

Matgeo-5.2.2

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Question

Q-5.2.2 Solve the simultaneous linear equations

$$5u - 4v + 8 = 0, \quad 7u + 6v - 9 = 0.$$

Solution

$$5u - 4v = -8 \quad (1)$$

$$7u + 6v = 9 \quad (2)$$

Writing in matrix form,

$$\begin{pmatrix} 5 & -4 \\ 7 & 6 \end{pmatrix} \begin{pmatrix} u \\ v \end{pmatrix} = \begin{pmatrix} -8 \\ 9 \end{pmatrix} \quad (3)$$

Augmented matrix,

$$\begin{pmatrix} 5 & -4 & -8 \\ 7 & 6 & 9 \end{pmatrix} \quad (4)$$

Row operation: $R_2 \rightarrow 5R_2 - 7R_1$,

$$\begin{pmatrix} 5 & -4 & -8 \\ 0 & 58 & 101 \end{pmatrix} \quad (5)$$

Normalize second row: $R_2 \rightarrow \frac{R_2}{58}$,

Solution

$$\begin{pmatrix} 5 & -4 & -8 \\ 0 & 1 & \frac{101}{58} \end{pmatrix} \quad (6)$$

Eliminate above: $R_1 \rightarrow R_1 + 4R_2$,

$$\begin{pmatrix} 5 & 0 & -\frac{30}{29} \\ 0 & 1 & \frac{101}{58} \end{pmatrix} \quad (7)$$

Normalize first row: $R_1 \rightarrow \frac{R_1}{5}$,

$$\begin{pmatrix} 1 & 0 & -\frac{6}{29} \\ 0 & 1 & \frac{101}{58} \end{pmatrix} \quad (8)$$

Solution

Thus, the solution vector is

$$\begin{pmatrix} u \\ v \end{pmatrix} = \begin{pmatrix} -\frac{6}{29} \\ \frac{101}{58} \end{pmatrix} \quad (9)$$

Plot

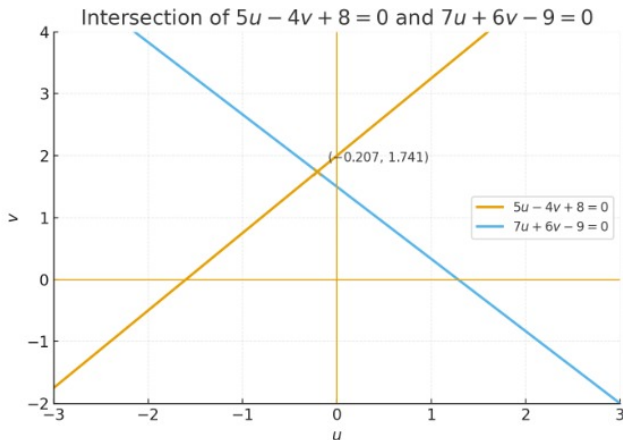


Figure: Intersection of $5u - 4v + 8 = 0$ and $7u + 6v - 9 = 0$ at $(-\frac{6}{29}, \frac{101}{58})$.