ASSIGNMENT 9

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1 QUESTION No 2.50

Solve $2x - y > 1, x - 2y < -1$.

2 SOLUTION

Let

$$2x - y > 1,$$
$$-x + 2y > 1. \qquad (2.0.1)$$

Let $u_1 > 0, u_2 > 0$. This may be expressed as

$$\mathbf{u} = \begin{pmatrix} u_1 \\ u_2 \end{pmatrix} > \mathbf{0} \qquad (2.0.2)$$

Now we have,

$$\begin{pmatrix} 2 & -1 \\ -1 & 2 \end{pmatrix} \mathbf{x} > \begin{pmatrix} 1 \\ 1 \end{pmatrix} \qquad (2.0.3)$$

$$\begin{pmatrix} 2 & -1 \\ -1 & 2 \end{pmatrix} \mathbf{x} - \mathbf{u} = \begin{pmatrix} 1 \\ 1 \end{pmatrix} \qquad (2.0.4)$$

$$\text{or,} \begin{pmatrix} 2 & -1 \\ -1 & 2 \end{pmatrix} \mathbf{x} = \begin{pmatrix} 1 \\ 1 \end{pmatrix} + \mathbf{u} \qquad (2.0.5)$$

Resulting in

$$\mathbf{x} = \begin{pmatrix} 2 & -1 \\ -1 & 2 \end{pmatrix}^{-1} \begin{pmatrix} 1 \\ 1 \end{pmatrix} + \begin{pmatrix} 2 & -1 \\ -1 & 2 \end{pmatrix}^{-1} \mathbf{u} \qquad (2.0.6)$$

$$\mathbf{x} = \begin{pmatrix} 1 \\ 1 \end{pmatrix} + \frac{1}{3} \begin{pmatrix} 2 & 1 \\ 1 & 2 \end{pmatrix} \mathbf{u} \qquad (2.0.7)$$

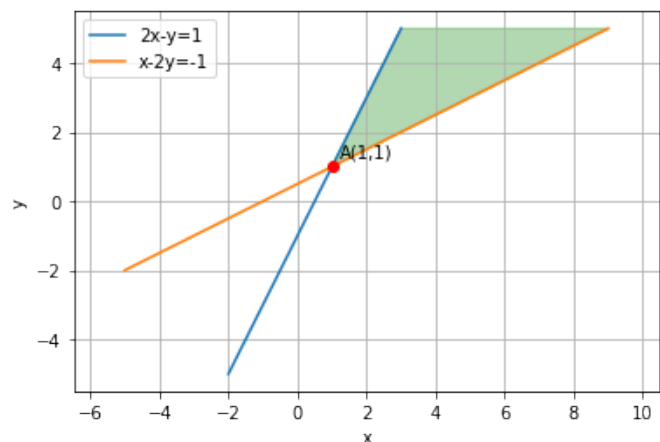Thus, the solution of the system of inequalities can be determined graphically and the desired region is the shaded triangle which is represented in below fig

Fig. 0: Graphical Solution