Solving Systems of Equations

- So far, we have solved systems using graphing and substitution. These notes show how to solve the system algebraically using ELIMINATION with addition and subtraction.
- Elimination is easiest when the equations are in standard form.

Solving a system of equations by elimination using addition and subtraction.

Step 1: Put the equations in Standard Form.	Standard Form: Ax + By = C
Step 2: Determine which variable to eliminate.	Look for variables that have the same coefficient.
Step 3: Add or subtract the equations.	Solve for the variable.
Step 4: Plug back in to find the other variable.	Substitute the value of the variable into the equation.
Step 5: Check your solution.	Substitute your ordered pair into BOTH equations.

1) Solve the system using elimination.

$$x + y = 5$$

$$3x - y = 7$$

Step 1: Put the equations in Standard Form.

They already are!

Step 2: Determine which variable to eliminate.

The y's have the same coefficient.

Step 3: Add or subtract the equations.

Add to eliminate y.

$$x + y = 5$$
$$(+)\ 3x - y = 7$$
$$4x = 12$$
$$x = 3$$

1) Solve the system using elimination.

$$x + y = 5$$
$$3x - y = 7$$

Step 4: Plug back in to find the other variable.

$x + y = 5$
$(3) + y = 5$
$y = 2$

Step 5: Check your solution.

(3, 2)
$(3) + (2) = 5$ ✓
$3(3) - (2) = 7$ ✓

The solution is (3, 2). What do you think the answer would be if you solved using substitution?

2) Solve the system using elimination.

$$4x + y = 7$$

$$4x - 2y = -2$$

Step 1: Put the equations in Standard Form.

They already are!

Step 2: Determine which variable to eliminate.

The x's have the same coefficient.

Step 3: Add or subtract the equations.

Subtract to eliminate x.

$$4x + y = 7$$
$$(-)\ 4x - 2y = -2$$
$$3y = 9$$
$$y = 3$$

Remember to "keep-change-change"

2) Solve the system using elimination.

$$4x + y = 7$$
$$4x - 2y = -2$$

Step 4: Plug back in to find the other variable.

$$4x + y = 7$$
$$4x + (3) = 7$$
$$4x = 4$$
$$x = 1$$

Step 5: Check your solution.

(1, 3)

$4(1) + (3) = 7$ ✓

$4(1) - 2(3) = -2$ ✓

Which step would eliminate a variable?

$3x + y = 4$

$3x + 4y = 6$

1. Isolate y in the first equation
2. Add the equations
3. ✓ Subtract the equations
4. Multiply the first equation by -4

Solve using elimination.

$$2x - 3y = -2$$
$$x + 3y = 17$$

1. (2, 2)
2. (9, 3)
3. (4, 5)
4. (5, 4) ✓

3) Solve the system using elimination.

$$y = 7 - 2x$$

$$4x + y = 5$$

Step 1: Put the equations in Standard Form.

2x + y = 7
4x + y = 5

Step 2: Determine which variable to eliminate.

The y's have the same coefficient.

Step 3: Add or subtract the equations.

Subtract to eliminate y.

$$\begin{array}{r} 2x + y = 7 \\ (-)\ 4x + y = 5 \\ \hline -2x = 2 \end{array}$$

$$x = -1$$

3) Solve the system using elimination.

$$y = 7 - 2x$$
$$4x + y = 5$$

Step 4: Plug back in to find the other variable.

$y = 7 - 2x$
$y = 7 - 2(-1)$
$y = 9$

Step 5: Check your solution.

(-1, 9)
$(9) = 7 - 2(-1)$ ✓
$4(-1) + (9) = 5$ ✓

What is the first step when solving with elimination?

1. Add or subtract the equations.
2. Plug numbers into the equation.
3. Solve for a variable.
4. Check your answer.
5. Determine which variable to eliminate.
6. Put the equations in standard form.

Find two numbers whose sum is 18 and whose difference 22.

1. 14 and 4
2. 20 and -2
3. 24 and -6
4. 30 and 8

4) Solve the system using elimination.

$$4x - 3y = 25$$

$$-3x + 8y = 10$$

Step 1: Put the equations in Standard Form.

Already in standard form.

Step 2: Determine which variable to eliminate.

Neither have a common coefficient so we multiply.

(3) 4x – 3y = 25

(4) -3x + 8y = 10

New equations:

12x – 9y = 75

-12x + 32y = 40

Now we eliminate the x values

4) Solve the system using elimination.

$$4x - 3y = 25$$

$$-3x + 8y = 10$$

Step 3: Add or subtract the equations.

Add to eliminate x.

$$12x - 9y = 75$$

$$(+)\ -12x + 32y = 40$$

$$23y = 115$$

$$y = 5$$

4) Solve the system using elimination.

$$4x - 3y = 25$$
$$-3x + 8y = 10$$

Step 4: Plug back in to find the other variable.

$$4x - 3y = 25$$
$$4x - 3(5) = 25$$
$$x = 10$$

Step 5: Check your solution.

(10, 5)

$4(10) - 3(5) = 25$ ✓

$-3(10) + 8(5) = 10$ ✓

5) Solve the system using elimination.

$$12x - 13y = 2$$

$$-6x + 6.5y = -2$$