

Answer Question #41201, Math, Linear Algebra

$$\begin{cases} 2x + y - 3z = 5 & (1) \\ 3x - 2y - 2z = 5 & (2) \\ 5x - 3y - z = 16 & (3) \end{cases}$$

We add (1) + (2):

$$\begin{cases} 2x + y - 3z = 5 & (1) \\ 5x - y - 5z = 10 & (2) \\ 5x - 3y - z = 16 & (3) \end{cases}$$

We subtract (2) from (3) :

$$\begin{cases} 2x + y - 3z = 5 & (1) \\ 5x - y - 5z = 10 & (2) \\ -2y + 4z = 6 & (3) \end{cases}$$

We multiply (1) by $\frac{5}{2}$:

$$\begin{cases} 5x + \frac{5}{2}y - \frac{15}{2}z = \frac{25}{2} & (1) \\ 5x - y - 5z = 10 & (2) \\ -2y + 4z = 6 & (3) \end{cases}$$

We sub from (2) - (1):

$$\begin{cases} 5x + \frac{5}{2}y - \frac{15}{2}z = \frac{25}{2} & (1) \\ -\frac{7}{2}y + \frac{5}{2}z = -\frac{5}{2} & (2) \\ -2y + 4z = 6 & (3) \end{cases}$$

We multiply (2) by $\frac{4}{7}$:

$$\begin{cases} 5x + \frac{5}{2}y - \frac{15}{2}z = \frac{25}{2} & (1) \\ -2y + \frac{10}{7}z = -\frac{10}{7} & (2) \\ -2y + 4z = 6 & (3) \end{cases}$$

We sub form (3) - (2):

$$\begin{cases} 5x + \frac{5}{2}y - \frac{15}{2}z = \frac{25}{2} & (1) \\ -2y + \frac{10}{7}z = -\frac{10}{7} & (2) \\ \frac{18}{7}z = \frac{52}{7} & (3) \end{cases}$$

From (3), we can find z:

$$\frac{18}{7}z = \frac{52}{7} \Rightarrow z = \frac{52}{7} * \frac{7}{18} = \frac{52}{18} = \frac{26}{9}$$

We can substitute z to (2), and find y:

$$\begin{cases} 5x + \frac{5}{2}y - \frac{15}{2}z = \frac{25}{2} & (1) \\ -2y + \frac{10}{7} * \frac{26}{9} = -\frac{10}{7} & (2) \\ z = \frac{26}{9} & (3) \end{cases}$$

$$-2y + \frac{260}{63} = -\frac{10}{7} \Rightarrow -2y = -\frac{10}{7} - \frac{260}{63} = -\frac{350}{63} = -\frac{50}{9} \Rightarrow y = \frac{25}{9}$$

We can substitute y and z to (1), and find x:

$$\begin{cases} 5x + \frac{5}{2} * \frac{25}{9} - \frac{15}{2} * \frac{26}{9} = \frac{25}{2} & (1) \\ y = \frac{25}{9} & (2) \\ z = \frac{26}{9} & (3) \end{cases}$$

$$5x + \frac{125}{18} - \frac{390}{18} = \frac{25}{2} \Rightarrow 5x - \frac{265}{18} = \frac{25}{2} \Rightarrow 5x = \frac{225}{18} + \frac{265}{18} = \frac{490}{18} \Rightarrow x = \frac{98}{18}$$
$$= \frac{49}{9}$$

Answer:

$$\begin{cases} x = \frac{49}{9} \\ y = \frac{25}{9} \\ z = \frac{26}{9} \end{cases}$$

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