Answer on Question#54307 – Math – Linear Algebra

$$D_1 = -32\frac{84}{213};\quad D_2 = 140\frac{80}{213};\quad D_3 = 35\frac{15}{213};\quad D_4 = 85\frac{65}{213}.$$

Question

Gauss Elimination Method

$$0 = 0.13D_1 + 0.03D_2$$

$$0 = 0.3D_1 + 0.13D_2 - 0.1D_4$$

$$2 = 0.13D_3 - 0.03D_4$$

$$-4 = -0.1D_2 - 0.03D_3 + 0.13D_4$$

Solution

Normalize notation

$$\begin{cases} 0.13D_1 + 0.03D_2 + 0.0D_3 + 0.0D_4 = 0 \\ 0.3D_1 + 0.13D_2 + 0.0D_3 - 0.1D_4 = 0 \\ 0.0D_1 + 0.0D_2 + 0.13D_3 - 0.03D_4 = 2 \\ 0.0D_1 - 0.1D_2 - 0.03D_3 + 0.13D_4 = -4 \end{cases}$$

Eliminate D_1 in the second row, using first one

$$\left(0.3 - 0.13 * \frac{0.3}{0.13}\right)D_1 + \left(0.13 - 0.03 * \frac{0.3}{0.13}\right)D_2 + 0.0D_3 - 0.1D_4 = 0$$

$$0.0D_1 + \frac{0.79}{13}D_2 + 0.0D_3 - 0.1D_4 = 0$$

Last three rows after operation (omit D_1 term). Rearrange order of third and fourth rows

$$\begin{cases} \frac{0.79}{13}D_2 + 0.0D_3 - 0.1D_4 = 0 \\ -0.1D_2 - 0.03D_3 + 0.13D_4 = -4 \\ 0.0D_2 + 0.13D_3 - 0.03D_4 = 2 \end{cases}$$

Eliminate D_2 in the second row, using first one

$$\left(-0.1 + \frac{0.79}{13} * \frac{1.3}{0.79}\right)D_2 + (-0.03)D_3 + \left(0.13 - 0.1 * \frac{1.3}{0.79}\right)D_4 = -4$$

$$0.0D_2 - 0.03D_3 - 0.13 * \frac{0.21}{0.79}D_4 = -4$$

Last two rows after operation (omit D_2 term)

$$\begin{cases} -0.03D_3 - 0.13 * \frac{0.21}{0.79}D_4 = -4 \\ 0.13D_3 - 0.03D_4 = 2 \end{cases}$$

Eliminate D_3 in the second row, using first one

$$\left(0.13 - 0.03 * \frac{0.13}{0.03}\right)D_3 + \left(-0.03 - 0.13 * \frac{0.21}{0.79} * \frac{0.13}{0.03}\right)D_4 = \left(2 - 4 * \frac{0.13}{0.03}\right)$$

$$0.0D_3 - \left(0.03 + 7 * \frac{0.13^2}{0.79}\right) D_4 = \left(2 - \frac{0.52}{0.03}\right)$$

$$0.0D_3 - \frac{0.142}{0.79} D_4 = -\frac{0.46}{0.03}$$

$$D_4 = \frac{0.46}{0.03} * \frac{0.79}{0.142} = \frac{46}{3} * \frac{790}{142} = \frac{23}{3} * \frac{790}{71} = \frac{18170}{213} = 85\frac{65}{213}$$

Eliminate D_4 term from the equations backward (3rd and 2nd equations respectively):

$$-0.03D_3 - 0.13 * \frac{0.21}{0.79} * \left(\frac{0.46}{0.03} * \frac{0.79}{0.142}\right) = -4$$

$$0.03D_3 = 4 - 7 * 0.13 * \frac{0.23}{0.071} = \frac{0.0747}{0.071} = \frac{747}{710}$$

$$D_3 = \frac{2490}{71} = 35\frac{15}{213}$$

$$\frac{0.79}{13} D_2 - 0.1 * \left(\frac{0.46}{0.03} * \frac{0.79}{0.142}\right) = 0$$

$$D_2 = \frac{13}{0.79} * 0.1 * \left(\frac{0.46}{0.03} * \frac{0.79}{0.142}\right)$$

$$D_2 = \frac{13}{0.142} * \frac{0.046}{0.03} = \frac{13}{0.142} * \frac{23}{15} = \frac{299}{2.13} = \frac{29900}{213} = 140\frac{80}{213}$$

Note: due to particular form of our equations, we have lower number of steps in algorithm.

Eliminate D_2 from the 1st equation

$$0.13D_1 + 0.03 * \left(\frac{13}{0.142} * \frac{0.046}{0.03}\right) = 0$$

$$D_1 = -\frac{0.03}{0.13} * \frac{13}{0.142} * \frac{0.046}{0.03} = -\frac{0.13}{0.13} * \frac{4.6}{0.142} = -\frac{6.9}{0.213} = -\frac{6900}{213} = -32\frac{84}{213}$$