Math 1201

7.5 Solve a System of Linear Equations Algebraically

To solve a system of equations algebraically means to solve without using a graph. There are two ways we will do this:

- Substitution
- Elimination

Solving by Elimination

Steps:

- Make sure the terms are written in the same order in each equation.
- Choose one of the variables to eliminate.
- Get opposite numbers, same magnitude but different sign, in front of this variable in each equation.
    - Determine a LCM for each of the numbers already in front of the variable that you chose to eliminate.
    - Multiply each individual equation by a certain number to get the LCM in front of the variable to be eliminated.
- Add the two equations together. This will eliminate one of the variables. Solve for the remaining variable.
- Solve for the second variable by substituting the value for the variable that you

Example 1:
Solve the following systems of equations using elimination.

(A)

$2x + y = 5$

$y = -x + 3$

① − ②

① $2x + y = 5$

− ② $x + y = 3$

$x = 2$

Sub x into ②

$y = -(2) + 3$

$= 1$

$(2, 1)$

(B)

① $2x - 4y = 7$

② $4x + y = 5$

$① + 4②$

$2x - 4y = 7$

$+ \; 16x + 4y = 20$

$18x = 27$

$\frac{18x}{18} = \frac{27}{18}$

$x = \frac{3}{2}$

Sub x into ①

$2\left(\frac{3}{2}\right) - 4y = 7$

$3 - 4y = 7$

$-4y = 7 - 3$

$-4y = 4$

$\frac{-4y}{-4} = \frac{4}{-4}$

$y = -1$

$\left(\frac{3}{2}, -1\right)$

must write as an ordered pair

(C)

① $3x - 4y = 7$

② $5x - 6y = 8$

$3① - 2②$

$9x - 12y = 21$

$-\; 10x - 12y = 16$

$-x = 5$

$x = -5$

Sub x into ①

$3(-5) - 4y = 7$

$-15 - 4y = 7$

$-4y = 7 + 15$

$-4y = 22$

$\frac{-4y}{-4} = \frac{22}{-4}$

$y = -11/2$

$\left(-5, -11/2\right)$

(D)

① $2x + 7y = 24$

② $3x - 2y = -4$

$3① - 2②$

$6x + 21y = 72$

$-6x - 4y = -8$

$25y = 80$

$\frac{25y}{25} = \frac{80}{25}$

$y = 16/5$

Sub y into ②

$3x - 2\left(\frac{16}{5}\right) = -4$

$3x - \frac{32}{5} = -4$

$3x = -\frac{4 \cdot 5}{1 \cdot 5} + \frac{32}{5}$

$3x = -\frac{20}{5} + \frac{32}{5}$

$\frac{1}{3} \cdot 3x = \frac{12}{5} \cdot \frac{1}{3}$

$x = \frac{12}{15} = \frac{4}{5}$

$\left(\frac{4}{5}, \frac{16}{5}\right)$

Textbook Questions: page 437 #3, 5, 6, 7