

Answer on Question #45755 – Engineering – Other

Obtain the solution set of the system $x - 3y + 4z = 9$, $4x + 3y + 2z = 7$, $y - 2x = 5 - 10z$ by elimination.

Solution:

The elimination method can be used to solve a system of linear equations. By adding or subtracting the three linear equations in a way that eliminates one of the variables, a single variable equation is left

$$\begin{cases} x - 3y + 4z = 9 & (1) \\ 4x + 3y + 2z = 7 & (2) \\ y - 2x = 5 - 10z & (3) \end{cases}$$

(1) + (2):

$$\begin{aligned} x - 3y + 4z + (4x + 3y + 2z) &= 9 + 7 \\ 5x + 6z &= 16 \\ z &= \frac{16 - 5x}{6} & (4) \end{aligned}$$

(2) \times -2:

$$\begin{cases} x - 3y + 4z = 9 & (1) \\ -8x - 6y - 4z = -14 & (2) \\ y - 2x + 10z = 5 & (3) \end{cases}$$

(2) + (1):

$$\begin{aligned} x - 3y + 4z + (-8x - 6y - 4z) &= 9 - 14 \\ -7x - 9y &= -5 \\ y &= \frac{5 - 7x}{9} & (5) \end{aligned}$$

(5) and (4) in (3):

$$\begin{aligned} \frac{5 - 7x}{9} - 2x &= 5 - 10 \cdot \frac{16 - 5x}{6} \\ 4(5 - 7x) - 72x &= 180 - 60(16 - 5x) \\ 800 - 400x &= 0 \end{aligned}$$

$$\begin{aligned} x &= 2 \\ y &= \frac{5 - 7x}{9} = \frac{5 - 7 \cdot 2}{9} = -1 \\ z &= \frac{16 - 5x}{6} = \frac{16 - 5 \cdot 2}{6} = 1 \end{aligned}$$

Answer: $x = 2$; $y = -1$; $z = 1$;