5.2.2

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Question. Solve the simultaneous linear equations

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

$$5u - 4v = -8 \tag{1}$$

$$7u + 6v = 9 \tag{2}$$

Writing in matrix form,

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

Augmented matrix,

$$\begin{pmatrix} 5 & -4 & -8 \\ 7 & 6 & 9 \end{pmatrix} \tag{4}$$

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

$$\begin{pmatrix} 5 & -4 & -8 \\ 0 & 58 & 101 \end{pmatrix} \tag{5}$$

Normalize second row: $R_2 \to \dfrac{R_2}{58}$,

$$\begin{pmatrix} 5 & -4 & -8 \\ 0 & 1 & \dfrac{101}{58} \end{pmatrix} \tag{6}$$

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

$$\begin{pmatrix} 5 & 0 & -\dfrac{30}{29} \\ 0 & 1 & \dfrac{101}{58} \end{pmatrix} \tag{7}$$

Normalize first row: $R_1 \to \dfrac{R_1}{5}$,

$$\begin{pmatrix} 1 & 0 & -\dfrac{6}{29} \\ 0 & 1 & \dfrac{101}{58} \end{pmatrix} \tag{8}$$

Thus, the solution vector is

$$\begin{pmatrix} u \\ v \end{pmatrix} = \begin{pmatrix} -\dfrac{6}{29} \\ \dfrac{101}{58} \end{pmatrix} \tag{9}$$

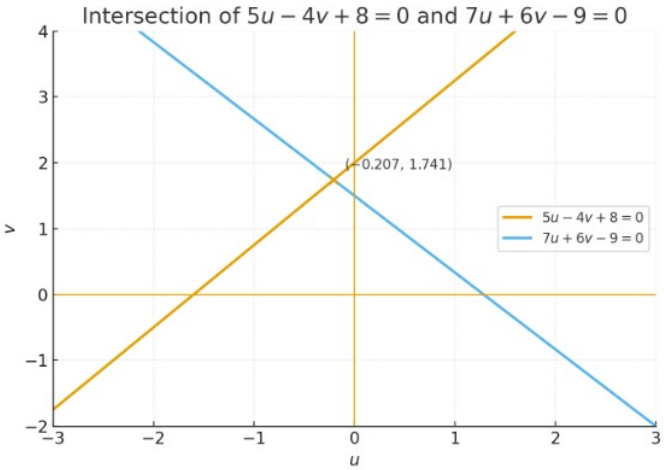

Fig. 0.1: Intersection of $5u - 4v + 8 = 0$ and $7u + 6v - 9 = 0$ at $\left(-\frac{6}{29}, \frac{101}{58}\right)$.