


SOLVING SYSTEMS OF EQUATIONS

Special Ed



$ax^2 + bx + c = 0$
 $x_{1,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

ALSO INCLUDES GOOGLE SLIDES



This unit was created with this guy in mind. He has autism and an intellectual disability. He is a non-reader and lacks many prerequisite math skills needed for high school math. With some support, he is able to do this unit and enjoys the challenge. He is my tester!!

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Also included with this unit you will separate pdfs with:

- Lesson plans
- Links and directions to digital activities (includes narrated version of book with animation)

This unit contains over 150 pages of material. But, don't worry!! I have included a 15 day lesson plan to help you make the most of everything packed in this unit.

Solving Systems of Equations

Lesson Plan

Preparation

- Print out a vocabulary board for each student to use throughout unit
 - Laminate or place in page protector
- Book
 - Print out, laminate, and bind
 - OR your students can listen to the pre-recorded movie included in the pdf that has directions and links to digital activities.
 - The movie is a great choice because I animated this one to help students see how each problem is worked through.
- Vocabulary cards
 - Print out a set of cards onto cardstock and laminate
 - Make one set for each student and also one for the teacher to use in I Spy games

Review

- If you have the first unit in this series, Reading and understanding systems of equations, you want to go over that the day before (unless you just finished it)
- There are some references to that unit in the book/movie, but it is NOT necessary to have that unit in order to be successful with this one.

Teaching Tips

1. *Color Coding:* this is a really easy way to add more structure to a matching activity. Outline or color in an empty box or sorting label. Outline or color in the corresponding picture symbols the same colors. Becomes a color matching task.
 - a. For more info, read more here:
<https://specialneedsforspecialkids.org/2015/09/05/using-color-coding-for-differentiation/>
 - b. I also have a blog post on differentiating one activity 3 ways:
<https://specialneedsforspecialkids.org/2018/10/22/differentiating-1-activity-3-ways-easily-and-effectively/>
2. *Make you own copies of the activities:* Every day I review the activity we did yesterday. For that reason:
 - a. I often complete the activity myself and often laminated it for easy review that I could use year after year.

The lesson plans contain:

Overall tips for teaching students with significant needs and who may lack some pre-requisite skills.

Quick Look

Day	Activity	Day	Activity	Day	Activity
1	<ul style="list-style-type: none"> • Book/movie • Vocabulary and power card introduction 	7	<ul style="list-style-type: none"> • Book/movie • Power card review • Using substitution to solve entire problem 	13	<ul style="list-style-type: none"> • Book/movie • Power card review • Using elimination to solve entire problem
2	<ul style="list-style-type: none"> • Book/movie • Vocabulary and power card review • Step 1 practice: substitution 	8	<ul style="list-style-type: none"> • Book/movie • Power card review • Using substitution to solve entire problem 	14	<ul style="list-style-type: none"> • Book/movie • Power card review • Using elimination to solve entire problem
3	<ul style="list-style-type: none"> • Book/movie • Vocabulary and power card review • Step 2 practice: substitution 	9	<ul style="list-style-type: none"> • Book/movie • Power card review • Step 1 practice: elimination 	15	<ul style="list-style-type: none"> • Book/movie • Vocab cards cut & paste
4	<ul style="list-style-type: none"> • Book/movie • Vocabulary and power card review • Step 3 practice: substitution 	10	<ul style="list-style-type: none"> • Book/movie • Power card review • Step 2 practice: elimination 		
5	<ul style="list-style-type: none"> • Book/movie • Vocabulary and power card review • Step 4 practice: substitution 	11	<ul style="list-style-type: none"> • Book/movie • Power card review • Step 3 practice: elimination 		
6	<ul style="list-style-type: none"> • Book/movie • Power card review • Step 5 practice: substitution 	12	<ul style="list-style-type: none"> • Book/movie • Power card review • Step 4 practice: elimination 		

The lesson plans contain:

A quick look at what you will do each day.

Day 11


Activity	Notes	Materials
Read or listen to a movie version of the book (10 minutes)	<ul style="list-style-type: none">• Read through the story, asking lots of questions• Continue to make connections between book and vocabulary board	<ul style="list-style-type: none">• Book• Vocabulary board
Power cards review (5 minutes)	<ul style="list-style-type: none">• Quick review.• Make sure students have the card for elimination for this lesson.	Substitution power card
Worksheet review (5 minutes)	<ul style="list-style-type: none">• Review the worksheet done yesterday	<ul style="list-style-type: none">• Worksheet from yesterday
Worksheet: practice the steps of elimination (20 minutes)	<ul style="list-style-type: none">• Complete the worksheet that only review step three of elimination.• There are a lot of problems (10) included. Choose the best number of problems your students can handle. Make frequent references to power card.	<ul style="list-style-type: none">• Worksheet•
Sharing (10 minutes)	<ul style="list-style-type: none">• Each student shares one of their finished problems with the group using the communication method of their choice	<ul style="list-style-type: none">• Completed worksheets• Communication devices




The lesson plans contain:

Detailed instructions on how that day's lesson should run including group and individual activities.

For this example, the  will represent the variable x.



The  will represent the variable y.


A  +  = \$12

B   +  = \$16

How much does each cupcake cost? How much does each piece of pie cost?

Decide which variable you want to eliminate. Once you do, determine what you need to multiply so when the equations are added together, the one variable is zero.

Let's get rid of the  or y. 

To get rid of the  we will need to make one negative by multiplying both sides by -1.








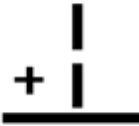
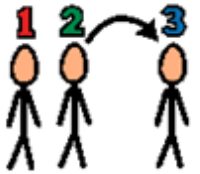
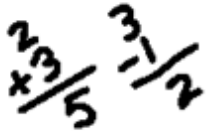






A   +  = \$7

-1 ( ) + -1 () = -1 (\$7)

-   -  = -\$7

This unit contains a book that is 37 pages and covers how to solve systems of equations using either substitution or elimination.

It comes in a pdf version as well as an mp4 version that is animated and narrated.

 systems	x, y variables	$5x$ coefficient	 related	$=$ equation
 substitution	 elimination	 choose	$+ -$ opposite	 how many
 how much	 add together	 next step	 solve	 check
 repeat that	 yes	 no	 I don't know	 need a break

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This unit comes with a vocabulary board.

Vocabulary boards are great for ALL students to assist with participation and engagement in group discussions.

Tips on how to use in the unit!!

variable

An unknown quantity in an expression or equation represented by a letter.

X, Y

equation

The values of two mathematical expressions are equal.

=

system

Two or more problems that are related and have the same variables.



coefficient

The number in front of the variable.

5X

elimination

Solving for one variable by multiplying one equation by a number that will make the coefficients of one variable opposites.



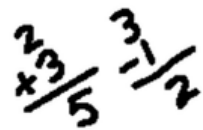
substitution

Solving for one variable and putting that answer into the other equation to solve for another variable.



solve

Finding the value of all variables in both/all equations.



check

Insert the value you got for each variable and make sure both/all equations are still true or equal.



This unit comes with 8 vocabulary cards.

The first week students will do a group activity using these cards to get more familiar with words that are likely new to them.

variable

An unknown quantity in an expression or equation represented by a letter.



equation

The values of two mathematical expressions are equal.



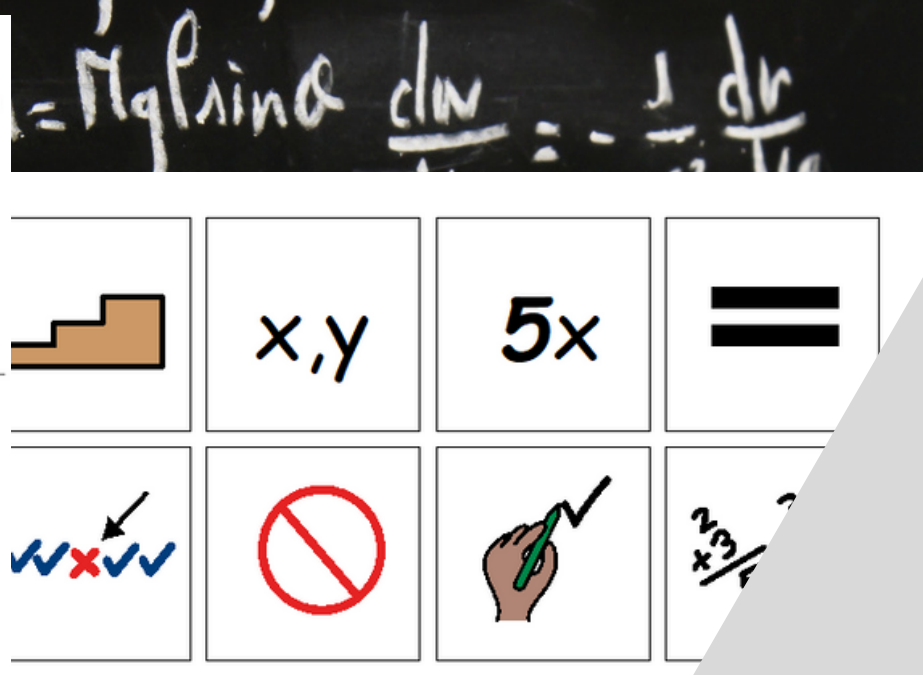
system

Two or more problems that are related and have the **same variables**.



coefficient

The number in front of the variable.



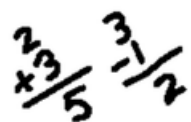
substitution



elimination



solve

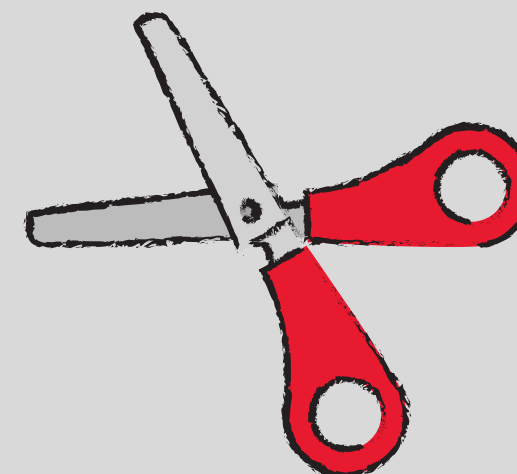


check



Finding the value of all variables in both/all equations.	The number in front of the variable.
Two or more problems that are related and have the same variables .	Insert the value you got for one variable into the other equation and make sure both/all equations are true or equal.
Solving for one variable by multiplying one equation by a number that will make the coefficients of one variable opposites.	The values of two mathematical expressions are equal.
Solving for one variable and putting that answer into the other equation to solve for another variable.	An unknown quantity in an expression or equation represented by a letter.

Students will also test their knowledge of these new words and symbols with a cut and paste activity on the last day.



Step by step cards for solving systems of equations. Made to fit on 4x6 index cards.

- Print on cardstock and laminate
- Glue together back-to-back

Substitution

1. Use either equation and solve for a variable. (best if variable has a coefficient of 1 or -1)
2. Substitute the resulting quantity from step 1 into the other equation.
3. Solve for the remaining variable.
4. Substitute the value found in step 3 into the other equation to find the value for the other variable.
5. Check you answers.

Sample: $2x + y = 15$ $x + 3y = 15$

1. $y = 15 - 2x$
2. $x + 3(15 - 2x) = 15$
3. $x = 6$
4. $2(6) + y = 15$
 $y = 3$

Substitution

Step by step cards for solving systems of equations. Made to fit on 4x6 index cards.

- Print on cardstock and laminate
- Glue together back-to-back

Elimination

1. Multiply one the equations by a factor that will line up one variable to eliminate.
2. Add the equations together.
3. Substitute the new value into one of the equations to solve for the eliminated variable.

Sample: $2x + y = 7$ $3x + y = 10$

1. $-1(2x) + -1(y) = -1(7) \rightarrow -2x - y = -7$
2.
$$\begin{array}{r} -2x - y = -7 \\ 3x + y = 10 \\ \hline x = 3 \end{array}$$
3. $3(3) + y = 10$
 $y = 1$

Elimination

There are power cards that outline the steps of substitution and elimination which students can use when working through problems.

Step 1: Isolate one of the variables on one side of the equation. Simplify if needed. **Do NOT solve the problem.**

$x - y = 4$	$2x - y = 5$
$x + y = 13$	$x - 2y = 2$
$3x + y = 11$	$2x - y = 11$
$x - 2y = 3$	$x - y = 3$
$x - 3y = 6$	

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Step 2: Substitute equation #1 into equation #2. Write the new equation.

#1 $x = 4 + y$ #2 $x - 2y = 2$	#1 $y = 2x - 5$ #2 $3x + 2y = 25$
#1 $x = 13 - y$ #2 $2x + y = 16$	#1 $x = 2 + 2y$ #2 $2x - y = 13$
#1 $y = 11 - 3x$ #2 $2x + y = 10$	#1 $y = 2x - 11$ #2 $x - y = 1$
#1 $x = 3 + 2y$ #2 $2x - y = 12$	#1 $x = 3 + y$ #2 $2x - 3y = 5$
	#1 $y = 16 - 3x$ #2 $x + 2y = 22$

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Step 3: Solve the new equation you created in step 2.

$(4 + y) - 2y = 2$	$3x + 2(2x - 5) = 25$
$2(13 - y) + y = 16$	$2(2 + 2y) - y = 13$
$2x + (11 - 3x) = 10$	$x - (2x - 11) = 1$
$2(3 + 2y) - y = 12$	$2(3 + y) - 3y = 5$
$2(6 + 3y) - 2y = 16$	$x + 2(16 - 3x) = 22$

There are worksheets that practice each individual step (5 steps in all) solving systems of equations using **substitution**. Each step has 10 questions

Step 4: Substitute the value from step 3 into equation #1 and solve for other variable.

$x = 4 + y$ ($y = 2$)	$y = 2x - 5$ ($x = 5$)
$x = 13 - y$ ($y = 10$)	$x = 2 + 2y$ ($y = 3$)
$y = 11 - 3x$ ($x = 1$)	$y = 2x - 11$ ($x = 10$)
$x = 3 + 2y$ ($y = 2$)	$x = 3 + y$ ($y = 1$)
$x = 6 + 3y$ ($y = 1$)	$y = 16 - 3x$ ($x = 2$)

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Step 5: Check your answer. Insert the values for x and y into both equations to check.

$x = 6$ $y = 2$	#1 $x = 4 + y$	#2 $x - 2y = 2$
$x = 3$ $y = 10$	#1 $x = 13 - y$	#2 $2x + y = 16$
$x = 1$ $y = 8$	#1 $y = 11 - 3x$	#2 $2x + y = 10$
$x = 7$ $y = 2$	#1 $x = 3 + 2y$	#2 $2x - y = 12$
$x = 9$ $y = 1$	#1 $x = 6 + 3y$	#2 $2x - 2y = 16$

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There are worksheets that practice each individual step solving systems of equations using **substitution**. Each step has 10 questions

Step 1: Multiply both sides of the equation by the coefficient in the top left corner.

-1	$x + y = 13$	-3	$2x - y = 18$
-1	$x - y = 6$	-2	$4x - y = 15$
-1	$x - 3y = 6$	2	$2x - y = 7$
2	$2x - y = 8$	1	$3x - y = 6$
-4	$x + y = 9$	-3	$x - y = 1$

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Step 2: Add the two equations together.

$\begin{array}{r} 2x + y = 20 \\ -x - y = -13 \\ \hline \end{array}$	$\begin{array}{r} x - 3y = 4 \\ -6x + 3y = -54 \\ \hline \end{array}$
$\begin{array}{r} x + 2y = 27 \\ -x + y = -6 \\ \hline \end{array}$	$\begin{array}{r} 3x - 2y = 5 \\ -8x + 2y = -30 \\ \hline \end{array}$
$\begin{array}{r} x - 2y = 12 \\ -x + 3y = -6 \\ \hline \end{array}$	$\begin{array}{r} x + 2y = 16 \\ 4x - 2y = 14 \\ \hline \end{array}$
$\begin{array}{r} x + 2y = 9 \\ 4x - 2y = 16 \\ \hline \end{array}$	$\begin{array}{r} x + y = 10 \\ 3x - y = 6 \\ \hline \end{array}$
$\begin{array}{r} 4x + y = 12 \\ -4x - 4y = -36 \\ \hline \end{array}$	$\begin{array}{r} 3x - 2y = 10 \\ -3x + 3y = -3 \\ \hline \end{array}$

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There are worksheets that practice each individual step (4 steps in all) solving systems of equations using **elimination**. Each step has 10 questions

Step 3: Substitute the value of the variable you just solved for in step 2 into this new equation.

$2x + y = 20$ ($x = 7$)	$x - 3y = 4$ ($x = 10$)
$x + 2y = 27$ ($y = 7$)	$3x - 2y = 5$ ($x = 5$)
$x - 2y = 12$ ($y = 6$)	$x + 2y = 16$ ($x = 6$)
$x + 2y = 9$ ($x = 5$)	$x + y = 10$ ($x = 4$)
$4x + y = 12$ ($y = 8$)	$3x - 2y = 10$ ($y = 7$)

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Step 4: Check your answer. Insert the values for x and y into both equations to check.

$x = 7$ $y = 6$	#1 $x + y = 13$	#2 $2x + y = 20$
$x = 13$ $y = 7$	#1 $x - y = 6$	#2 $x + 2y = 27$
$x = 24$ $y = 6$	#1 $x - 2y = 12$	#2 $x + y = 30$
$x = 5$ $y = 2$	#1 $x + 2y = 9$	#2 $2x - y = 9$
$x = 1$ $y = 8$	#1 $x + y = 9$	#2 $4x + y = 12$

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There are worksheets that practice each individual step solving systems of equations using **elimination**. Each step has 10 questions

Use substitution to solve the following problem.

#1

$$2 \text{ keys} + \text{heart} = \$7$$

$$\text{key} + \text{heart} = \$5$$

Step 1: Solve for one of the variables

Step 2: Substitute the value of step 1 into second equation.

Use substitution to solve the following problem.

#1

$$2 \text{ keys} + \text{heart} = \$7$$

$$\text{key} + \text{heart} = \$5$$

Step 5: Check your answer.

Use substitution to solve the following problem.

#1

$$2 \text{ keys} + \text{heart} = \$7$$

$$\text{key} + \text{heart} = \$5$$

Step 3: Copy problem from step 2 and solve for remaining variable.

Step 4: Substitute the value from step 3 into other equation and solve for other variable.

There are 5 problems using each method to work through all the steps at one time using pictures.

Use elimination to solve the following problem.

#4

$$\text{Watermelon slice} - \text{Apple} = \$4 \qquad \text{3 Watermelon slices} + \text{2 Apples} = \$17$$

Step 1: Decide which variable to get rid of and multiply both sides of the equation so the coefficients will be opposites.

Step 2: Add the two equations together using the new equation you made in step 1.

Use elimination to solve the following problem.

#4

$$\text{Watermelon slice} - \text{Apple} = \$4 \qquad \text{3 Watermelon slices} + \text{2 Apples} = \$17$$

Step 3: Substitute the value of the variable you just solved for into the other equation.

Step 4: Check your answer.

In this unit, this is used in place of my normal multiple-choice assessment.

Use elimination to solve the following problem.

#3

$$\text{☞} + \text{☞} + \text{☞} = \$18$$

$$\text{☞} + \text{☞} + \text{☞} = \$15$$

Step 1: Decide which variable to get rid of and multiply both sides of the equation so the coefficients will be opposites.

$$-1(\text{☞} + \text{☞}) + -1(\text{☞}) = -1(\$15)$$

$$-\text{☞} - \text{☞} - \text{☞} = -\$15$$

Step 2: Add the two equations together using the new equation you made in step 1.

$$\text{☞} + \text{☞} + \text{☞} = \$18$$

$$-\text{☞} - \text{☞} - \text{☞} = -\$15$$

$$\text{☞} = \$3$$

Use elimination to solve the following problem.

#3

$$\text{☞} + \text{☞} + \text{☞} = \$18$$

$$\text{☞} + \text{☞} + \text{☞} = \$15$$

Step 3: Substitute the value of the variable you just solved for into the other equation.

$$\text{☞} + \text{☞} + \text{☞} = \$15$$

$$\text{☞} + 3 = \$15$$

$$\text{☞} = \$12$$

$$\text{☞} = \$6$$

Step 4: Check your answer.

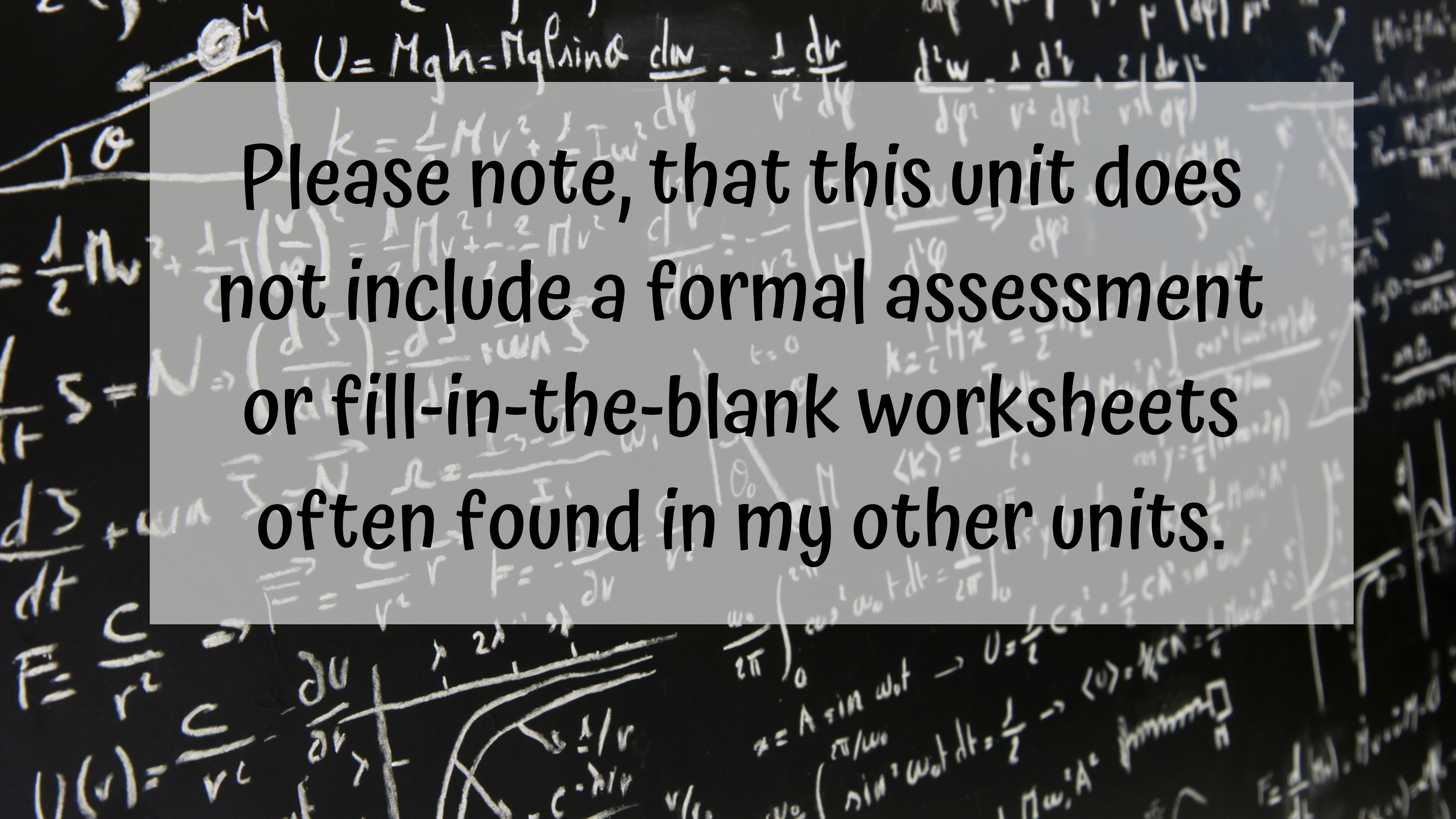
$$\text{☞} + \text{☞} + \text{☞} = \$18$$

$$\text{☞} + \text{☞} + \text{☞} = \$15$$

$$\$12 + \$6 = \$18 \checkmark$$

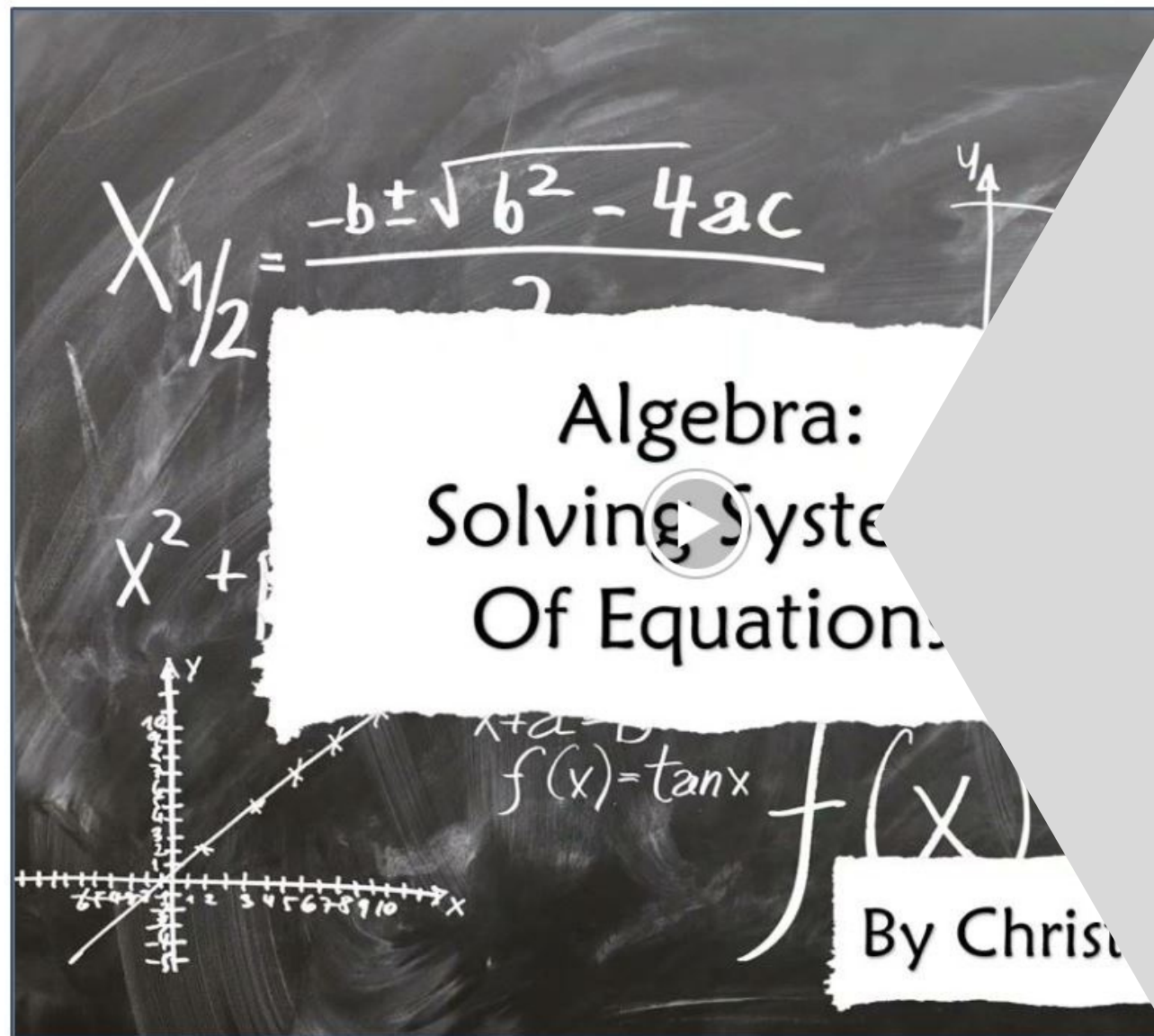
$$\$12 + \$3 = \$15 \checkmark$$

Each set of worksheets (including the ones with individual steps) has detailed step-by-step answer keys.



Please note, that this unit does not include a formal assessment or fill-in-the-blank worksheets often found in my other units.

Listen to the movie about solving systems of equations



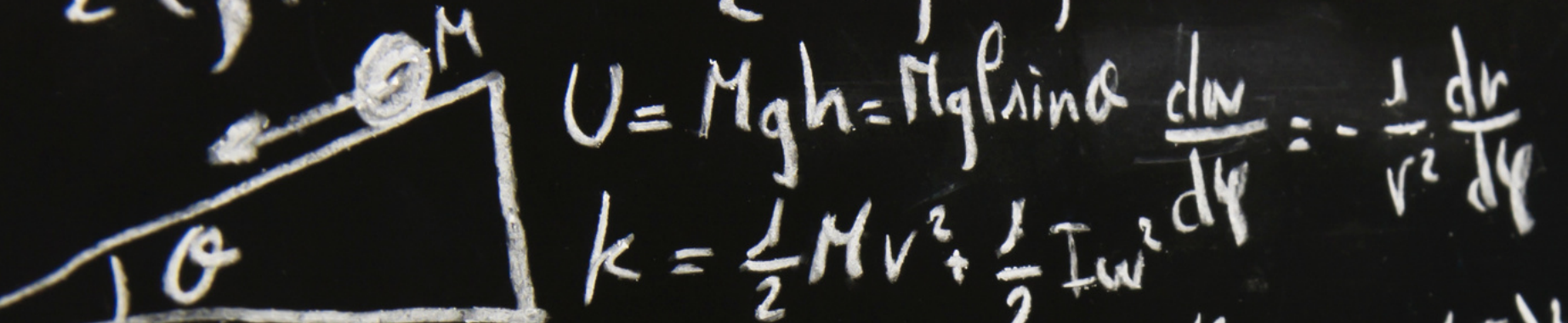
This unit includes digital activities. Part of that is a movie version of the book you can play in a google slide. This movie is animated and narrated.

-1	$x + y = 13$	-3	$2x - y = 18$
	<input type="text"/>		<input type="text"/>
-1	$x - y = 6$	-2	$4x - y = 15$
	<input type="text"/>		<input type="text"/>
-1	$x - 3y = 6$	2	$2x - y = 7$
	<input type="text"/>		<input type="text"/>
2	$2x - y = 8$	1	$3x - y = 6$
	<input type="text"/>		<input type="text"/>
-4	$x + y = 9$	-3	$x - y = 1$
	<input type="text"/>		<input type="text"/>

Solving Equations using **elimination**: STEP 1

- Multiply both sides of the equation by coefficient in the top left corner.

There are 2 sets of 29 google slides that include all the worksheets in the unit. Students can type in the answers.



#1 $x = 4 + y$ #2 $x - 2y = 2$ <input type="text"/>	#1 $y = 2x - 5$ #2 $3x + 2y = 25$ <input type="text"/>
#1 $x = 13 - y$ #2 $2x + y = 16$ <input type="text"/>	#1 $x = 2 + 2y$ #2 $2x - y = 13$ <input type="text"/>
#1 $y = 11 - 3x$ #2 $2x + y = 10$ <input type="text"/>	#1 $y = 2x - 11$ #2 $x - y = 1$ <input type="text"/>
#1 $x = 3 + 2y$ #2 $2x - y = 12$ <input type="text"/>	#1 $x = 3 + y$ #2 $2x - 3y = 5$ <input type="text"/>
#1 $x = 6 + 3y$ #2 $2x - 2y = 16$ <input type="text"/>	#1 $y = 16 - 3x$ #2 $x + 2y = 22$ <input type="text"/>

Solving Equations using **substitution**: STEP 2

- Substitute equation #1 into equation #2.
- Match the correct equation to each box.

<input type="text" value="x = 3 + y"/>	<input type="text" value="x = 4 + y"/>
<input type="text" value="2x - 5 = y"/>	<input type="text" value="y = 11 - 3x"/>
<input type="text" value="x = 13 - y"/>	<input type="text" value="y = 16 - 3x"/>
<input type="text" value="x = 6 + 3y"/>	<input type="text" value="x = 2 + 2y"/>
<input type="text" value="y = 2x - 11"/>	<input type="text" value="x = 3 + 2y"/>

One set is differentiated with color for students who need more support. In this set, students are NOT typing but clicking and dragging over their answers.



Use **elimination** to solve the following problem.

$$\begin{matrix} \text{☀} \text{☀} - \text{☾} \text{☾} = 8 & \text{☀} + \text{☾} = 12 \end{matrix}$$

Step 1:

2

Step 2:

$$+ \underline{\hspace{2cm}}$$

Step 3:

Step 4:

$$\text{☀} \text{☀} - \text{☾} \text{☾} = 8$$

$$\text{☀} + \text{☾} = 12$$

Look at the equations below and place them in the correct order to solve the problem.

Step 1: Find the correct equation that multiplies both sides of the circled equation by the coefficient to the right of the box

Step 2: Find the correct equation that adds the two equations together using the new equation you made in step 1.

Step 3: Find the correct equation that substitutes the value of the variable you just solved for in step 2 into either one of the equations.

Step 4: Find the correct equations that check your answer.

$$\begin{matrix} 2(\text{☀}) + 2(\text{☾}) = 2(12) \\ \text{☀} \text{☀} + \text{☾} \text{☾} = 24 \end{matrix}$$

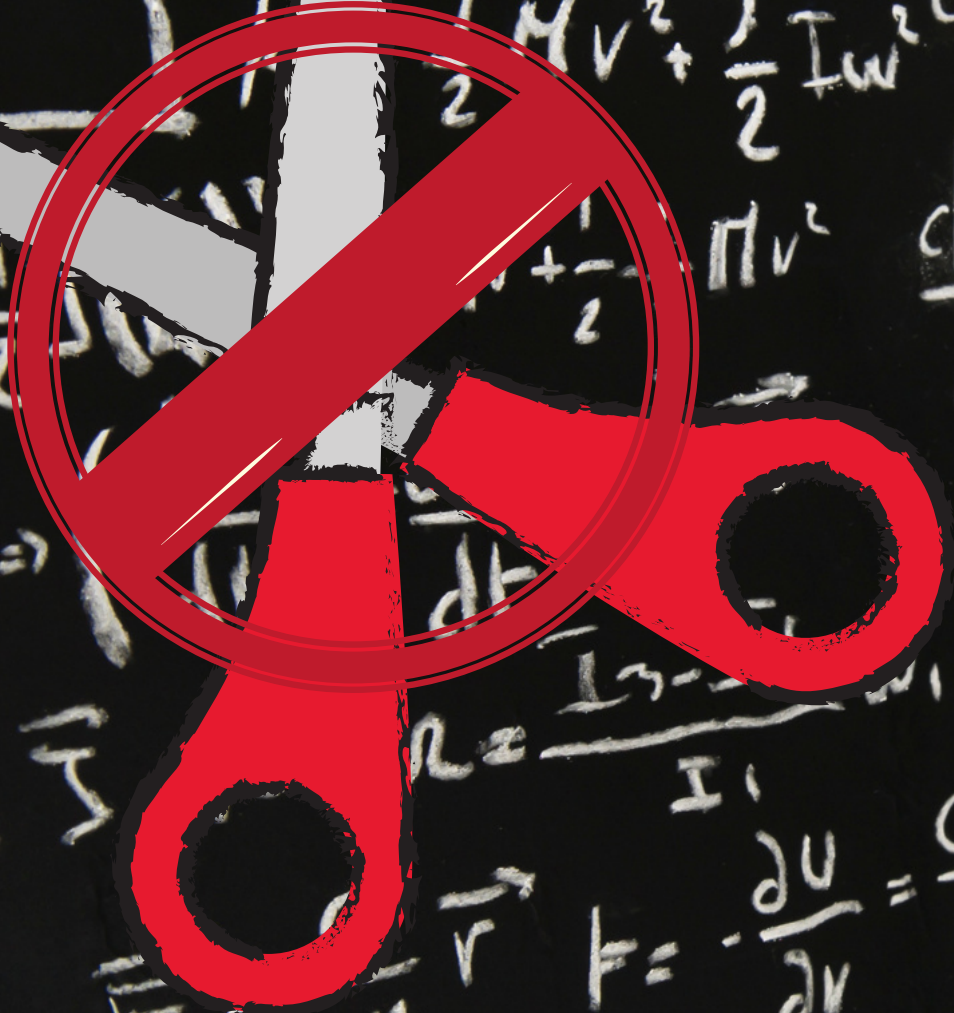
$$\begin{matrix} \text{☀} + \text{☾} = 12 \\ 8 + \text{☾} = 12 \\ \text{☾} = 4 \end{matrix}$$

$$\begin{matrix} \text{☀} \text{☀} - \text{☾} \text{☾} = 8 \\ + \text{☀} \text{☀} + \text{☾} \text{☾} = 24 \\ \hline \text{☀} \text{☀} \text{☀} \text{☀} = 32 \\ \text{☀} = 8 \end{matrix}$$

$$16 - 8 = 8$$

$$8 + 4 = 12$$

Mix and match from both sets to make a perfect set for each student.



I realize there will be some students out there unable to do cutting activities. I have a blog post with ways to complete activities without a pair of scissors!!

[Click Here to read more!!](#)