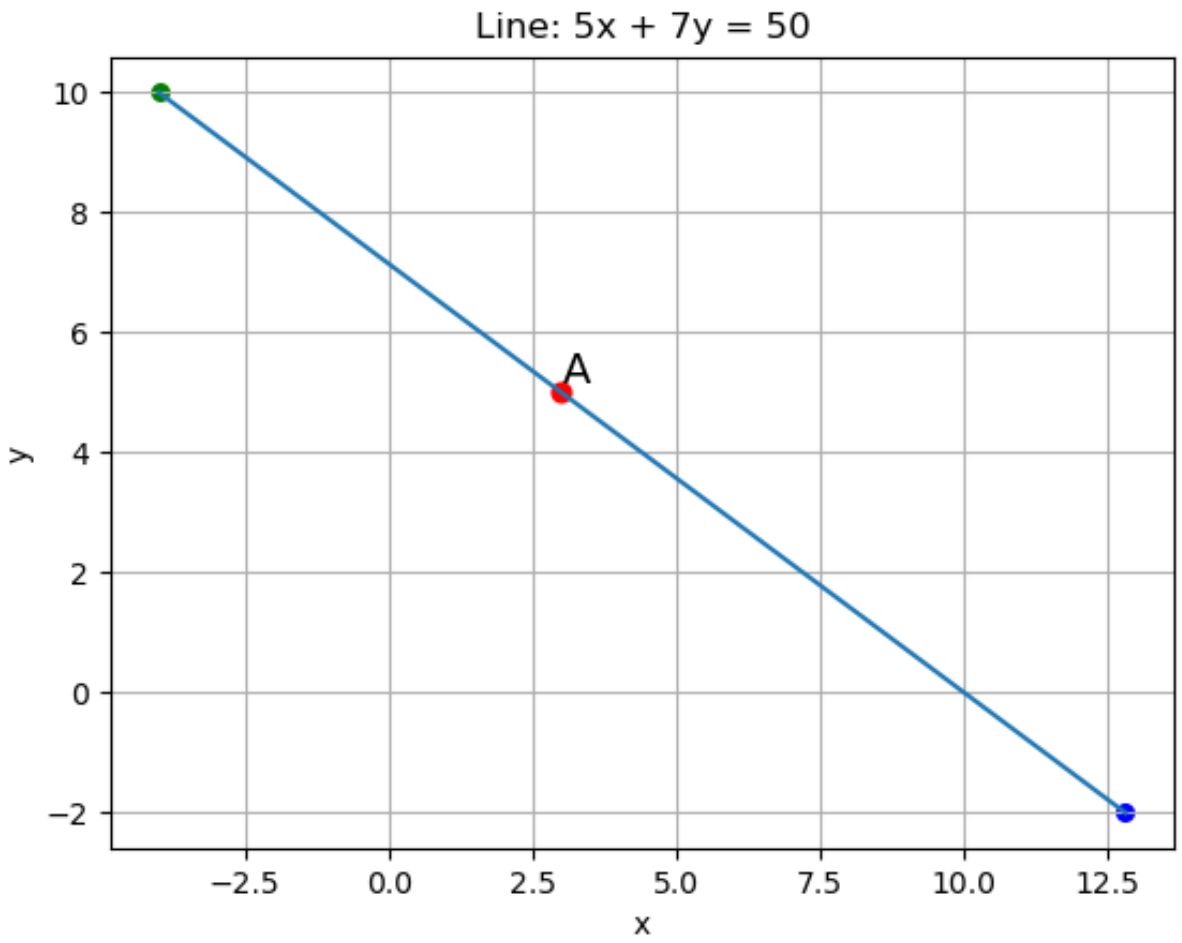
From the first row:

$$5x + 7y = 50 \implies 5x + 35 = 50 \implies x = 3$$

Thus, the cost of one pencil is ₹3 and the cost of one pen is ₹5:

$$\boxed{\mathbf{x} = \begin{pmatrix} 3 \\ 5 \end{pmatrix}}$$

Plot


Line: 5x + 7y = 50
A
10
8
6
4
2
0
−2
y
−2.5
0.0
2.5
5.0
7.5
10.0
12.5
x