# Systems of 3 Equations

To solve a System of Equations containing more than just two variables, you should use the Addition Method repeatedly until you have found the value of one of the variables.

Recall: Types of solutions:

**No solution**, the lines are parallel. The system is called **Inconsistent**.
**1 unique answer**, the point of intersection. The system is **Independent**.
**Infinite number of solutions**, both equations represent the same line. **Dependent**.

With a system of 3 or more equations, you need to check your answer in all equations to be sure that the system is consistent, that it has an order triple that satisfies all the equations.

Solve:

1. $x + y - z = -4$
2. $2x + y + z = 3$
3. $x - 2y + 3z = 14$

First decide which variable you are going to eliminate completely.

For this problem, z is a candidate.

Add equations 1. and 2. together.

1. $x + y - z = -4$
2. $\underline{2x + y + z = 3}$

4. $3x + 2y = -1$ this is a new equation, we'll call it 4.

Multiply every term in equation 1. By 3 and then add it to equation 3.

1. $3x + 3y - 3z = -12$
2. $\underline{x - 2y + 3z = 14}$

5. $4x + y = 2$ This is a new equation we'll call 5.

Now use equations 4 and 5, determine which variable you want to eliminate.

4. $3x + 2y = -1$
5. $4x + y = 2$ multiply equation 5. By $-2$ to eliminate y

Add the two equations together.

4. $3x + 2y = -1$
5. $-8x - 2y = -4$
   $-5x = -5$
   $x = 1$

Now substitute $x = 1$ back into either equation 4. Or 5.

$3(1) + 2y = -1$

$3 + 2y = -1$

$2y = -4$

$Y = -2$

Now substitute back into one of the original equations both $x = 1$ and $y = -2$ to solve for z.

1. $X + y - z = -4$
   $(1) + (-2) - z = -4$
   $-1 - z = -4$
   $-z = -3$
   $z = 3$

Check this order triplet into the other two equations

2. $2x + y + z = 3$
   $2(1) + (-2) + (3) = 3$

3. $X - 2y + 3z = 14$
   $(1) - 2(-2) + 3(3) = 14$

Therefore, $(1, -2, 3)$ is the solution to the system of equations.