Systems of Linear Equations
2x2 Gauss-Jordan Method

$$\begin{bmatrix} \text{MATH by Wilson} \\ \text{Your Personal Mathematics Trainer} \\ \text{MathByWilson.com} \end{bmatrix}$$

2x2:

$l_1 : 5x - 2y = 19$

$l_2 : 3x + 4y = 1$

$Solution : (x, y) = (?, ?)$

Gauss-Jordon Method (A Matrix Method) :

$l_1 : 5x - 2y = 19$

$l_2 : 3x + 4y = 1$

Augmented Matrix

$\begin{matrix} \color{red}{x} & \color{red}{y} \end{matrix}$

$\left[\begin{array}{cc|c} 5 & -2 & 19 \\ 3 & 4 & 1 \end{array}\right]$

Goal: *Transform* $\left[\begin{array}{cc|c} 5 & -2 & 19 \\ 3 & 4 & 1 \end{array}\right]$ into $\left[\begin{array}{cc|c} 1 & 0 & x\ sol \\ 0 & 1 & y\ sol \end{array}\right]$ using the Row Operations, if possible:

To transform $\begin{bmatrix} a & c \\ b & d \end{bmatrix} = \begin{bmatrix} 5 & -2 \\ 3 & 4 \end{bmatrix}$ into $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, we should do the steps in the "wisdom order":

1. Make $a = 1$
2. Make $b = 0$
3. Make $d = 1$
4. Make $c = 0$

$\frac{1}{5} * R_1 \rightarrow R_1 : \left[\begin{array}{cc|c} 1 & \frac{-2}{5} & \frac{19}{5} \\ 3 & 4 & 1 \end{array}\right]$ <Multiply Row 1 by "1/5" and store result in Row 1>

$-3 * R_1 + R_2 \rightarrow R_2 : \left[\begin{array}{cc|c} 1 & \frac{-2}{5} & \frac{19}{5} \\ 0 & \frac{26}{5} & -\frac{52}{5} \end{array}\right]$ <Multiply Row 1 by "-3" then add Row 2 and

store the result in Row 2>

$\dfrac{5}{26} * R_2 \rightarrow R_2 : \begin{bmatrix} 1 & \dfrac{-2}{5} & \bigg| & \dfrac{19}{5} \\ 0 & 1 & \bigg| & -2 \end{bmatrix}$ <Multiply Row 2 by "5/26" and store result in Row 2>

$\dfrac{2}{5} * R_2 + R_1 \rightarrow R_1 : \begin{bmatrix} 1 & 0 & \bigg| & 3 \\ 0 & 1 & \bigg| & -2 \end{bmatrix}$ <Multiply Row 2 by "2/5" then add Row 1 and store

result is Row 1

The solution is in the last column: $Solution : (3, -2)$