

Solving 3x3 system of equations by linear combination

Goal:

Use linear combination to get 2 equations with 2 variables
and then use linear combination to eliminate another variable.

<http://www.mathwarehouse.com/algebra/planes/systems/three-variable-equations.php>

Solve this system by linear combination:

(2, -5, 4)

$$I \quad x - 3y - 2z = 9$$

$$II \quad 3x + 2y + 6z = 20$$

$$III \quad 4x - y + 3z = 25$$

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

$$3x - 9y - 6z = 27$$

$$II \quad 3x + 2y + 6z = 20$$

$$-2II + 2(4x - y + 3z = 25)$$

$$-8x + 2y - 6z = -50$$

$$II \quad 3x + 2y + 6z = 20$$

$$(B) -5x + 4y = -30$$

$$(A) 6x - 7y = 47$$

$$(B) -5x + 4y = -30$$

$$\begin{array}{r} 24x - 28y = 188 \\ -35x + 28y = -210 \\ \hline -11x = -22 \\ \hline x = 2 \end{array}$$

$$(B) -5(2) + 4y = -30$$

subst into

$$II \quad 3x + 2y + 6z = 20$$

$$3(2) + 2(-5) + 6z = 20$$

$$6 - 10 + 6z = 20$$

$$-4 + 6z = 20$$

$$\frac{6z = 24}{6} \quad z = 4$$

$$-10 + 4y = -30$$

$$+10 \quad +10$$

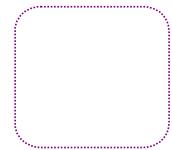
$$\frac{4y = -20}{4} \quad y = -5$$

$$\begin{array}{l} \text{Check} \\ (2) - 3(-5) - 2(4) = 9 \\ 2 + 15 - 8 = 9 \\ 17 - 8 = 9 \\ 9 = 9 \end{array}$$

$$\begin{array}{l} \text{Check} \\ 3(2) + 2(-5) + 6(4) = 20 \\ 6 - 10 + 24 = 20 \\ 30 - 10 = 20 \\ 20 = 20 \end{array}$$

$$\begin{array}{l} \text{Check} \\ 4(2) - (-5) + 3(4) = 25 \\ 8 + 5 + 12 = 25 \\ 25 = 25 \end{array}$$

$$3. \text{I } x + y + z = 5$$



$$\text{II } \underline{3x - z = 2} \rightarrow \text{LOOK!}$$

$$\text{III } x - y + 2z = 0$$

$$\text{I } x + y + z = 5$$

$$\text{III } x - y + 2z = 0$$

$$\begin{array}{r} \text{(A)} \cancel{\text{I } 2x + 3z = 5} \\ \text{II } (3x - z = 2)3 \rightarrow \end{array} \begin{array}{l} 2x + 3z = 5 \\ 9x - 3z = 6 \\ \hline 11x = 11 \\ x = 1 \end{array} \boxed{(1, 3, 1)}$$
$$\begin{array}{r} 2x + 3z = 5 \\ 2(1) + 3z = 5 \\ -2 + 3z = 5 \\ 3z = 3 \\ z = 1 \end{array} \quad \begin{array}{l} x + y + z = 5 \\ (1) + y + (1) = 5 \\ y + 2 = 5 \\ y = 3 \end{array}$$

$$\begin{array}{l} \text{Check} \\ (1) + (3) + (1) = 5 \\ 5 = 5 \end{array} \checkmark$$

$$\begin{array}{l} \text{Check} \\ 3(1) - (1) = 2 \\ 3 - 1 = 2 \\ 2 = 2 \end{array} \checkmark$$

$$\begin{array}{l} \text{Check} \\ (1) - (3) + 2(1) = 0 \\ 1 - 3 + 2 = 0 \\ -2 + 2 = 0 \\ 0 = 0 \end{array} \checkmark$$