

Chapter 6	Systems of Equations and Inequalities
Section 3	Systems of Linear Equations in Several Variables

In this section, we will be converting a system of equations into a triangular system and solving by back substitution.

Changing a system to a triangular system is a variant of the elimination method. For a system with three equations:

Change to Triangular Form:

1. Eliminate the x from the second and third equations using the first equation.
2. Eliminate the y from the third equation using the modified second equation.

Solve by Back Substitution:

3. The third equation will now have only one variable: the z . Solve the third equation for z .
4. The second equation will have only a y and a z . Plug in the value of z found in Step 3 and solve for y .
5. The first equation still has x , y , and z . Plug in the value of z found in Step 3 and the value of y found in step 4 and solve for x .

Another way of looking at this:

1. Use equations 1 and 2 to eliminate x .
2. Use equations 1 and 3 to eliminate x .
3. Use the results from Steps 1 and 2 to eliminate y and solve for z .
4. Use the z value from Step 3 in one of the results from Steps 1 or 2 and solve for y .
5. Use the z value from Step 3 and the y value from Step 4 in any one of the original equations and solve for z .

A third way of looking at this:

1. Change the first equation so that the coefficient on the x is a $+1$. Swap equations if necessary.
2. Add multiples of the first equation to the second and third equations to eliminate the x .
3. Change the second equation so that the coefficient on the y is a $+1$. Swap with equation 3 if necessary.
4. Add multiples of the second equation to the third to eliminate the y .