

To solve a system of equations with 3 variables, we use elimination to make a system with 2 variables and then solve this simpler system.

Ex Solve

$$\begin{aligned} x + 4y + 3z &= 5 & \textcircled{1} \\ x + 3y + 2z &= 4 & \textcircled{2} \\ x + y - z &= -1 & \textcircled{3} \end{aligned}$$

subtract  $\textcircled{1}$  and  $\textcircled{2}$

$$\begin{aligned} x + 4y + 3z &= 5 \\ - (x + 3y + 2z &= 4) \\ \hline y + z &= 1 & \textcircled{4} \end{aligned}$$

subtract  $\textcircled{1}$  and  $\textcircled{3}$

$$\begin{aligned} x + 4y + 3z &= 5 \\ - (x + y - z &= -1) \\ \hline 3y + 4z &= 6 & \textcircled{5} \end{aligned}$$

$$4 \times (y + z = 1) \quad \textcircled{4}$$

$$3y + 4z = 6 \quad \textcircled{5}$$

$$\begin{aligned} 4y + 4z &= 4 \\ - (3y + 4z &= 6) \\ \hline y &= -2 \end{aligned}$$

$$\begin{aligned} y &\downarrow \textcircled{4} \\ (-2) + z &= 1 \\ z &= 3 \end{aligned}$$

Now take these 2 values and sub. into any of the original equations to find the third variable

$$x + 4y + 3z = 5 \quad \textcircled{1}$$

$$x + 4(-2) + 3(3) = 5$$

$$x - 8 + 9 = 5$$

$$x = 4$$

$$\boxed{(4, -2, 3)}$$

Ex. 2

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Ex. Solve

$$3x - 3y - 2z = 14 \quad (1)$$

$$5x + y - 6z = 10 \quad (2)$$

$$x - 2y + 4z = 9 \quad (3)$$

① and 3×②

$$3x - 3y - 2z = 14$$

$$+ (15x + 3y - 18z = 30)$$

$$\hline 18x \quad -20z = 44$$

2×② and ③

$$10x + 2y - 12z = 20$$

$$+ (x - 2y + 4z = 9)$$

$$\hline 11x \quad -8z = 29$$

$$18x - 20z = 44 \quad (4)$$

$$11x - 8z = 29 \quad (5)$$

2×④

$$36x - 40z = 88$$

5×⑤

$$- (55x - 40z = 145)$$

$$\hline -19x \quad = -57$$

$$\boxed{x = 3}$$

④

$$18(3) - 20z = 44$$

$$54 - 20z = 44$$

$$-20z = -10$$

$$\boxed{z = 0.5}$$

①

$$3(3) - 3y - 2(0.5) = 14$$

$$9 - 3y - 1 = 14$$

$$-3y = 6$$

$$y = -2$$

$$(3, -2, 0.5)$$