

U3D1

Solving Linear Systems in 3-Variables

Aug 13-9:09 AM

Solve by elimination:

Eliminate 1 variable by adding the equations together after getting additive opposites.

1. $2x + 3y = 7$
 $(2x + y = 3) \cdot -1$

$$\begin{array}{r} 2x + 3y = 7 \\ -2x - y = -3 \\ \hline \end{array}$$

$$\begin{array}{r} 2y = 4 \\ y = 2 \end{array}$$

$$\begin{array}{r} 2x + y = 3 \\ 2x + 2 = 3 \\ -2 \quad -2 \\ \hline \end{array}$$

$$\begin{array}{r} 2x = \frac{1}{2} \\ x = \frac{1}{2} \end{array}$$

$$\begin{array}{r} x = \frac{1}{2} \\ y = 2 \end{array}$$

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

Aug 13-9:03 AM

2. $5x - 2y = 4$

$(-2x + y = 2) \cdot 2$

$$\begin{array}{r} 5x - 2y = 4 \\ -4x + 2y = 4 \\ \hline \end{array}$$

$$\begin{array}{r} 5x - 2y = 4 \\ -4x + 2y = 4 \\ \hline \end{array}$$

$$\begin{array}{r} 5x - 2y = 4 \\ -4x + 2y = 4 \\ \hline x = 8 \end{array}$$

$$\begin{array}{r} -2x + y = 2 \\ -2(8) + y = 2 \\ \hline \end{array}$$

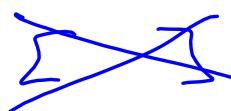
$$\begin{array}{r} -2x + y = 2 \\ -2(8) + y = 2 \\ \hline -16 + y = 2 \end{array}$$

$$\begin{array}{r} -16 + y = 2 \\ +16 \quad +16 \\ \hline y = 18 \end{array}$$

$$y = 18$$

$$\begin{array}{l} x = 8 \\ y = 18 \end{array}$$

$$\text{or } (8, 18)$$



Aug 13-9:07 AM

What if you want to solve for 3 variables?

3 equations

Aug 13-9:07 AM

How would you solve the following?

1. Combine 2 EQs at a time to get EQs 4 & 5 by eliminating the same variable.

$$\begin{array}{l} \textcircled{1} \quad 2x + 3y - z = 5 \\ \textcircled{2} \quad 4x - y - z = -1 \\ \textcircled{3} \quad x + 4y + z = 12 \end{array} \quad \left. \begin{array}{l} \\ \\ \end{array} \right\} \begin{array}{l} \text{Eliminate} \\ z \end{array}$$

$$\begin{array}{r} \textcircled{1} + \textcircled{3} \\ 2x + 3y - z = 5 \\ x + 4y + z = 12 \\ \hline 3x + 7y = 17 \quad \textcircled{4} \end{array}$$

$$\begin{array}{r} \textcircled{2} + \textcircled{3} \\ 4x - y - z = -1 \\ x + 4y + z = 12 \\ \hline 5x + 3y = 11 \quad \textcircled{5} \end{array}$$

2. Solve the 2 variable system with EQs 4 & 5

$$\begin{array}{r} \textcircled{4} \quad (3x + 7y = 17) \times 5 \\ \textcircled{5} \quad (5x + 3y = 11) \times -3 \\ \hline 15x + 35y = 85 \\ -15x - 9y = -33 \\ \hline 26y = 52 \\ \hline y = 2 \end{array}$$

Find x

$$\begin{array}{r} \textcircled{5} \quad 5x + 3y = 11 \\ 5x + 3(2) = 11 \\ 5x + 6 = 11 \\ 5x = 5 \\ x = 1 \end{array}$$

3. Find last variable by substituting your 2 solutions into an original EQ.

$$\begin{array}{r} \textcircled{1} \quad 2x + 3y - z = 5 \\ 2(1) + 3(2) - z = 5 \\ 2 + 6 - z = 5 \\ 8 - z = 5 \\ -8 \quad -8 \\ \hline -z = -3 \\ z = 3 \end{array}$$

$$\begin{array}{l} x = 1 \\ y = 2 \\ z = 3 \end{array}$$

Aug 13-9:08 AM

Solve:

$$\begin{array}{l} \textcircled{1} \quad x + 2y - z = 8 \\ \textcircled{2} \quad y + z = 4 \\ \textcircled{3} \quad x - y - z = 2 \end{array} \quad \left. \begin{array}{l} \\ \\ \end{array} \right\} \text{eliminate } z$$

$$\begin{array}{r} \textcircled{2} + \textcircled{3} \\ y + z = 4 \\ x - y - z = 2 \\ \hline x = 6 \end{array}$$

$$\begin{array}{r} \textcircled{1} + 2\textcircled{3} \\ x + 2y - z = 8 \\ 2x - 2y - 2z = 4 \\ \hline 3x - 3z = 12 \\ \hline x = 6 \\ 3(6) - 3z = 12 \\ 18 - 3z = 12 \\ -18 \quad -18 \\ \hline -3z = -6 \\ \hline z = 2 \end{array}$$

Need y

$$\begin{array}{r} \textcircled{2} \quad y + z = 4 \\ y + 2 = 4 \\ \hline y = 2 \end{array}$$

$$\begin{array}{l} x = 6 \\ y = 2 \\ z = 2 \end{array}$$

Check

$$\begin{array}{l} x + 2y - z = 8 \\ 6 + 2(2) - 2 = 8 \\ 6 + 4 - 2 = 8 \\ 8 = 8 \end{array}$$

$$\begin{array}{l} y + z = 4 \\ 2 + 2 = 4 \\ 4 = 4 \end{array}$$

$$\begin{array}{l} x - y - z = 2 \\ 6 - 2 - 2 = 2 \\ 2 = 2 \end{array}$$

Aug 13-9:08 AM

Check using your graphing calculator.

2^{nd} x^{-1} Brings up MATRIX

EDIT Choose A. Asks for size. Enter number of rows by number of columns.
Enter coefficients in x, y, z, constant order. Then 2^{nd} mode to quit.

2^{nd} x^{-1} Brings up MATRIX again.

MATH B:rref(2^{nd} x^{-1} 1:[A]

Let's practice by checking the previous 2 questions.