I Can Do This! Systems of Equations – Grade Eight

Ohio Standards Connection:

Patterns, Functions and Algebra

Benchmark H
Solve systems of linear equations involving two variables graphically and symbolically.

Indicator 10
Solve 2 by 2 systems of linear equations graphically and by simple substitution.

Indicator 11
Interpret the meaning of the solution of a 2 by 2 system of equations.

Related Benchmark C
Translate information from one representation (words, table, graph or equation) to another representation of a relation or function.

Related Indicator 1
Relate the various representations of a relationship; i.e. relate a table to graph, description and symbolic form.

Related Benchmark D
Use algebraic representations, such as tables, graphs, expressions, functions and inequalities, to model and solve problem situations.

Lesson Summary:
Students solve systems of 2-by-2 linear equations using tables, graphs and substitution. The lesson builds on previous experiences with problem situations represented and solved using a system of equations. Students practice more formal strategies for representing and solving systems of equations.

Estimated Duration: Two hours 20 minutes to three hours

Commentary:
Prerequisite knowledge and skill for this lesson include:
- graphing linear equations by hand and with technology (if available);
- simplifying expressions;
- writing equivalent expressions; and
- making tables of values from equations.

Pre-Assessment:
Students circulate through twelve stations drawing upon informal, intuitive strategies to solve problem situations modeled by 2-by-2 systems of linear equations. Attachment A, Pre-Assessment Problem Situations, provides a variety of informal and formal representations, as well as levels of sophistication and complexity. Students present their solutions to the class. Students may use various methods (graphically, by table, symbolically, and by intuition).

Scoring Guidelines:
Classify student performance on the pre-assessment activity as:

| Level 4: Expert | Solves all problem situations and demonstrates skill in all methods (intuitive, tabular, graphical, symbolic). |
| Level 3: Proficient | Solves at least six problem situations, demonstrating some skill in at least one or two methods and understands remaining methods when demonstrated by other students. |
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**Ohio Standards Connection:**

**Related Indicator 7**
Use symbolic algebra (equations and inequalities), graphs and tables to represent situations and solve problems.

**Related Indicator 8**
Write, simplify and evaluate algebraic expressions (including formulas) to generalize situations and solve problems.

**Related Benchmark F**
Solve and graph linear equations and inequalities.

**Indicator 9**
Solve linear equations and inequalities graphically, symbolically and using technology.

**Mathematical Processes Benchmarks**

**A.** Formulate a problem or mathematical model in response to a specific need or situation, determine information required to solve the problem, choose method for obtaining this information and set limits for an acceptable solution.

<table>
<thead>
<tr>
<th>Level 2: Advanced Beginner</th>
<th>Solves four to six problem situations and shows some understanding of one or two methods for solving similar problem situations.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1: Novice</td>
<td>Solves fewer than four of the problem situations and has difficulty explaining or using methods designed for finding solutions to those and/or similar problem situations.</td>
</tr>
</tbody>
</table>

**Post-Assessment:**
Distribute Attachment B, *Lost at Sea Activity*. Students solve a real-world problem, use multiple methods for systems of equations and present solutions on a poster. Students make a graph and write a system of equations to model the problem situation. Have students complete the tasks on the activity sheet independently and then work in small groups to present their solution(s) to the class.

**Scoring Guidelines:**
See Attachment C, *Sample Scoring Guidelines for Post-Assessment*.

**Instructional Procedures:**

**Part One: Pre-Assessment Activity**
1. Arrange the classroom to create twelve stations prior to the lesson. Prepare copies of each problem from Attachment A, *Pre-Assessment Problems Situations* and place one in each station around the room.

**Instructional Tip:**
Attachment A, *Pre-Assessment Problems Situations*, represents a range of problems from easy to complex. Each problem is coded to identify method and level of difficulty. These nine problems represent a minimum set of problems for this activity:
- S1-substitution-easy
- S2-substitution-medium
- S3-substitution-difficult
- T1-table-easy (whole number solutions)
- T2-table-medium (positive and negative integer solutions)
- T3-table-difficult (rational solutions)
Ohio Standards Connection:

C. Recognize and use connections between equivalent representations and related procedures for a mathematical concept.

E. Use a variety of mathematical representations flexibly and appropriately to organize, record and communicate mathematical ideas.

H. Locate and interpret mathematical information accurately, and communicate ideas, processes and solutions in a complete and easily understood manner.

G1-graph easy (graph provided, students extend graphs, solutions are integers)

G2-graph- medium (tables or equations provided, students graph line, solutions are integers)

G3-graph- difficult (tables or equations provided, students graph line, solutions are rational numbers)

These three problems are more challenging:

L1-linear combination-easy

L2-linear combination-medium

L3-linear combination-difficult

2. Provide an overview of the activity:
   a. Have students get into pairs or groups of three. Assign a beginning station to each group.
   b. Students find copies of a different problem at each station.
   c. Give students two minutes to write their solution to the problem at each station. Have students write solutions in a journal
   d. Direct students to the next station.

Instructional Tip:
Complete the activity at desks if the classroom area is not conducive for setting up twelve stations. For example, prepare multiple envelopes or packets of materials – each containing copies of one of the twelve problems. Give each student one envelope. Ask students to take a copy of the problem out of the envelope and solve the problem. Students pass the envelope to the next student when directed to do so – the envelopes move rather than the students.

3. Observe students as they complete the problems note the strategies students use to solve the problem situations: graphs, tables or substitution.

4. Give students additional time to prepare to share their solutions after completing all problem situations.

5. Have students share their solutions. Select students or groups to allow each to have an opportunity to succeed; e.g., call on a group that may have success with simpler problems to share their solutions early in the process.

6. Pose questions to discuss or summarize the various methods used and the name for each method after all solutions have been presented.
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- What connections do you see among (or what do you notice about) the different methods of solving systems (graphically, by table, symbolically)?
- When would different methods be more prudent to use in solving a problem?

Part Two:
7. Distribute Attachment D, Graphic Organizer. Provide students an overview of the document used to organize different strategies to solve problems similar to those in the previous activity.
8. Students complete the graphic organizer independently to identify an example for each method and determine when that method is most appropriate. Then, organize the students into pairs and have them compare their responses with their partner.
9. Facilitate a class discussion during which students share their responses. See Attachment E, Sample Responses for Graphic Organizer.
10. Pose problems for the students to solve which include a variety of problems and strategies. Sample problems are included on Attachment F, Practice Problems and Solutions.
11. Allow students to work with partners as needed. Observe students, ask probing questions and provide assistance as needed to support concept development.
12. Continue having different groups of students solve a problem(s). Be certain to include each type of problem (by graph, by table and by substitution) in the practice; however, point out or focus attention on systems that can be solved using substitution. Students doing group work may ask for assistance from other students. Using this method helps to quickly identify students who may need assistance and/or which strategy students may be having difficulty learning and using.
13. Distribute Attachment G, Homework Problems. Instruct students to complete the problems as homework.

Part Three:
14. Organize students into groups of two or three.
15. Facilitate sharing and discussion of the solutions for the homework problems. Students take turns sharing the solutions with the members of the group.

Instructional Tip:
Use a “critical friends” process. One student shares his/her solution while the other student(s) listen. Then the other students ask clarifying questions, such as, “Why did you …?” and “How do you know that …?” The reviewed student responds to the questions.

16. Ask student groups or individuals to share solutions and solution strategies with the class, including those that may contain errors. Clarify and discuss common misconceptions.
17. Collect and review students’ individual work as an informal assessment and adjust the lesson to provide further instruction and practice, as needed. See Attachment H, Solutions to Homework Problems.
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Part Four: Post-Assessment Activity
18. Distribute copies of Attachment B, Lost at Sea Activity. Instruct students to solve the problem using different strategies and present their solutions to the class.
19. Explain the scoring guidelines for this activity with students before they begin completing the task and/or allow students to assist in developing scoring guidelines. This provides an opportunity for students to think about and discuss the strategies for solving systems of linear equations.
20. Have students work independently or in small groups based upon whether an individual evaluation or score is more appropriate or a group evaluation is sufficient.
21. Circulate among the students, providing support as they work on their solutions. Assist students or groups that need assistance in understanding or getting started. Ask probing or clarifying questions; however, avoid giving too much direction.
22. Have students or small groups present their solutions to the class. In small groups remind students that each person in the group should participate in the presentation; e.g., share or explain the response to one of the questions.
23. Assess student performance using the agreed upon scoring guidelines.

Differentiated Instructional Support:
Instruction is differentiated according to learner needs, to help all learners either meet the intent of the specified indicator(s) or, if the indicator is already met, to advance beyond the specified indicator(s). Using the knowledge domain of revised Bloom’s taxonomy can assist the development of differentiated standards and assessments.
• Provide physical models at the stations that can be manipulated to assist kinesthetic learners.
• Consider substituting problem situations to reflect the students’ interests.
• Balance group work and independent work to allow students opportunities to work in a variety of settings.
• Build on individual student strengths, particularly when organizing small groups. One student may have greater skill in presenting a solution through a poster or visual means. Another may have greater skill in using mathematical symbols. Another student may have excellent verbal skills. Use this information to assist students in assigning roles to present solutions.
• Provide a visual representation of the Lost at Sea, Attachment B, problem situation to assist students who may have difficulty understanding the problem situation as presented on the activity sheet.
• Challenge students with more difficult problems; e.g., problems that may involve “less friendly” numbers or have solutions that are not integers. Consider introducing additional strategies or techniques for solving systems of linear equations to students with advanced understanding and skills, such as linear combinations and/or matrices.

Extensions:
• Students identify examples of situations outside of school that can be modeled using a system of linear equations. Some examples of real-world situations include comparing cell phone plans, power companies, checking accounts, etc. Students identify examples of situations
outside of school that can be modeled using a system of linear of equations. Some examples of real-world situations include comparing cell phone plans, power companies, checking accounts, etc.

- Students investigate a given situation by finding advertisements or other sources of information for different plans and identifying which plan is better for given situations; e.g., which cell phone plan is better for a grandmother who only uses a cell phone for emergencies versus a college student away from home.
- Students create problem situations that can be represented and solved using systems of 2-by-2 equations. Use problem situations as additional practice or in future lessons or assessments to reinforce skills in solving systems of equations.

**Home Connections:**
- Have students ask parent/guardian to identify workplace and every day situations where a decision between two choices needs to be made and for which systems of 2-by-2 linear equations could be used to find a solution.
- Consider creating an activity or using the pre-assessment activity in a “Family Mathematics Night” event. This could be especially rewarding if younger siblings attend because many appropriate approaches will probably be used by different age groups. The types of problems used in the lesson activities may be a great way to provide family members a glimpse of your classroom and stimulate discussion.

**Interdisciplinary Connections:**
Examples of connections include linear programming and economics /consumer decisions.

**Materials and Resources:**
The inclusion of a specific resource in any lesson formulated by the Ohio Department of Education should not be interpreted as an endorsement of that particular resource, or any of its contents, by the Ohio Department of Education. The Ohio Department of Education does not endorse any particular resource. The Web addresses listed are for a given site’s main page, therefore, it may be necessary to search within that site to find the specific information required for a given lesson. Please note that information published on the Internet changes over time, therefore the links provided may no longer contain the specific information related to a given lesson. Teachers are advised to preview all sites before using them with students.

For the teacher: Transparencies of each of the pre-assessment problems for the stations, the scoring guidelines and the Lost at Sea problem situation; at least two different manipulatives that can be used by students at the stations to represent objects in the pre-assessment problems. Optional: A graphic display representing the “Lost at Sea” situation to help clarify the problem

For the student: Copies of Attachments A, B, D and G
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Vocabulary:
- linear equation
- system of equations

Technology Connections:
- Use a graphing calculator or graphing software to locate the point of intersection of two lines.
- Use graphing calculator or graphing software to generate a table of values to locate the point of intersection (ordered pairs).
- Use graphing calculator and matrices to solve the system of equations

Research Connections:

Attachments:
Attachment A, Pre-Assessment Problem Situations
Attachment B, Lost at Sea Activity and Solutions
Attachment C, Post-Assessment Scoring Rubrics
Attachment D, Systems of Equations Graphic Organizer
Attachment E, Sample Responses for Graphic Organizer
Attachment F, Practice Exercises and Solutions Answer Key
Attachment G, Systems of Linear Equations Homework Exercises
Attachment H, Systems of Linear Equations Homework Exercises Answer Key
Two happy face discs and one cube weigh 42 units. One happy face disc and one cube weigh 30 units.

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\begin{align*}
\begin{array}{c}
\text{😊😊} \\
\text{ unidades}
\end{array}
+ \begin{array}{c}
\text{キューブ}
\end{array}
&= 42 \text{ Units} \\
\begin{array}{c}
\text{😊} \\
\text{キューブ}
\end{array}
&= 30 \text{ Units}
\end{align*}
\]

What is the weight of each?

\[
\begin{align*}
\begin{array}{c}
\text{😊} \\
\text{キューブ}
\end{array}
&= \_
\end{align*}
\]

Explain your reasoning:

Two apples and three baskets weigh 21 units. Two apples and two baskets weigh 15 units.

\[
\begin{align*}
\begin{array}{c}
\text{りんご} \\
\text{バスケット}
\end{array}
+ \begin{array}{c}
\text{バスケット}
\end{array}
&= 21 \text{ Units} \\
\begin{array}{c}
\text{りんご} \\
\text{バスケット}
\end{array}
&= 15 \text{ Units}
\end{align*}
\]

What is the weight of each?

\[
\begin{align*}
\begin{array}{c}
\text{りんご} \\
\text{バスケット}
\end{array}
&= \_
\end{align*}
\]

Explain your reasoning:
Three clocks and two reindeer cost $4,750. Two clocks and two reindeer cost $3,700.

Find the value of each object:

Find the value of each object:

Write equations to model the situations then try to solve the problem using the procedure described in your explanation.
Attachment A (Continued)
Pre-Assessment Problem Situations
Code: S3 or L3

1. Two happy faces = 34

2. Nine happy faces = ___

3. One happy face = ____

Code: S3 or L3
Attachment A (Continued)
Pre-Assessment Problem Situations
Code: T1

\[ y = 2x + 8 \]

\[ y = 3x + 5 \]

<table>
<thead>
<tr>
<th>x</th>
<th>y</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>8</td>
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<tr>
<td>1</td>
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<td>12</td>
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<td>3</td>
<td>14</td>
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<td>4</td>
<td>16</td>
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<tr>
<td>5</td>
<td>18</td>
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<tr>
<td>6</td>
<td>20</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>x</th>
<th>y</th>
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</thead>
<tbody>
<tr>
<td>0</td>
<td>5</td>
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<tr>
<td>1</td>
<td>8</td>
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<td>2</td>
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<td>4</td>
<td>17</td>
</tr>
<tr>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>6</td>
<td>23</td>
</tr>
</tbody>
</table>

What is the ordered pair that satisfies both equations?
Attachment A (Continued)
Pre-Assessment Problem Situations
Code: T3

\[ y = 5x + 15 \quad \text{and} \quad y = 9x + 1 \]

<table>
<thead>
<tr>
<th>( x )</th>
<th>( y )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td>2</td>
<td>25</td>
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<tr>
<td>3</td>
<td>30</td>
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<tr>
<td>4</td>
<td>35</td>
</tr>
<tr>
<td>5</td>
<td>40</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>( x )</th>
<th>( y )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>19</td>
</tr>
<tr>
<td>3</td>
<td>28</td>
</tr>
<tr>
<td>4</td>
<td>37</td>
</tr>
<tr>
<td>5</td>
<td>46</td>
</tr>
</tbody>
</table>

Find the ordered pair that satisfies both equations.
Find the ordered pair which satisfies both equations.
Find the ordered pair of the point of intersection.

\[ y = \frac{-1}{2}x + 3 \quad \text{and} \quad y = 2x - 2 \]
Find the ordered pair of the point of intersection.
Find the ordered pair of the point of intersection of the two lines.
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Attachment B
Lost at Sea

You are part of the rescue team in a ship at sea. One of your divers is 250 feet below sea level, and she injured herself. She only has a 7 minute supply of air in her tank, and can only rise towards the surface at a rate of 10 feet per minute. You are sending down a rescue sub. The sub can descend at a rate of 30 feet per minute.

Note: Normally, the diver would take safety stops when ascending to avoid suffering from the bends, but in this emergency, the diver will be placed in a decompression chamber when they get her to the surface, if they get her in time.

1. At what depth, to the nearest foot, will the two meet?

2. Will the diver still have any oxygen left in her tank when the sub gets to her?
3. On a sheet of graph paper or with a graphing calculator, make a graph that represents this problem.

4. Explain how you arrived at your answers for questions #1 and #2.

5. If possible, write an equation to model this problem.

6. Prepare a brief presentation to share your chart and findings.
1. \( h = \text{depth in feet} \quad t = \text{minutes} \)
   \[ h = 10t - 250 \quad \text{injured diver} \]
   \[ h = -30t \quad \text{rescue sub} \]
   
   \[ 10t - 250 = -30t \]
   \[ -250 = -40t \]
   \[ 6.25 \text{ minutes} = t \]
   
   \[ h = (-30)(6.25) \]
   \[ h = -187.5 \text{ feet} \]

2. The sub will get to her before she runs out of oxygen.

3. The interval for the \( x \)-axis is one minute.
   The interval for the \( y \)-axis is 30 feet.

4. Answers will vary. Accept appropriate reasoning and strategies.

5. See equation in #1.

6. Score presentation based on solution, graphs, communication and reasoning.
## Sample Holistic Scoring Guidelines:

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Solves problem using all three methods (a graph, a table and by substitution)</td>
</tr>
</tbody>
</table>
| 3     | Demonstrates understanding and skill in all three methods; however, makes a minor flaw(s) in one method. For example,  
  - Contains minor computation error(s)  
  - Makes minor error in completing a table or graph |
| 2     | Demonstrates understanding and some skill in two methods and does not attempt third method or response shows major gaps in skill in the third method. |
| 1     | Demonstrates understanding and skill in one method. May not attempt or makes errors in other methods. |
| 0     | Shows little progress in solving problem. May attempt one or more methods; however, is unable to complete any method successfully. |
### Sample Analytic Scoring Guidelines:

<table>
<thead>
<tr>
<th>Solve by Graphing</th>
<th>Complete Understanding</th>
<th>Good Understanding</th>
<th>Some Understanding</th>
<th>Limited Understanding</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Graphs lines and accurately locates the point of intersection.</td>
<td>Graphs lines, but makes one or two errors in plotting points or using slope, and locates the point of intersection.</td>
<td>Understands the concept, but makes numerous errors graphing and/or locating the point of intersection.</td>
<td>Needs help understanding how to graph a line, and the significance of the point of intersection.</td>
</tr>
</tbody>
</table>

| Solve by creating a table of values | Accurately completes a table of values, and is able to select appropriate values to locate point of intersection. | Completes a table of values with minor errors, and locates point of intersection when the solution involves integers | Completes the table of values with numerous errors, and has difficulty finding the point of intersection. | Has difficulty completing a table and selecting appropriate values to use narrowing into the point of intersection. |

| Solving by using substitution | Easily manipulates the expressions, and locates the ordered pair for the point of intersection. | Can manipulate the expressions, understands the concept, but makes minor errors. | Manipulates the expressions, but makes numerous errors, and stops once the solution for one variable has been located. | Has difficulty manipulating expressions, and doesn’t make the connection between graphs, equations and solution. |

| Solve by using linear combination (optional – may not be teaching this at this point or this year) | Fully understands the manipulation of the equations in order to be able to eliminate a variable by addition or subtraction and arrives at the correct point of intersection. | Understands the concept, but makes computation errors which result in a wrong point of intersection. | Can add (or subtract) the equations to eliminate a variable and arrive at the point of intersection, but only when like terms are lined up and no multiplication (or division) needs to be done prior to addition (or subtraction). | Does not understand the concept. May be able to occasionally calculate one of the variables, but makes no connection to the point of intersection and the graph of the lines. |
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**Attachment D**

**Systems of Equations Graphic Organizer**

<table>
<thead>
<tr>
<th>Method: Graph</th>
<th>Method: Table</th>
<th>Method: Substitution</th>
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</thead>
<tbody>
<tr>
<td>Example:</td>
<td>Example:</td>
<td>Example:</td>
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<tr>
<td>Best used when:</td>
<td>Best used when:</td>
<td>Best used when:</td>
</tr>
</tbody>
</table>
## I Can Do This! Systems of Equations – Grade Eight

### Attachment E

**Sample Responses for Graphic Organizer**

<table>
<thead>
<tr>
<th>Method:</th>
<th>y = 2x - 1 and y = -3x + 4</th>
<th>Method:</th>
<th>2x + 3y = 12 and -4x + 2y = 8</th>
<th>Method:</th>
<th>y = 3x + 1 and 2x + y = 16</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Graph</strong></td>
<td></td>
<td><strong>Table</strong></td>
<td></td>
<td><strong>Substitution</strong></td>
<td></td>
</tr>
<tr>
<td>Example:</td>
<td><img src="image" alt="Graph Example" /></td>
<td>Example:</td>
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<td>Example:</td>
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<tr>
<td><strong>Best used when:</strong></td>
<td>The equation is easy to graph and the point of intersection is obvious and coordinates appear to be integers.</td>
<td><strong>Best used when:</strong></td>
<td>A table is given and the solution is obvious or easy to arrive at. Solutions are integers.</td>
<td><strong>Best used when:</strong></td>
<td>One of the variables is easily isolated. If the solution is not obvious from the graph and/or table, then use algebraic methods. Substitution is the first algebraic method taught.</td>
</tr>
</tbody>
</table>
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Attachment F
Practice Exercises

Name: ____________________________ Date: ______________________

Directions: Find the solution for each pair of equations.

1. \[ y = 2x + 5 \quad \text{and} \quad y = -3x + 10 \]

2. \[ y = -3x - 4 \quad \text{and} \quad y = 4x - 32 \]

3. \[ y = -5x - 12 \quad \text{and} \quad 3x + y = 14 \]

4. \[ x + 5y = 6 \quad \text{and} \quad x + 3y = 14 \]

5. \[ 3x + y = 20 \quad \text{and} \quad x - 7y = -8 \]

6. \[ 3x + 7y = 21 \quad \text{and} \quad 3x + 5y = 15 \]

7. \[ y = 5x + 6 \quad \text{and} \quad y = 5x + 1 \]

8. \[ y = 2x + 3 \quad \text{and} \quad 4x - 2y = -6 \]
1. $x = 1 \quad y = 7$
2. $x = 4 \quad y = -16$
3. $x = -13 \quad y = 53$
4. $x = 26 \quad y = -4$
5. $x = 6 \quad y = 2$
6. $x = 0 \quad y = 3$
7. empty set (parallel lines, no point of intersection)
8. The equations are equivalent. The graphs of each equation are the same lines or same set of points.

Note: Discuss the various methods which were used and which method was the most efficient to use. Many students will want to solve these graphically when substitution would be much more efficient.
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### Attachment G

**Systems of Linear Equations Homework Exercises**

**Directions:** Solve each system of linear equations using different strategies.

<table>
<thead>
<tr>
<th>System</th>
<th>Substitution</th>
<th>Tabular</th>
<th>Graph</th>
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</thead>
<tbody>
<tr>
<td>( y = x - 3 )</td>
<td></td>
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<td>and</td>
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<tr>
<td>( y = 3x + 5 )</td>
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<tr>
<td>( y = 5x )</td>
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<td>and</td>
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<tr>
<td>( 2x + y = 21 )</td>
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<tr>
<td>( y = 7x - 12 )</td>
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<td>and</td>
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<tr>
<td>( 4x - 2y = 34 )</td>
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<tr>
<td>( 12x - 7y = 20 )</td>
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<td>and</td>
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<tr>
<td>( 3x + 2y = 6 )</td>
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</tbody>
</table>
I Can Do This! Systems of Equations – Grade Eight

Attachment H

Systems of Linear Equations Homework Exercises Answer Key

<table>
<thead>
<tr>
<th></th>
<th>Substitution</th>
<th>Tabular</th>
<th>Graph</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y = x - 3 ) and ( y = 3x + 5 )</td>
<td>( x - 3 = 3x + 5 ) ( -8 = 2x ) ( -4 = x ) ( y = -4 - 3 ) ( y = -7 ) ((-4, -7))</td>
<td>( x )</td>
<td>( x - 3 )</td>
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<td></td>
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<td>-5</td>
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<td>-6</td>
</tr>
<tr>
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<td>-4</td>
<td>-7</td>
</tr>
<tr>
<td>( y = 5x ) and ( 2x + y = 21 )</td>
<td>( 2x + 5x = 21 ) ( 7x = 21 ) ( x = 3 ) ( y = 5(3) ) ((3, 15))</td>
<td>( x )</td>
<td>( 5x )</td>
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<td>10</td>
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<td></td>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td>( y = 7x - 12 ) and ( 4x - 2y = 34 )</td>
<td>( 4x - 2(7x-12) = 34 ) ( 4x - 14x + 24 = 34 ) (-10x = 10 ) ( x = -1 ) ( y = 7(-1)-12 ) ((-1,-19))</td>
<td>( x )</td>
<td>( 7x-12 )</td>
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<td></td>
<td>0</td>
<td>-12</td>
</tr>
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<td>2</td>
<td>-5</td>
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<td>2</td>
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<td>-1</td>
<td>-19</td>
</tr>
<tr>
<td>( 12x - 7y = 20 ) and ( 3x + 2y = 6 )</td>
<td><strong>Linear Combination:</strong> ( 12x - 7y = 20 ) ( -12x - 8y = -24 ) ( -15y = -4 ) ( \frac{4}{15} ) ( 3x + 2(\frac{4}{15}) = 6 ) ( 3x = \frac{90}{15} - \frac{8}{15} ) ( x = (\frac{1}{3})(\frac{82}{15}) ) ( \frac{82}{45}, \frac{4}{15} )</td>
<td>( x )</td>
<td>( 7x-12 )</td>
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<td>-1</td>
<td>-19</td>
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This system of equations can be solved using a table, however it is not an easy task as fractions are involved.