MISSISSIPPI DEPARTMENT OF EDUCATION

Ensuring a bright future for every child

MISSISSIPPI

EXEMPLAR

Units & Lessons

MATHEMATICS

Grade 8

Grant funded by:

W.K. KELLOGG FOUNDATION

Lesson 8: Elimination

Focus Standard(s): 8.EE.8b

Additional Standard(s): 8.EE.7a, 8.EE.7b, 8.EE.8a

Standards for Mathematical Practice: SMP.4, SMP.6. SMP.7, SMP.8

Estimated Time: 50 minutes

Resources and Materials:

- Document camera
- Highlighters
- Red pen or pencil
- Handout 8.1: Magic Boxes
- Handout 8.2: Elimination

Lesson Target(s):

- Students will understand the relationship between linear equations in two variables and lines in a plane.
- Students will understand the relationship between equivalent forms of linear equations.

Guiding Question(s):

- How can linear combinations be used to solve systems of equations algebraically?
- How can elimination be used in solving systems of equations?

Vocabulary

Academic Vocabulary:	**Instructional Strategies for Academic Vocabulary:**
• Coefficient • Constant • Elimination • Inverse • Variable	☐ Introduce words with student-friendly definition and pictures ☐ Model how to use the words in discussion ☐ Read and discuss the meanings of words in a mathematical context

Symbol	Type of Text and Interpretation of Symbol
	Instructional support and/or extension suggestions for students who are EL, have disabilities, or perform well below the grade level and/or for students who perform well above grade level
✓	Assessment (Pre-assessment, Formative, Self, or Summative)

Instructional Plan

Understanding Lesson Purpose and Student Outcomes: Students will solve Box Puzzles to strengthen addition of integers to prepare for the elimination method of solving systems of equations. Teacher will model how to use elimination and students will work with groups in an assembly line to solve systems using the elimination method.

Anticipatory Set/Introduction to the Lesson:
Note: The purpose for the box puzzles is to allow students the opportunity to see the elimination process without the confusion of the variables.

Distribute **Handout 8.1: Box Puzzles** and allow students time to analyze the first box puzzle that is already filled in completely (SMP.8). After students have sufficient time to identify the structure, have them complete the box puzzle activity. Facilitate a whole group discussion about the completion using prompting questions to guide the discussion.

Prompting Questions:

- Did anyone find the pattern?
- What did you notice about the last two puzzles?
- What two methods have we used to solve systems of equations?

Explain to the class that we will now learn an additional method for solving systems of equations called the elimination method.

Activity 1: Modeling
Distribute and project a copy of **Handout 8.2: Elimination**. Call attention to the first problem. Ask students to find two terms that are inverses of one another?
Students and teacher highlight *3y* and *-3y.*

$$2x + 3y = 5$$
$$4x - 3y = 1$$

Prompting Questions:

- What happens when we add these two terms?
- Our coefficient becomes zero. What is zero times *y*?

Explain to learners that the term "eliminates" through addition, but that if those terms get added, the other like-terms must as well.

Teacher and students use a red pen to mark through the *y* terms.

$$2x + 3y = 5$$
$$4x - 3y = 1$$

Model the addition of the other terms and how to solve for *x*.

Prompting Questions:

- What can we do with the value we found for *x*?
- What method does replacing *x* in one equation remind you of?
- Do you think we should substitute in the first equation or the second?

Have two student volunteers to solve for *y* through substitution on the board with each student solving one of the equations.

Prompting Questions:

- Did our volunteers get different values for *y*?
- What conjecture can we make about which equation to use for substituting *x* to solve for *y*?
- Why do you think this method is referred to as the elimination method?

Ask half the class to substitute the solution into the first equation and the other half to substitute the solution into the second equation. Discuss the final solution. Explain to students that this is a 'self-check' process that will help them in the future. Repeat the modeling process with problem number 2.

For students who are EL, have disabilities, or perform well below grade-level:

- Distribute pre-solved documents to learners and allow them to trace with a pen rather than take notes.

Extensions for students with high interest or working above grade level:

- Students can solve the problem using the substitution method and compare the solutions to those using elimination method.

Activity 2: Assembly Line

Distribute a blank piece of paper to each student sitting in the first row.

Explain that students sitting in the first row will copy the problem and pass the paper to the student sitting behind them. Students sitting in the second seat will highlight inverse terms and pass the paper to the student sitting behind them. Students sitting the third seat will use a red pen to show elimination and add the other two terms, or eliminate. Students sitting in the fourth seat will solve for 'x'

Students sitting in the fifth seat will substitute and solve for 'y' then run to the board and write the solution.

First team finished gets 5 points, second team 4 points, etc…

Discuss the problem.

Students move to the seat behind them. Students in the back move to the front. If time allows, play the game until all learners have completed each step.

Note: Once students have played a few rounds, some may be tempted to simply solve the entire system and just pass the paper back. It is important that each student get a chance to complete each step of the solving process. Monitor student progress closely during this activity. (SMP.4)

Reflection and Closing:

- ✓ Remind students of the three methods of solving equations. Students write in journal as teacher discusses the following points. (SMP.7)
  - **Graphing:** best used when both equations are in slope-intercept form and when solution is an integer.
  - **Substitution:** best used when one variable in isolated in an equation

- **Elimination:** best used when both equations in standard form

Homework

Instruct students to complete **Handout 8.2: Elimination** and instruct students to complete overnight.

Handout 8.1: Box Puzzles

Name: _____ Date: _____

Directions: Find a pattern to complete each box. The first one has been done for you. Use the last one to create your own.

2	2	4
1	4	5
3	6	9

	1	7
	-1	-3
		4

6		6
5	7	12
11		

-4	-2	-6
	1	5
0		

-2	3	
6	4	
	7	

Handout 8.1: Box Puzzles KEY

Name: _____ Date: _____

Directions: Find a pattern to complete each box. The first one has been done for you. Use the last one to create your own.

2	2	4
1	4	5
3	6	9

6	1	7
-2	-1	-3
4	0	4

6	0	6
5	7	12
11	7	18

-4	-2	-6
4	1	5
0	-1	-1

-2	3	1
6	4	10
4	7	11

Handout 8.2: Elimination

Name: _____ Date: _____

Directions: Solve each system of equations using elimination, or linear combinations. Remember to list your solution as a coordinate pair.

1. $2x + 3y = 5$
   $4x - 3y = 1$

2. $3x + 5y = -9$
   $-6x - 5y = 18$

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

4. $x - 4y = -18$
   $-x + 3y = 11$

5. $2x - 5y = -24$
   $-2x - 3y = -16$

6. $5x - 3y = 2$
   $-5x + 3y = 8$

7. $-2x + 7y = 3$
   $-4x + 14y = 6$

Handout 8.2: Elimination KEY

Name: _____ Date: _____

Directions: Solve each system of equations using elimination, or linear combinations. Remember to list your solution as a coordinate pair.

1. $2x + 3y = 5$
   $4x - 3y = 1$

   (1, 1)

2. $3x + 5y = -9$
   $-6x - 5y = 18$

   (-3, 0)

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

   (-2, -1)

4. $x - 4y = -18$
   $-x + 3y = 11$

   (10, 7)

5. $2x - 5y = -24$
   $-2x - 3y = -16$

   $(\frac{1}{2}, 5)$

6. $5x - 3y = 2$
   $-5x + 3y = 8$

   No Solution

7. $-2x + 7y = 3$
   $-4x + 14y = 6$

   Infinite Solutions

For training or questions regarding this unit, please contact:

exemplarunit@mdek12.org