EE 2240

Problem #02

Use Cramer's Rule to solve for x, y and z.

$$\begin{bmatrix} -3 & 6 & 2 \\ 5 & 1 & 12 \\ 1 & -2 & -4 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 15 \\ 43 \\ -15 \end{bmatrix}$$

$$x = \frac{\begin{vmatrix} 15 & 6 & 2 \\ 43 & 1 & 12 \\ -15 & -2 & -4 \end{vmatrix}}{\begin{vmatrix} -3 & 6 & 2 \\ 5 & 1 & 12 \\ 1 & -2 & -4 \end{vmatrix}} = \frac{15\begin{vmatrix} 1 & 12 \\ -2 & -4 \end{vmatrix} - 6\begin{vmatrix} 43 & 12 \\ -15 & -4 \end{vmatrix} + 2\begin{vmatrix} 43 & 1 \\ -15 & -2 \end{vmatrix}}{-3\begin{vmatrix} 1 & 12 \\ -2 & -4 \end{vmatrix} - 6\begin{vmatrix} 5 & 12 \\ 1 & -4 \end{vmatrix} + 2\begin{vmatrix} 5 & 1 \\ 1 & -2 \end{vmatrix}}$$

$$= \frac{15[(1)(-4) - (12)(-2)] - 6[(43)(-4) - (12)(-15)] + 2[(43)(-2) - (1)(-15)]}{-3[(1)(-4) - (12)(-2)] - 6[(5)(-4) - (12)(1)] + 2[(5)(-2) - (1)(1)]}$$

$$= \frac{15(20) - 6(8) + 2(-71)}{-3(20) - 6(-32) + 2(-11)} = \frac{110}{110} = 1$$

$$y = \frac{\begin{vmatrix} -3 & 15 & 2 \\ 5 & 43 & 12 \\ 1 & -15 & -4 \end{vmatrix}}{110} = \frac{-3\begin{vmatrix} 43 & 12 \\ -15 & -4 \end{vmatrix} - 15\begin{vmatrix} 5 & 12 \\ 1 & -4 \end{vmatrix} + 2\begin{vmatrix} 5 & 43 \\ 1 & -15 \end{vmatrix}}{110}$$

$$= \frac{-3[(43)(-4) - (12)(-15)] - 15[(5)(-4) - (12)(1)] + 2[(5)(-15) - (43)(1)]}{110}$$

$$= \frac{-3(8) - 15(-32) + 2(-118)}{110} = \frac{220}{110} = 2$$

$$z = \frac{\begin{vmatrix} -3 & 6 & 15 \\ 5 & 1 & 43 \\ 1 & -2 & -15 \end{vmatrix}}{110} = \frac{-3\begin{vmatrix} 1 & 43 \\ -2 & -15 \end{vmatrix} - 6\begin{vmatrix} 5 & 43 \\ 1 & -15 \end{vmatrix} + 15\begin{vmatrix} 5 & 1 \\ 1 & -2 \end{vmatrix}}{110}$$

$$= \frac{-3[(1)(-15) - (43)(2)] - 6[(5)(-15) - (43)(1)] + 15[(5)(-2) - (1)(1)]}{110}$$

$$= \frac{-3(71) - 6(-118) + 15(-11)}{110} = \frac{330}{110} = 3$$