

## Solving Systems of Three Equations

Use graphing calculator to solve each system. ✓

$$\begin{aligned} 1) \quad & -2x - 5y + 4z = 21 \\ & -5x - 5y + z = 21 \\ & -4y - 4z = 8 \end{aligned}$$

$$\begin{bmatrix} -2 & -5 & 4 \\ -5 & -5 & 1 \\ 0 & -4 & -4 \end{bmatrix} \cdot \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 21 \\ 21 \\ 8 \end{bmatrix}$$

$$(-1, -3, 1)$$

$$\begin{aligned} 2) \quad & 5x + y - 4z = -4 \\ & -3y - 6z = -21 \\ & -x - y - z = -6 \end{aligned}$$

$$\begin{bmatrix} 5 & 1 & -4 \\ 0 & -3 & -6 \\ -1 & -1 & -1 \end{bmatrix} \cdot \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} -4 \\ -21 \\ -6 \end{bmatrix}$$

$$(5, -5, 6)$$

$$\begin{aligned} 3) \quad & -4x - 6z = -12 \\ & -6x - 4y - 2z = 6 \\ & -x + 2y + z = 9 \end{aligned}$$

$$\begin{bmatrix} -4 & 0 & -6 \\ -6 & -4 & -2 \\ -1 & 2 & 1 \end{bmatrix} \cdot \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} -12 \\ 6 \\ 9 \end{bmatrix}$$

$$(-3, 1, 4)$$

$$\begin{aligned} 4) \quad & 4x - 4y + 2z = -14 \\ & 4x + 2y = 14 \\ & -3y + z = -10 \end{aligned}$$

$$\begin{bmatrix} 4 & -4 & 2 \\ 4 & 2 & 0 \\ 0 & -3 & 1 \end{bmatrix} \cdot \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} -14 \\ 14 \\ -10 \end{bmatrix}$$

"Error" no inverse exists

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

$$\begin{bmatrix} 1 & -3 & 1 \\ -4 & 0 & -6 \\ 2 & 3 & 2 \end{bmatrix} \cdot \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} -7 \\ 4 \\ 4 \end{bmatrix}$$

$$(-1, 2, 0)$$

$$\begin{aligned} 6) \quad & 6x + 3y - 3z = -18 \\ & 6x + y + 4z = -28 \\ & 5z = -10 \end{aligned}$$

$$\begin{bmatrix} 6 & 3 & -3 \\ 6 & 1 & 4 \\ 0 & 0 & 5 \end{bmatrix} \cdot \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} -18 \\ -28 \\ -10 \end{bmatrix}$$

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

$$\begin{aligned} 7) \quad & -12x - 4y + 4z = -21 \\ & -4z = 6 \\ & 12x + 12y + 4z = -1 \end{aligned}$$

$$\begin{bmatrix} -12 & -4 & 4 \\ 0 & 0 & -4 \\ 12 & 12 & 4 \end{bmatrix} \cdot \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} -21 \\ 6 \\ -1 \end{bmatrix}$$

$$\left(\frac{5}{3}, -\frac{5}{4}, -\frac{3}{2}\right)$$

$$\begin{aligned} 8) \quad & 4x + 5y = -6 \\ & 10x - 30y + 50z = -27 \\ & 4x + 4y + z = -6 \end{aligned}$$

$$\begin{bmatrix} 4 & 5 & 0 \\ 10 & -30 & 50 \\ 4 & 4 & 1 \end{bmatrix} \cdot \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} -6 \\ -27 \\ -6 \end{bmatrix}$$

$$-1- \left(\frac{1}{2}, -\frac{8}{5}, -\frac{8}{5}\right)$$

$$\begin{aligned} 9) \quad & 36x - 6y + 6z = -1 \\ & 12x + 6z = -3 \\ & 18x - 6y + 6z = -1 \end{aligned}$$

$$\begin{bmatrix} 36 & -6 & 6 \\ 12 & 0 & 6 \\ 18 & -6 & 6 \end{bmatrix} \cdot \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} -1 \\ -3 \\ -1 \end{bmatrix}$$

$$\left(0, -\frac{1}{3}, -\frac{1}{2}\right)$$

$$\begin{aligned} 10) \quad & -2x + y - 4z = 4 \\ & 5x - 2y = 18 \\ & x - 5z = 17 \end{aligned}$$

$$\begin{bmatrix} -2 & 1 & -4 \\ 5 & -2 & 0 \\ 1 & 0 & -5 \end{bmatrix} \cdot \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 4 \\ 18 \\ 17 \end{bmatrix}$$

$$(2, -4, -3)$$

$$\begin{aligned} 11) \quad & -3z = 6 \\ & 2x + y - 2z = 6 \\ & -6x - 3y = -6 \end{aligned}$$

$$\begin{bmatrix} 0 & 0 & -3 \\ 2 & 1 & -2 \\ -6 & -3 & 0 \end{bmatrix} \cdot \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 6 \\ 6 \\ -6 \end{bmatrix}$$

"Error" no inverse exists

$$\begin{aligned} 12) \quad & 6y + 6z = -30 \\ & 4x - 6y - 3z = 26 \\ & x + y + z = -3 \end{aligned}$$

$$\begin{bmatrix} 0 & 6 & 6 \\ 4 & -6 & -3 \\ 1 & 1 & 1 \end{bmatrix} \cdot \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} -30 \\ 26 \\ -3 \end{bmatrix}$$

$$(2, -1, -4)$$

$$\begin{aligned} 13) \quad & -6x - y + z = -7 \\ & 4z = -6 \\ & 4x - 24y + 24z = 17 \end{aligned}$$

$$\begin{bmatrix} -6 & -1 & 1 \\ 0 & 0 & 4 \\ 4 & -24 & 24 \end{bmatrix} \cdot \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} -7 \\ -6 \\ 17 \end{bmatrix}$$

$$\left(\frac{5}{4}, -2, -\frac{3}{2}\right)$$

$$\begin{aligned} 14) \quad & 3x + 6y = -4 \\ & x + y - z = -2 \\ & 9x - 12y + 15z = 28 \end{aligned}$$

$$\begin{bmatrix} 3 & 6 & 0 \\ 1 & 1 & -1 \\ 9 & -12 & 15 \end{bmatrix} \cdot \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} -4 \\ -2 \\ 28 \end{bmatrix}$$

$$\left(-2 \cdot 10^{-14}, -\frac{2}{3}, \frac{4}{3}\right)$$

$$\begin{aligned} 15) \quad & 5x + 5y + 30z = 24 \\ & 5x - 5y - 20z = -11 \\ & -4y + 10z = 1 \end{aligned}$$

$$\begin{bmatrix} 5 & 5 & 30 \\ 5 & -5 & -20 \\ 0 & -4 & 10 \end{bmatrix} \cdot \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 24 \\ -11 \\ 1 \end{bmatrix}$$

$$\left(\frac{4}{5}, 1, \frac{1}{2}\right)$$

$$\begin{aligned} 16) \quad & 3x - 1 = 3z \\ & 4 = 6y - 3z - 3x \\ & -2x + 6z = 10y - 7 \end{aligned}$$

$$\begin{bmatrix} 3 & 0 & -3 \\ 3 & -6 & 3 \\ -2 & -10 & 6 \end{bmatrix} \cdot \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 1 \\ -4 \\ -7 \end{bmatrix}$$

$$\left(4 \cdot 10^{-14}, \frac{1}{2}, -\frac{1}{3}\right)$$