Algebra 2 Lesson 3-6: Systems with Three Variables Mrs. Snow, Instructor

In Sec. 3.2 we studied systems made up of 2 equations. We discovered that when we solved both equations for a point (x,y), that this point is not only the a solution to both equations, but also the point where the two lines intersect. Thus, it is a solution to the system of equations. What if we are given a system of 3 equations containing 3 variables, x, y, and z? Note that this system could not be graphed on the Cartesian plane; it may be graphed in a 3-dimension system. At this time we will not concern ourselves with graphing the system to determine a solution; rather we will look at the algebraic methods studied in 3.2 and apply them to 3 equations.

In elimination you will combine 2 of the equations such that you eliminate a variable. Next you combine two other equations so to eliminate the same variable. Now you have 2 equations and 2 unknowns, solve just as you did in section 3.2, then find the 3rd variable.

Example:	Step 1: combine equ. 1 & 2	Step 3
Solve the system of equations using	1. x + y + z = 6	3x + 4z = 15
the elimination method.	2. $2x - y + 3z = 9$	-(3x + 8z = 27)
1. $x + y + z = 6$	3x + 4z = 15	-4z = -12
2. $2x - y + 3z = 9$		z = 3
3. $-x + 2y + 2z = 9$		x = 1
-	Step 2: combine equ 2 & 3	Step 4 subbing x and z into:
Step 1 Add eq. 1 and 2 to eliminate y	2. $2(2x - y + 3z = 9)$	x + y + z = 6
Step 2: Multiply 2 times eq 2 then add		1 + y + 3 = 6
eq 2 and 3 to eliminate y.	4x - 2y + 6z = 18	y = 2
Step 3: Take the results of Step 1 and	3. $-x + 2y + 2z = 9$	<i>ANS</i> : (1, 2, 3)
2, two equations with two unknowns	3x + 8z = 27	check:
and solve for the variables.		1 + 2 + 3 = 6
Step 4: Substitute the solutions for the		$2(1) - 2 + 3(3) = 9\sqrt{2}$
two variables into an equation to solve		
for the 3 rd variable		-1 + 2(2) + 2(3) = 9 V

The key is to analyze the equations to see which may be combined to eliminate a variable with little or no alteration.

In substitution, select an equation that can be easily solved in terms of one of the variables, for example solve x in terms of y and z. Next substitute the expression into the other remaining equations for the variable that you solved.

Example:	Step 1	Step 4
Solve the system of equations using	x = y + z + 6	x - 3 - 4 = -8
the substitution method.	Step 2 $x + y + z = -8$	x = -
x + y + z = -8 x - y - z = 6 2x - 3y + 2z = -1	y + z + 6 + y + z = -8 2y + 2z = -14	Ans (-1, -3, -4)
 Step 1 Solve one equation in terms of the other variables. Step 2 Substitute this term into both remaining equations for the variable. Step 3 Write the 2 equations as a system and solve as outlined in 3.2 Step 4 Once the two variable are solved, the first variable may then be calculated. 	2x - 3y + 2z = -1 $2(y + z + 6) - 3y + 2z = -1$ $2y + 2z + 12 - 3y + 2z = -1$ $-y + 4z = -13$ Step 3 multiply second by 2 and add to first: $2y + 2z = -14$ $-2y + 8z = -26$ $10z = -40$ $z = -4$ $y = -3$	check: -1 - 3 - 4 = -8 -1 + 3 + 4 = 6 2(-1) - 3(-3) + 2(-4) = -1