

Solve the following system of 3 linear equations in 3 variables:

$$-2x + 5y + z = 8 \quad (1)$$

$$x - 2y - 3z = -13 \quad (2)$$

$$x + 3y - z = 5 \quad (3)$$

1. Choose a pair of equations, and eliminate one of the variables by using the addition method.

(Hint: You can eliminate z by adding equations (1) and (3)!)

Solution: Add equations (1) and (3) in order to eliminate z :

$$-2x + 5y + z = 8$$

$$x + 3y - z = 5$$

$$\hline -x + 8y = 13$$

2. Choose a *different* pair of equations, and eliminate the *same* variable:

Solution: Add 3 times equation (1) to equation (2) in order to eliminate z :

$$-6x + 15y + 3z = 24$$

$$x - 2y - 3z = -13$$

$$\hline -5x + 13y = 11$$

3. Solve the resulting system of 2 equations in 2 variables:

Solution: Multiply through the equation from step 1 by -5 and add to equation from step 2:

$$5x - 40y = -65$$

$$-5x + 13y = 11$$

$$\hline -27y = -54$$

So $y = 2$. Plug this into either equation above to solve for x , e.g., substituting $y = 2$ into the 2nd equation:

$$-5x + 13(2) = 11 \implies -5x = -15 \implies x = 3$$

4. Substitute the values of the 2 variables solved for above into any of the 3 original equations, and solve for the 3rd variable.

Solution: Substituting $x = 3$ and $y = 2$ into equation (1):

$$-2(3) + 5(2) + z = 8 \implies -6 + 10 + z = 8 \implies z = 4$$

5. Check the solution by substituting into each of the original equations.

Solution: Substitute $x = 3$, $y = 2$, and $z = 4$ into each of equations (1), (2), and (3) and verify that the RHS equals the LHS.