

Answer on Question #43863 – Math – Linear Algebra

Solve the following matrix by Gaussian Model

$$1.) -4x + y = 3$$

$$3x - 5y = 0$$

$$2.) 3x + 4y + 5z = -9$$

$$2x - 3y + 3z = -1$$

$$x + 2y - 4z = -15$$

Solution.

$$1. \begin{cases} -4x + y = 3 \\ 3x - 5y = 0 \end{cases}$$

We write the extended system matrix

$$\left[\begin{array}{cc|c} -4 & 1 & 3 \\ 3 & -5 & 0 \end{array} \right] \sim \left[\begin{array}{cc|c} -12 & 3 & 9 \\ 12 & -20 & 0 \end{array} \right] \sim \left[\begin{array}{cc|c} 0 & -17 & 9 \\ 3 & -5 & 0 \end{array} \right]$$

From first row we get $y = -\frac{9}{17}$ and from second row we get $3x + 5 * \frac{9}{17} = 0$, hence $x = -\frac{15}{17}$.

Answer. $x = -\frac{15}{17}, y = -\frac{9}{17}$.

$$2.) \begin{cases} 3x + 4y + 5z = -9 \\ 2x - 3y + 3z = -1 \\ x + 2y - 4z = -15 \end{cases}$$

We write the extended system matrix

$$\left[\begin{array}{ccc|c} 3 & 4 & 5 & -9 \\ 2 & -3 & 3 & -1 \\ 1 & 2 & -4 & -15 \end{array} \right] \sim \left[\begin{array}{ccc|c} 1 & 2 & -4 & -15 \\ 2 & -3 & 3 & -1 \\ 3 & 4 & 5 & -9 \end{array} \right] \sim \left[\begin{array}{ccc|c} 1 & 2 & -4 & -15 \\ 0 & 7 & -11 & -29 \\ 0 & 2 & -17 & -36 \end{array} \right] \sim \left[\begin{array}{ccc|c} 1 & 2 & -4 & -15 \\ 0 & 2 & -17 & -36 \\ 0 & 7 & -11 & -29 \end{array} \right] \sim$$

$$\sim \left[\begin{array}{ccc|c} 1 & 2 & -4 & -15 \\ 0 & 14 & -119 & -252 \\ 0 & -14 & 22 & 58 \end{array} \right] \sim \left[\begin{array}{ccc|c} 1 & 2 & -4 & -15 \\ 0 & 14 & -119 & -252 \\ 0 & 0 & -97 & -194 \end{array} \right] \sim \left[\begin{array}{ccc|c} 1 & 2 & -4 & -15 \\ 0 & 14 & 0 & -14 \\ 0 & 0 & 1 & 2 \end{array} \right] \sim$$

$$\sim \left[\begin{array}{ccc|c} 1 & 2 & -4 & -15 \\ 0 & 1 & 0 & -1 \\ 0 & 0 & 1 & 2 \end{array} \right] \sim \left[\begin{array}{ccc|c} 1 & 0 & -4 & -13 \\ 0 & 1 & 0 & -1 \\ 0 & 0 & 1 & 2 \end{array} \right] \sim \left[\begin{array}{ccc|c} 1 & 0 & 0 & -5 \\ 0 & 1 & 0 & -1 \\ 0 & 0 & 1 & 2 \end{array} \right]$$

So the result is $x = -5, y = -1$ and $z = 2$.

Answer. $x = -5, y = -1, z = 2$.