



A desk with a lamp, a blueprint, a compass, a ruler, and markers. The background is a brick wall. The desk is covered with a blueprint that has various architectural drawings and text, including "STONE WALL", "LAUNDRY", "BED RM 2 10' x 12'", "CLO", "T.CLO", "DRESSING ABOVE", "SLIP", and "DR". A large blue arrow points from the bottom right towards the center. A silver desk lamp is in the top left. A yellow ruler is at the bottom left. A compass is next to the ruler. Three markers (green, blue, and red) and a red pen are scattered on the desk.

Solving Systems of Equations

The Elimination Method



Essential Questions

- How do you solve systems of equations using the Elimination Method?
- 
- 
- 

Shoulder Buddy

- What does “eliminate” mean to you?
- On Your Own: write down as many different ways you can describe the word “eliminate”
- Share with your partner your thoughts
- Share with the class



A desk with a lamp, a ruler, and a pen. The background is a brick wall. The desk is white and has a lamp on the left, a ruler on the right, and a pen at the bottom. The text is centered on the desk.

Getting rid of???

- How do we get rid of a number in math?
- We **CANCEL** it out which means we need **OPPOSITE NUMBERS!!**

Are the equations of the system in standard form?

$$Ax + By = C$$

$$Ax + By = C$$

Example 1

$$\begin{cases} -2x + y = 5 \\ + \quad (2x + 2y = 7) \end{cases}$$

$$3y = 12$$

$$y = 4$$

$$2x + 2(4) = 7$$

$$2x + 8 = 7$$

$$2x = -1$$

$$x = -\frac{1}{2}$$

$$\left(-\frac{1}{2}, 4\right)$$

SOLVE BY ELIMINATION

Directions: Fill in the blanks

$$\begin{array}{r} 4x + y = 10 \\ + (2x - y = 2) \\ \hline 6x = 12 \end{array}$$

1. Which variable has the same coefficient and opposite signs?

y

2. To eliminate this variable we add both equations together.

3. The resulting equation is

$$\underline{6x} = \underline{12}$$

4. Solve:

$$\frac{\cancel{6}x}{\cancel{6}} = \frac{12}{6}$$

$$x = \underline{2}$$

5. To find the other variable we substitute our answer in step 4 into one of the original equations. Let's use the equation

$$4x + y = 10$$

6. $4(\underline{2}) + y = 10$

7. $\begin{array}{r} 8 + y = \underline{10} \\ -8 \qquad -8 \\ \hline \end{array}$

8. $y = \underline{2}$

9. The solution to the system is $(\underline{2}, \underline{2})$

10. Check:

11. $4x + y = 10$

12. $4(\underline{2}) + \underline{2}$

13. $\underline{8} + 2$

14. $\checkmark \quad 10 = \underline{10}$

$$2x - y = 2$$

12. $2(\underline{2}) - 2$

13. $\underline{4} - 2$

14. $\checkmark \quad 2 = 2$

Example 2

Consider the system

$$\begin{cases} 3x + y = 14 \\ 4x - y = 7 \end{cases}$$

+ (

$$\begin{array}{r} 3x + y = 14 \\ 4x - y = 7 \\ \hline 7x = 21 \\ \hline x = 3 \end{array}$$

The result $x = 3$ is circled in red. A red arrow points from the circled $x = 3$ to the y term in the first equation of the system above.

$$\begin{array}{r} 3(3) + y = 14 \\ 9 + y = 14 \\ -9 \quad -9 \\ \hline y = 5 \end{array}$$

The result $y = 5$ is circled in blue. The solution pair $(3, 5)$ is boxed in green.

NOTE: We use the Elimination Method, if we can immediately cancel out two like terms.



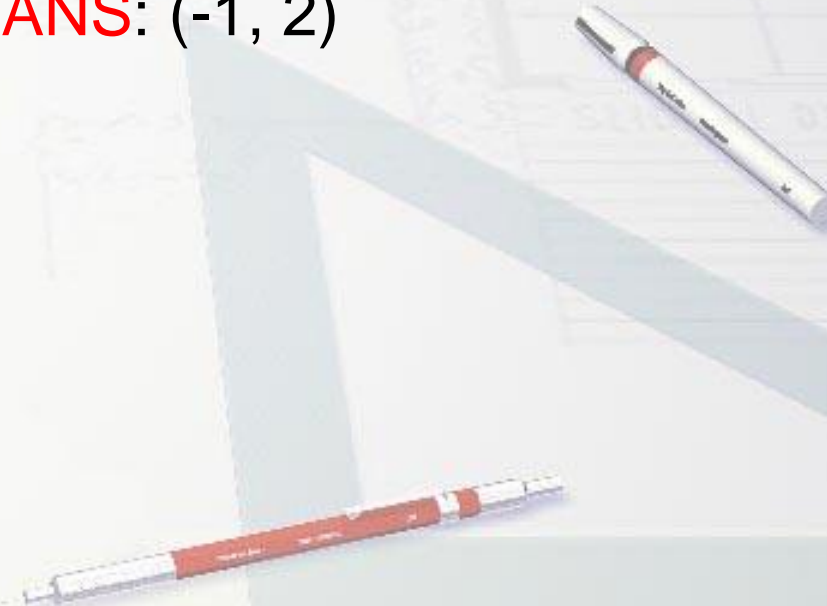
Your turn...

1.
$$\begin{cases} 2x + y = 5 \\ 3x - y = 15 \end{cases}$$

ANS: (4, -3)

2.
$$\begin{cases} x + 6y = 11 \\ -x + 2y = 5 \end{cases}$$

ANS: (-1, 2)



Example 3

Consider the system

$$\begin{cases} 6x + 11y = -5 \\ 6x + 9y = -3 \end{cases}$$

Example 3

Consider the system

$$6x + 11y = -5$$

$$+ \quad 6x + 9y = -3$$

$$12x + 20y = -8$$

← When we add equations together,
nothing cancels out

Now What????

Example 3 Again

Consider the system $6x + 11y = -5$

$$\begin{cases} 6x + 11y = -5 \\ -1 \cdot (6x + 9y = -3) \end{cases} \quad \begin{array}{r} 6x + 11y = -5 \\ + (-6x - 9y = 3) \\ \hline 2y = -2 \end{array} \quad \begin{array}{r} 2y = -2 \\ \hline y = -1 \end{array}$$

What do we need in order to eliminate?

$$6x + 11(-1) = -5$$

$$\begin{array}{r} 6x - 11 = -5 \\ + 11 \quad + 11 \\ \hline 6x = 6 \end{array} \quad \begin{array}{r} 6x = 6 \\ \hline x = 1 \end{array}$$

$$\begin{array}{r} 6x = 6 \\ \hline 6 \quad 6 \end{array}$$

$$(1, -1)$$

Example 4

Consider the system

$$\begin{cases} 4x + 2y = 2 \\ (5x + 2y = 4) \cdot -1 \end{cases}$$

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

$$\begin{array}{r} 4(2) + 2y = 2 \\ 8 + 2y = 2 \\ -8 \quad \quad \quad 2 \\ \hline 2y = -6 \end{array}$$

$$\begin{array}{r} 2y = -6 \\ \hline y = -3 \end{array}$$

$$x = 2$$

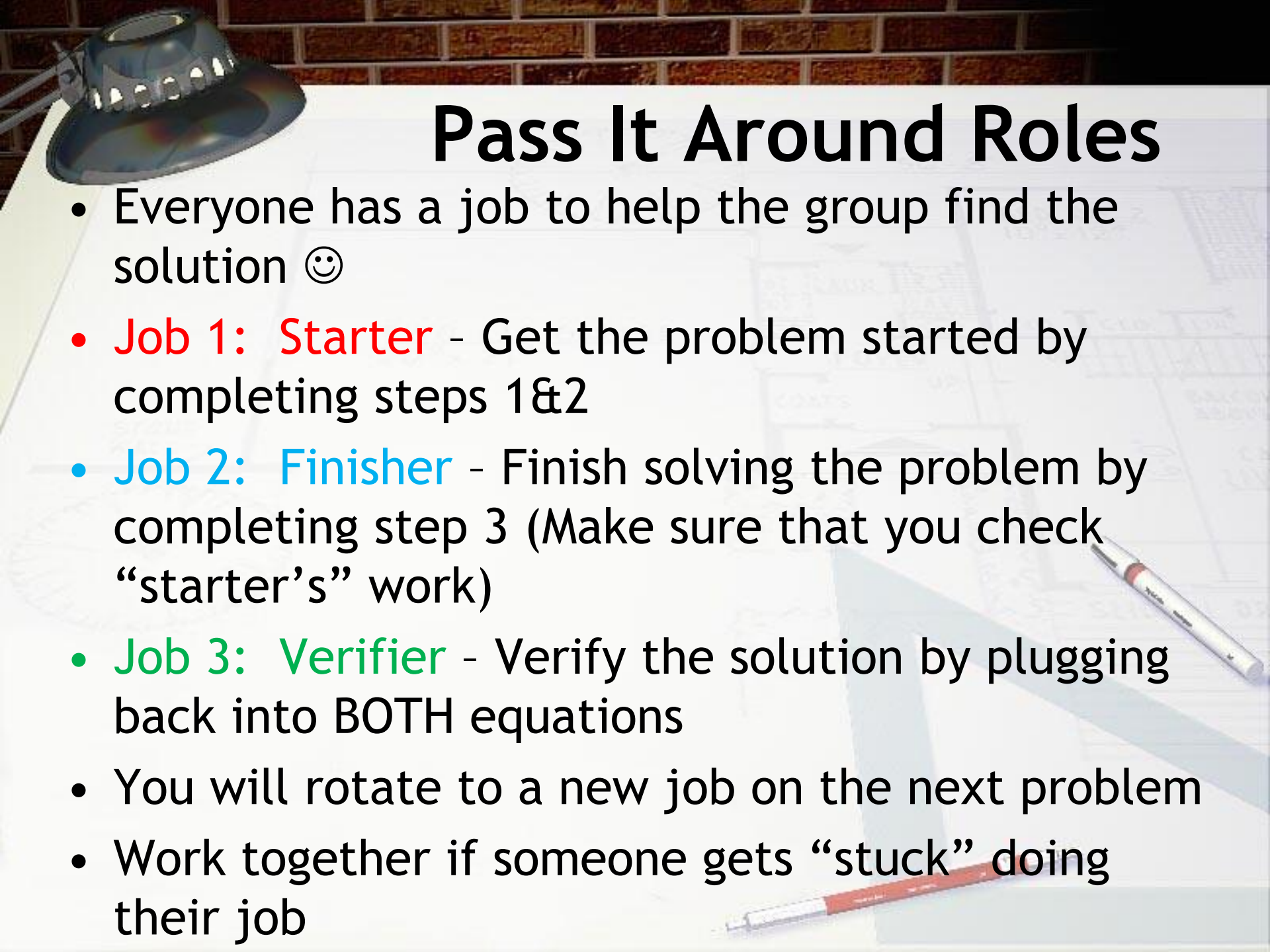
$$y = -3$$

$$(2, -3)$$

Your turn 3

Consider the system

$$\begin{array}{l} -1 \left\{ \begin{array}{l} 5x - 2y = 3 \\ 5x + y = -9 \end{array} \right. \end{array}$$
$$\begin{array}{r} 5x - 2y = 3 \\ 5x + y = -9 \\ \hline \end{array}$$
$$\begin{array}{r} \cancel{5x} + 2y = -3 \\ \cancel{5x} + y = -9 \\ \hline 3y = -12 \\ \frac{3y}{3} = \frac{-12}{3} \\ y = -4 \end{array}$$
$$\begin{array}{r} 5x - 4 = -9 \\ \quad +4 \quad +4 \\ \hline 5x = -5 \\ \frac{5x}{5} = \frac{-5}{5} \\ x = -1 \end{array}$$
$$(-1, -4)$$



Pass It Around Roles

- Everyone has a job to help the group find the solution 😊
- **Job 1: Starter** - Get the problem started by completing steps 1&2
- **Job 2: Finisher** - Finish solving the problem by completing step 3 (Make sure that you check “starter’s” work)
- **Job 3: Verifier** - Verify the solution by plugging back into BOTH equations
- You will rotate to a new job on the next problem
- Work together if someone gets “stuck” doing their job

Pass it Around

$$x + y = 10$$

$$x - y = 2$$

(6, 4)

Pass It Around

$$2x - y = -6$$

$$2x + 3y = 14$$

$(-0.5, 5)$

Pass it Around

$$\begin{aligned}x + 5y &= -13 \\ 2x - 5y &= -20\end{aligned}$$

$(-11, -.4)$

Pass It Around

$$2x - 3y = 6$$

$$x + 3y = 12$$

(6, 2)


A desk with a lamp, a blueprint, a compass, a ruler, and markers. The background is a brick wall. The desk is covered with a blueprint of a house. A lamp is in the top left corner. A compass is in the bottom left corner. A ruler is in the bottom left corner. Three markers are in the bottom center and right. The text "Elimination using Multiplication" is in the center. The text "LEQ: How do you solve a system of equations using the elimination method?" is in the center.

Elimination using Multiplication

LEQ: How do you solve a system of equations using the elimination method?



How do you eliminate?

- Tell your shoulder buddy what is the first thing you look for to eliminate a variable?
 - (Think about what is the 1st step of the elimination method)
 - **Look for Opposite Numbers**
 - [Flow Chart Elimination.pdf](#)
- 

Fabulous Flow Chart for Elimination Exhilaration

Start Here!

Are the equations of the system in standard form?

$$Ax + By = C$$

$$Ax + By = C$$



IF NO

Using appropriate algebra,
rearrange the equations to get
them in standard form.

Then go here

IF
YESPick a letter, any letter!!
Choose a variable to eliminate!
Your choice!!Are the coefficients of the variable you choose opposites?
(That means...is one negative and one positive?????)

IF NO

Make them opposites by
distributing a -1 to every
term in the equation!

Then go here

IF
YES

Are the coefficients of the variable you choose the same?

IF NO

Swap coefficients and
distribute throughout the
entire equation.IF
YES

Add vertically!

Solve for the remaining variable.

Substitute the answer back into the original system of
equations to solve for the other unknown variable.When you are finished, you should have a solution that
represents an (x,y) ordered pair which is the point of
intersection on a graph!

Then go here

Solution: (x, y) 

What to Eliminate?!?!

Consider the system

$$4x + 2y = 6$$

$$x + 3y = -6$$

← Multiply by **-4** to eliminate the x term

What to Eliminate?!?!

Consider the system

$$\begin{cases} -2x + 2y = 6 \\ x + 3y = -6 \end{cases}$$

← Multiply by **2** to eliminate the x term

What to Eliminate?!?!

Consider the system

$$\begin{cases} -2x + y = 6 \\ 8x + 3y = -6 \end{cases}$$

← Multiply by **-3** to eliminate the y term

What to Eliminate?!?!

Consider the system

$$\begin{cases} x - 5y = 16 \\ 3x + y = -6 \end{cases}$$

← Multiply by **5** to eliminate the y term



Example 5: Elimination using Multiplication

Consider the system

$$-3 (x + 2y = 6)$$

$$3x + 3y = -6$$


Elimination using Multiplication

Consider the system

$$\begin{array}{r} \cancel{-3x} + \cancel{-6y} = \cancel{-18} \\ + \cancel{3x} + 3y = -6 \\ \hline -3y = -24 \\ y = 8 \end{array}$$

ANS: (x, 8)

Elimination using Multiplication

Consider the system

$$\begin{cases} x + 2y = 6 \\ 3x + 3y = -6 \end{cases} \quad \leftarrow \text{Substitute } y = 8 \text{ into equation}$$

$$y = 8$$

$$x + 2(8) = 6$$

$$x + 16 = 6$$

$$x = -10$$

ANS: (x, 8)

Elimination using Multiplication

Consider the system

$$\begin{cases} x + 2y = 6 \\ 3x + 3y = -6 \end{cases} \quad \leftarrow \text{Substitute } y = 14 \text{ into equation}$$

$$y = 8$$

$$x + 2(8) = 6$$

$$x + 16 = 6$$

$$x = -10$$

ANS: (-10, 8)

Example 6

Consider the system

$$\begin{cases} 3x + 4y = 22 \\ x - 5y = -37 \end{cases}$$

Your turn

1.
$$\begin{cases} x + 2y = 5 \\ 2x + 6y = 12 \end{cases}$$

ANS: (3, 1)

2.
$$\begin{cases} x + 2y = 4 \\ x - 4y = 16 \end{cases}$$

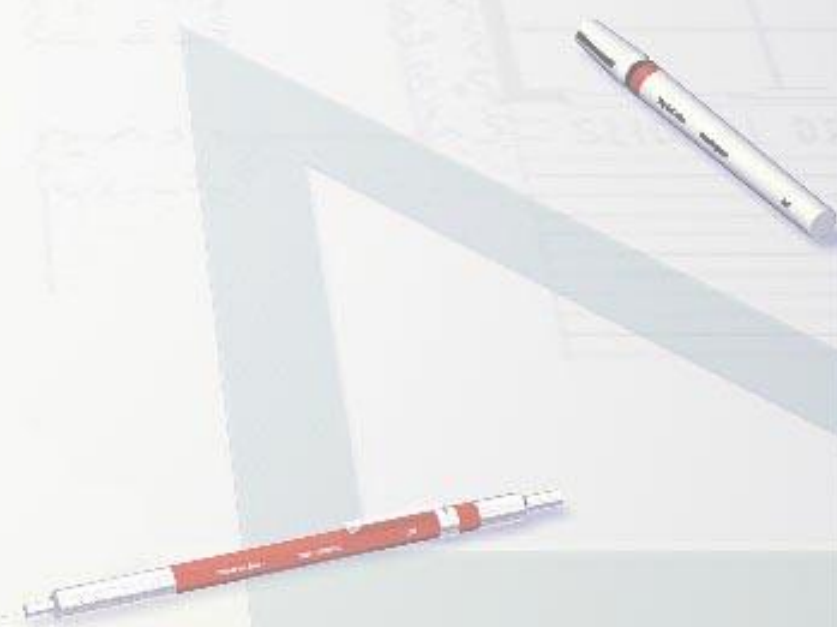
ANS: (8, -2)

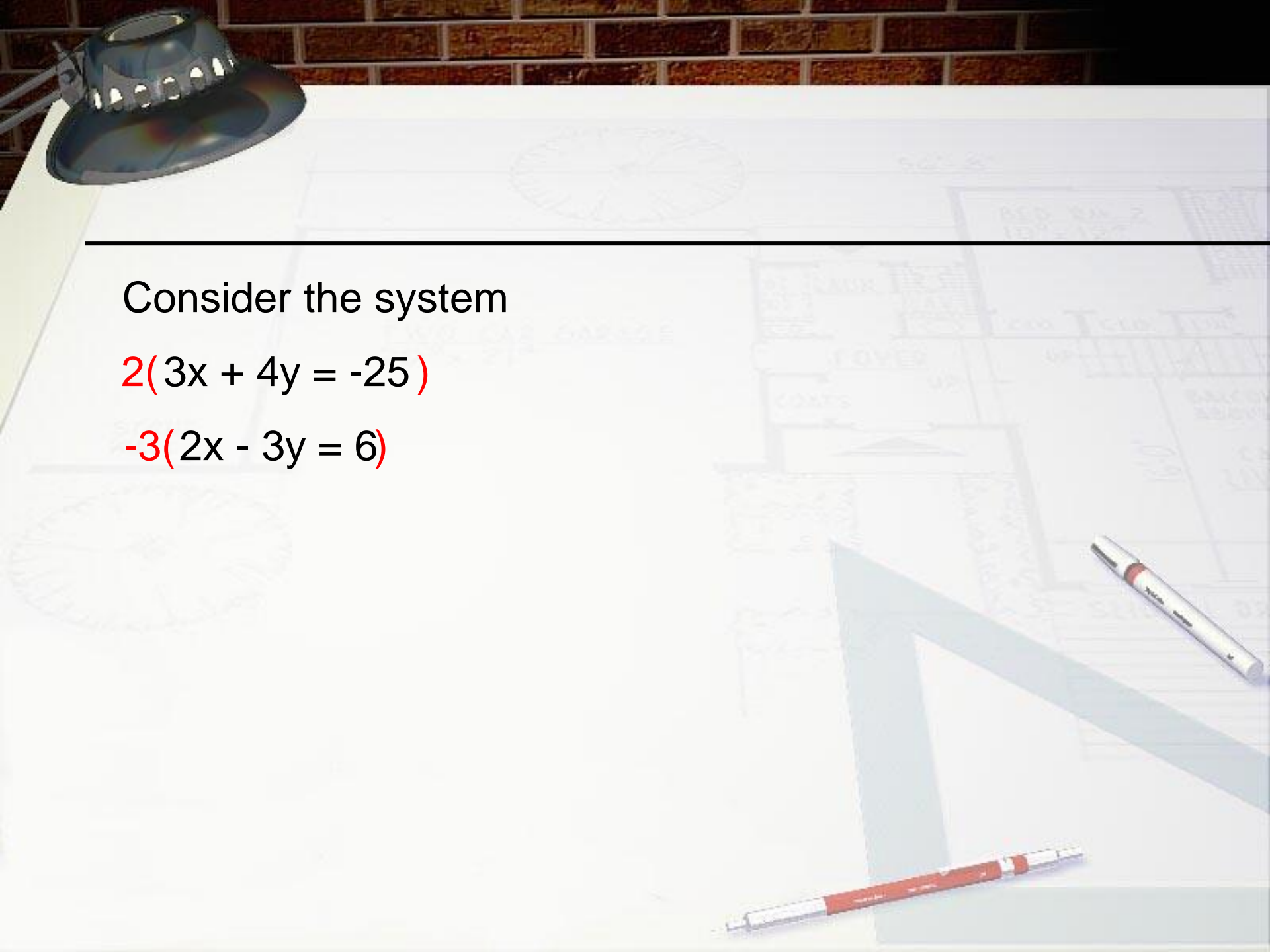


Example 7: More multiplying

Consider the system

$$\begin{cases} 3x + 4y = -25 & \longleftarrow \text{Multiply by } 2 \\ 2x - 3y = 6 & \longleftarrow \text{Multiply by } -3 \end{cases}$$





Consider the system

$$2(3x + 4y = -25)$$

$$-3(2x - 3y = 6)$$




Consider the system


$$6x + 8y = -50$$

$$+ \quad -6x + 9y = -18$$

$$17y = -68$$

$$y = -4$$
 

ANS: (x, -4)



Consider the system

$$\begin{cases} 3x + 4y = -25 \\ 2x - 3y = 6 \end{cases}$$

← Substitute $y = -4$

$$2x - 3(-4) = 6$$

$$2x + 12 = 6$$

$$2x + 12 = 6$$

$$2x = -6$$

$$x = -3$$

ANS: $(x, -4)$

Consider the system

$$\begin{cases} 3x + 4y = -25 \\ 2x - 3y = 6 \end{cases}$$

← Substitute $y = -4$

$$2x - 3(-4) = 6$$

$$2x + 12 = 6$$

$$2x + 12 = 6$$

$$2x = -6$$

$$x = -3$$

ANS: $(-3, -4)$

Example 8

Consider the system


$$\begin{cases} 2x + 2y = -8 \\ 3x - 3y = 18 \end{cases}$$



Your turn

1.
$$\begin{cases} x + 2y = 5 \\ 2x + 6y = 12 \end{cases}$$

2.
$$\begin{cases} x + 2y = 4 \\ x - 4y = 16 \end{cases}$$



Your turn

1.

$$4x + y = 9$$

$$3x + 2y = 8$$

2.

$$2x + 3y = 1$$

$$5x + 7y = 3$$

JOURNAL

Solve the system using elimination method:

$$2x + 5y = 7$$

$$3x + y = -9$$

The solution is:



- a. (12, -4)
- b. (-4, 3)
- c. (4, -21)
- d. No Solution



YES!

The solution is $(4, -21)$. You can verify this by plugging it into the system:

$$2(4) + 5(-21) = 7$$

$$3(4) + (-21) = -9$$




A desk with a lamp, a ruler, and markers on a brick wall background. The lamp is in the top left corner. The ruler is in the bottom right corner. The markers are in the bottom right corner. The background is a brick wall.

Question 3

Try Again

Journal

- What kinds of errors have you made in using the elimination method to solve system of equations?
- What do you think you can do to reduce those errors?



Comic Book

- Create a Comic book to explain how to solve systems of equations using the elimination method.
- Your Comic Book must have a hero and describe in detail all of the steps
- You can use an example if it helps you 😊



A desk with a lamp, a ruler, and a pen. The background is a brick wall. The desk is white and has a lamp in the top left corner, a ruler in the bottom right corner, and a pen in the bottom right corner. The text is centered on the desk.

Classwork

- Complete your Comic Book
- If you don't finish in class complete tonight for homework.

Journal

- You now have worked with three different methods for solving systems of linear equations. How do you decide when to use the following?:
 - Graphing method
 - Substitution method
 - Elimination method



A desk with a lamp, a large sheet of paper with faint sketches, and drawing tools like a marker and a pencil.

Homework

- Complete Comic Book mini project.

Quote

"The difference between perseverance and obstinacy is that one comes from a strong will, and the other from a strong won't."

Henry Ward Beecher