Unit 4 Overview

SAMPLE Unit of Study: Algebra I

Systems of Equations and Inequalities

Overview

Unit Description

In this unit, students explore how to represent and solve situations that can be modeled with systems of equations and inequalities. Students extend their work with systems of equations from eighth grade by exploring three commonly used methods for solving a system of linear equations in two variables: graphing, substitution, and linear combinations. Particular attention is given to linear combinations. Students develop a strong conceptual understanding of this method of solving—exploring why linear combinations produce a new system of equations with the same solution set.

After working with systems of equations, students move to linear inequalities. In previous grades and earlier in this course, students worked with single-variable inequalities. In this unit, they extend this understanding to two-variable linear inequalities—graphing and understanding their half-plane solution sets. Students then combine their understanding of linear inequalities and systems of equations by exploring the solution set for a system of linear inequalities in two variables.

Throughout the unit, students deepen their strategic competence and procedural fluency in modeling relationships. One third of the lessons are dedicated solely to modeling real-world scenarios with systems of equations, inequalities, and systems of inequalities. Students create models that represent real-world situations, solve real-world problems using their models, and interpret their solutions in a real-world context.

Big Ideas

- A solution to a system of equations or inequalities contains the values of the variables that can make each of the equations or inequalities in the system true.
- The solution to a system of equations or inequalities can be found by locating the intersection of the equations or inequalities graphed in the plane.
- Linear combination of a system of equations produces a new system with the same solution.
- Real-world situations that involve linear relationships of equality or inequality can be modeled with systems of equations, inequalities, and/or systems of inequalities.
Unit 4 Overview

Essential Questions

- What does a solution to a system of linear equations represent? Does every system have a solution? How do you know?
- What are the methods for solving systems and why do they work?
- What does a solution to a linear inequality with two variables look like? What about a system of two linear inequalities? Does every system have a solution?
- How can modeling with systems of linear equations and linear inequalities help solve problems in the real world?

Key Standards

The following focus standards are intended to guide teachers to be purposeful and strategic in both what to include and what to exclude when teaching this unit. Although each unit emphasizes certain standards, students are exposed to a number of key ideas in each unit, and as with every rich classroom learning experience, these standards are revisited throughout the course to ensure that students master the concepts with an ever-increasing level of rigor.

| Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions. | A-REI.5 |
| Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. | A-REI.6 |
| Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes. | A-REI.12 |
| Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. | A-CED.3 |

Recommended Structures

The Unit Outline included in this document provides a framework for weekly instruction, practice, and assessment. Each week of instruction includes digital lessons that students will complete independently, as well as opportunities for whole-group and small-group teacher-led instruction. The Unit Outline will use the following icons.
### Unit 4 Overview

#### Preparation for Weekly Instruction
- Learning Goals
- Edgenuity Digital Lessons

#### Modifications for Special Populations
- Supporting English Learners
- Work for Early Finishers

#### Additional Instructional Support
- Developing Higher-Order Thinking
- Supporting Foundational Math Skills
- Common Misconceptions & Reteaching Strategies
- Social Emotional Learning Connections
# Unit 4 Overview

## Week 1 – Solving Systems of Equations

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<thead>
<tr>
<th>Learning Goals</th>
<th>Unit 4: Systems of Equations and Inequalities</th>
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<tbody>
<tr>
<td>This week, students will solve systems of equations via graphing and substitution, as well as explore using linear combinations to solve a system of linear equations.</td>
<td></td>
</tr>
<tr>
<td>• Analyze a system of linear equations to determine if it has one solution, no solution, or infinitely many solutions. (A-REI.6)</td>
<td></td>
</tr>
<tr>
<td>• Solve a system of linear equations graphically and algebraically (via substitution). (A-REI-6)</td>
<td></td>
</tr>
<tr>
<td>• Interpret the solution of a system of linear equations in a modeling context. (A-CED.3)</td>
<td></td>
</tr>
<tr>
<td>• Verify that using linear combinations on a system of two equations in two variables produces a system with the same solutions. (A-REI.5)</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Edgenuity Digital Lessons</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Solving Systems of Linear Equations: Graphing</td>
</tr>
<tr>
<td>• Solving Systems of Linear Equations: Substitution</td>
</tr>
<tr>
<td>• Solving Systems: Introduction to Linear Combinations</td>
</tr>
</tbody>
</table>

## Week at a Glance

| Day 1 | Build background knowledge and introduce the unit. Graph the equation \( y = 2x + 5 \) and show it to the class. Ask students, “What does the graph represent?” Discuss with students that the line represents all the possible solutions to the equation. If needed, explain that the point (1, 7) is on the line because it satisfies the equation; it makes the equation true. Ensure that there is sufficient understanding of this concept and explain that it is a big idea for this new unit where they will be graphing systems as a means to find solutions. The graph of each equation in the system represents all possible solutions to each individual equation. A point where the lines intersect represents values where both equations are satisfied—or true—at the same time. Thus, the intersection point is a solution to the system. |

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### Unit 4 Overview

Split the class into groups of two students, having each pair practice graphing a system and verifying that the intersection point is in fact a solution to both equations. Depending on the aptitude of your class, vary the difficulty by using different number types in equations of the form $y = kx$, $y = mx + b$, $y = b$, and $x = c$ similar to the systems shown below. Have the pairs share their results.

- $y = -2; x = 3$
- $y = 4x; x = -1$
- $y = x + 1; y = 0$
- $y = 3x - 2; y = x + 4$

<table>
<thead>
<tr>
<th>Day 2</th>
<th>Students will work independently on the digital lesson: “Solving Systems of Linear Equations: Graphing.” Monitor students who are struggling and provide individual attention as needed.</th>
</tr>
</thead>
</table>

| Day 3 | **Developing Higher Order Thinking**  
|       | Open the class period with a discussion question.  
|       | • *How can you tell from a system of equations alone when the system has one solution, no solution, or infinitely many solutions?*  
|       | Encourage students to draw pictures—using examples and non-examples—and evaluate the claims of others during the discussion.  
|       | After the discussion have students work on the next lesson: “Solving Systems of Linear Equations: Substitution.” Monitor students who are struggling and provide individual attention as needed. |

| Day 4 | Use data to identify students who did not pass the quiz from the previous digital lesson. These students will be Group A. Students who passed the quiz will be Group B. During the first part of the class period, pull Group A together for re-teaching while Group B students work on the next digital lesson (“Solving Systems: Introduction to Linear Combinations”). For the remaining time, work with students individually or in small groups as needed. |

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Common Misconceptions & Reteaching Strategies

Substitution can be quite confusing for students with weak conceptual understanding and/or procedural fluency in working with equations. Start with a system where both equations are set equal to \( y \), like \( y = 2x - 5 \) and \( y = -x + 1 \). In a system such as this one, the work of solving for a variable is already done, so the conceptual work of understanding what we are substituting and why we are doing it can be the focus. Talk through the idea that because both \( 2x - 5 \) and \( -x + 1 \) are equal to \( y \), they must also equal each other. Writing the equation \( 2x - 5 = -x + 1 \) gives us an equation in only one variable that we can solve to find the value of \( x \). This process is the heart of the substitution method.

Another point of struggle can occur when students are presented with a system in which they need to solve for a variable before substituting. This the intermediate step of “getting rid of one of the variables” is a tricky one to understand without a solid foundation. Explain to students that with a given equation any form of it still says the same thing, and thus has the same solutions. Use examples like \( y = x + 2 \) and \( y - 2 = x \). Ask students to prove to you that these two equations are the same and have the same solutions. Explan that this understanding can be transferred to equations like \( 12 = 3x + y \) and \( 12 - 3x = y \). Go through a few examples of using substitution to solve a system and emphasize that all the equations obtained to isolate a variable are equivalent.

Day 5

Some students will need this day to finish the week’s required digital lessons. Other students will be finished. Refer to the work for early finishers for those that have completed the required lessons.

Modifications for Special Populations

Supporting English Learners

<table>
<thead>
<tr>
<th>Low Proficiency</th>
<th>High Proficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front-load needed vocabulary before students begin the lesson on Day 2. (Vocabulary needs will vary with unit of study. Direct students to create a KWL (Know –</td>
<td>Engage any prior knowledge students may have on this unit of study.</td>
</tr>
</tbody>
</table>
each student population, but consider Want to Learn – Learned) chart. Discuss what they including substitution, elimination, linear already know and want to learn about equations and equations, graph, line, solution, fraction, intersection, supply, demand, and equilibrium.)

Visit https://esl-voices.com/example-k-w-l-chart-from-instructional-strategies-2/ to see a sample KWL chart.

**Work for Early Finishers**

Ask students whether or not a system of equations can ever have exactly two solutions... what about exactly three or exactly four? Discuss what the graphs of systems with more than one, but not infinitely many, solution would look like. Have students graph the system $y = x$ and $y = x + 1$. Extend thinking by asking students how one of these lines would need to change so that the system can have exactly two solutions. Is there more than one way to change it? Look for students to determine that a curve or turn in one of the lines can lead to two solutions. Then have students create and graph (using available technology) systems of two equations using equations like the ones below.

- $y = |x|
- y = (x + 1)^2 - 1
- y = -0.5
- y = -x^2

Allow early finishers to begin the first digital lesson from Week 2, in which they will solve a system of equations using linear combinations, as well as model and solve a real-world problem with a system of linear equations.

**Supporting Foundational Math Skills**

For success in this unit, students will need to activate their prior knowledge of interpreting, graphing, and solving linear equations. Work with students needing support in these foundational skills by providing increased support with the lesson: “Solving Systems of Linear Equations: Substitution.” Work with the individual equations in each system, and equation at a time. Discuss with students what the graph of the equation will look like and how they know. Discuss what the graph represents. Because an equation such as $y = 2x$ has infinitely many solutions, we use a graph to visually display the solutions. Any point on the graph satisfies the equation (makes it true), so it is a solution. Encourage students to create a real-world scenario that is represented by the equation. Interpreting the equation will provide an opportunity for the students to explore and grapple with the relationship expressed
in the equation on a graph. Discussing what the equation could model in the real-world will provide contextualization that will be imperative for the de-contextualization they will be asked to do in the lessons that follow next week. After interpreting each equation, discussing what they expect the graph to look like, and creating a real-world situation it could represent, use the method of substitution to solve the system. Ask students to talk through why each step does not change the value of the equation. Ensure that students understand that keeping the equations true ensures that the relationships remain the same.

For additional support in solving for a variable, talk about the steps students would take if the other variable was a number. The same steps can be used when there are two variables! If you want to solve $2x + 4y = 16$ for $y$, you could first think about what would happen if $x = 3$.

\[
\begin{align*}
2(3) + 4y &= 16 \\
4y &= 16 - 2(3) & \text{(Subtract the product.)} \\
y &= \frac{16 - 2(3)}{4} & \text{(Divide by the coefficient.)}
\end{align*}
\]

Same as if we had left $x$ in.

\[
\begin{align*}
2x + 4y &= 16 \\
4y &= 16 - x & \text{(Subtract the product.)} \\
y &= \frac{16 - x}{4} & \text{(Divide by the coefficient.)}
\end{align*}
\]

**Social Emotional Learning Connections**

Direct students to write down a problem they have encountered in life (IE: fight with a friend, being grounded, etc.). Have 1-2 students share their answer. Choose 1 problem to use as the classroom scenario. In small groups, ask students to brainstorm as many solutions to the problem as possible in one minute. Have groups share out some possible solutions. Lead a discussion connecting how solving systems of linear equations can be completed in many different ways similar to solving real world problems students come upon. Ask questions including how do you know which solution to choose? What happens if one solution doesn’t work? How do you cope with additional challenges?
## Week 2 – Modeling with Systems of Linear Equations

### Learning Goals
This week, students will finish exploring using linear combinations to solve a system and apply what they have learned about solving systems in the previous week to solve problems in a real-world context.

- Solve a system of linear equations using linear combinations. (A-REI-6)
- Create a system of linear equations to model a problem in a real-world context. (A-CED.3)
- Solve a system of linear equations in a real-world context and interpret the solution. (A-REI-6)

### Edgenuity Digital Lessons
- Solving Systems of Linear Equations: Linear Combinations
- Modeling with Systems of Linear Equations

### Week at a Glance

<table>
<thead>
<tr>
<th>Day</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 1</td>
<td>Use data to identify students who did not pass the quiz from the lesson “Solving Systems: Introduction to Linear Combinations.” These students will be Group A. Students who passed the quiz will be group B. During the first part of the class period, pull Group A together for re-teaching while Group B students work on the next lesson: “Solving Systems of Linear Equations: Linear Combinations.”</td>
</tr>
</tbody>
</table>

### Common Misconceptions & Reteaching Strategies
Students that struggle with linear combination tend to not have a good enough grounding with the idea of combining the equations. Thus, these students tend to always add or always subtract the two equations without real understanding of how or why they would use either. The idea that linear equations can be combined is a rather complex, yet elegant concept. Explore with students a set of equations like $5 = x + 2y$ and $3 = x + y$. Explain that each equation is a true statement about the relationship between $x$ and $y$. When working with equations, you need to be sure that when you change
the value of one side of the equal sign, you change the value on the other side in the exact same way—always keeping it balanced. In the case of $5 = x + 2y$, we could subtract 3 to both sides without changing the relationship between $x$ and $y$.

\[
5 = x + 2y \\
5 - 3 = x + 2y - 3 \\
2 = x + 2y - 3
\]

The second equation states that $x + y$ is equal to 3. That means we can substitute $x + y$ for 3 anywhere in our work and still have balanced equations. When we replace 3 on the right-hand side of the equation in the second line of our work above, we eliminate all of the $x$ terms and find the value of $y$.

\[
5 = x + 2y \\
5 - 3 = x + 2y - (x + y) \\
2 = x + 2y - x - y \\
2 = y
\]

We often use a short-hand notation to do this with linear combinations:

\[
5 = x + 2y \\
-3 = x + y \\
2 = 0x + y
\]

However, the result is the same either way. It may be helpful for students that struggle with the conceptual understanding of linear combinations to use the more formal way of writing out the steps to combining, as shown above.

**Day 2** Students will work independently on the digital lesson: “Solving Systems of Linear Equations: Linear Combinations.” If students have completed this lesson already, guide them to the work for early finishers. Work with individual students as needed.
### Day 3

Use data to identify students who struggled with the following learning objectives:

- Use technology to find or approximate the solution of a system of linear equations graphically.
- Solve a system of linear equations using substitution.
- Solve a system of linear equations using linear combinations.

Group students in pairs or triads such that each grouping has at least one student who did not struggle with these objectives and at least one student who did. Have students work in groups to create posters, worksheets, or other activities that could teach younger students how to correctly use these three methods to solve a system of linear equations in a mathematical context.

**Common Misconceptions & Reteaching Strategies**

Students who struggle with representing equations graphically may benefit from making a table of values to support the process of graphing in the plane and/or to determine if the end result is reasonable. Empower students to use a table to represent the relationship between two variables, before or after graphing a line. Be sure to explain that the tables of values for a system might not contain the intersection point.

Students may have a misconception that when using technology to graph a line, they are required to use a specific form of the equation (e.g., slope-intercept form). For students with this issue, emphasize that using technology reduces the need for students to ensure they have an equation in any specific form—other than instances where the student needs to isolate $y$. Illustrate this by graphing an equation like $2y - 3x = 4$ using its equivalent equation: $y = \frac{4-3x}{2}$. Explain that while the “simplified” version ($y = 2 - \frac{3}{2}x$) will also work, they do not need to complete this step. Verify this by using technology to graph all three equations, noting the lines are identical.

### Day 4

Open the class period by showing the following systems to the class:
Developing Higher Order Thinking

Lead a discussion around the three different methods for solving a system of linear equations in a mathematical context, referencing the three systems shown above.

- Which system would the method of substitution be the most efficient strategy for solving?
- What about graphing or linear combination?
- What features of the system indicate that one method is most efficient?
- How do you know which method to use when solving systems?

Encourage students to demonstrate the method they think is most efficient and evaluate the claims of others during the discussion.

After the discussion have students work on “Modeling with Systems of Linear Equations” for the remainder of the class period. Monitor students who are struggling and provide individual attention as needed.

Day 5
Some students will need this day to finish the week’s required digital lessons. Other students will be finished. Refer to the work for early finishers for those that have completed the required lessons.

 Modifications for Special Populations

<table>
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<th>Supporting English Learners</th>
<th>Low Proficiency</th>
<th>High Proficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sentence frames are given to students to help them structure their thoughts in English. Each frame is made</td>
<td>Place students in small groups and create a poster that demonstrates all 3 methods of solving a system. Each</td>
<td></td>
</tr>
</tbody>
</table>
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of a mostly completed sentence and one or more blank student will state his/her preferred way of solving the spaces. Students need to fill in the blanks with their own problem. As an additional activity, students can create a ideas. Pair students and ask them to describe the pie chart demonstrating the results of the class. graphic and algebraic solutions to systems of linear equations using sentence frames. Ask students to read their final sentence(s) aloud.

### Work for Early Finishers

Have students consider a system of three linear equations in two variables. Can such a system have no solution even if the graphs of the equations intersect? Have students graph the system \( y = x, y = -x, \) and \( y = 3x - 2 \) as a part of this discussion. Students should find that while pairs of lines intersect to form a triangle, the three lines do not intersect at any single point. There is not solution to this system because no one ordered pair satisfies all equations.

Once they have demonstrated understanding of solving a system of three equations in only two variables, challenge them to think through methods for solving a system of three linear equations in three variables such as the one below. If time allows, provide a few simple examples and ask them to prepare a mini-lesson walking the class through how to solve the system.

\[
\begin{align*}
2x - 3y + z &= -5 \\
x + y - z &= -2 \\
x + y &= 1
\end{align*}
\]

Alternatively, provide students with a system of two linear equations in two variables with two unknown coefficients. Show them the solution to the system and ask them to determine the coefficients. As with the previous suggested challenge, ask these students to present out to the class their method for determining the value of the coefficients.

Allow early finishers to begin the first digital lesson from Week 3, in which they will graph linear inequalities and solve systems of linear inequalities.

### Supporting Foundational Math Skills

Writing equations that model real-world situations is a skill that is explored many grade-levels before Algebra I. Students that have weakness in this foundational skill would greatly benefit from reviewing additive relationships.
and how they are different from multiplicative relationships. Have discussions around how situations involving words like *each* or *per* likely indicate a multiplicative relationship that can be modeled with either multiplication or division. Whereas words like *in total* or *difference* likely indicate an additive relationship that can be modeled with addition or subtraction. All this being said, there are no hard-and-fast rules for which operations to use to model real-world situations. Use some real-world examples to discuss efficient strategies for creating equations.

Suggest that students rewrite the scenario in their own words and/or select a number for one variable and talk through how to determine the other variable with words alone.

As a culminating activity, walk through the item below, having students indicate the correct answer (indicated with star) and why. Then, ask students to explain why each one of the incorrect answer choices is purposefully crafted to catch the student misreading the situation.

Last month Maria hiked the 5-mile mountain trail a number of times and she hiked the 10-mile canal trail several times. Let $x$ represent the number of times she hiked the 5-mile trail and let $y$ represent the number of times she hiked the 10-mile trail. If she hiked a total of 90 miles, which equation can be used to find the number of times Maria hiked each trail?

a) $x + y = 90$

★b) $5x - 10y = 90$

c) $90 - 10y = 5x$

d) $90 + 10y = 5x$

### Social Emotional Learning Connections

On Day 4 of this week, students are presented with three systems and asked which method of solving is the most efficient, or best. Some students may claim one method of solving is more efficient than another simply due to their level of comfort with that particular procedure. For example, a student may claim that substitution is always most efficient for them because it is the one they understand and produces the fewest mistakes. This answer can be recognized as an asset and validated as correct. Create a supportive learning environment by utilizing an asset-based approach in your responses to students preferred content entry points.
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## Week 3 – Inequalities

<table>
<thead>
<tr>
<th>Learning Goals</th>
<th>Main Task: Students will graph, model, and solve problems in real-world contexts that can be modeled with a linear inequality in two variables and begin to explore graphing the solution to a system of linear inequalities.</th>
</tr>
</thead>
</table>
|                | • Graph the solution to a linear inequality or a system of linear inequalities in two-variables. (A-REI.12)  
|                | • Model a real-world problem with a linear inequality in two-variables and interpret the solution. (A-CED.3)  
|                | • Solve a real-world problem that can be modeled by a linear inequality in two variables. (A-REI.12) |

| Edgenuity Digital Lessons | • Graphing Two-Variable Linear Inequalities  
|                        | • Modeling with Two-Variable Linear Inequalities  
|                        | • Solving Systems of Linear Inequalities |

## Week at a Glance

<table>
<thead>
<tr>
<th>Day 1</th>
<th>Students will work independently on the digital lesson: “Graphing Two-Variable Linear Inequalities.” Monitor students who are struggling and provide individual attention as needed.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 2</td>
<td>Use data to identify students who did not pass the quiz from the previous digital lesson. These students will be Group A. Students who passed the quiz will be Group B. During the first part of the class period, pull Group A together for re-teaching while Group B students work on the second digital lesson (“Modeling with Two-Variable Linear Inequalities”). For the remaining time, work with students individually or in small groups as needed.</td>
</tr>
</tbody>
</table>

### Common Misconceptions & Reteaching Strategies

Students that struggle with graphing two-variable linear inequalities in the plane may have a misconception thinking that we treat inequalities the same as we treat equation; especially since the first step of graphing inequalities is the same as graphing an equation. For these students it can be
helpful to explain why it is imperative that we determine the type of line (open or closed) and the direction of the shading (above or below) when graphing inequalities.

Tell students that a system of inequalities has a solution set that includes the points (4, 1) and (2, 3). Then show students the four graphs below and ask them to identify the correct graph of the system of inequalities. Ask students to justify their answers.

Another common misconception is that the solution to an inequality must always be an inequality. While there is not necessarily exactly one solution to every inequality, students may be asked if one
ordered pair *does represent a solution* to the inequality. Discuss with students how the infinite points in the shaded region all serve as individual solutions for the inequality. It is often helpful to have students test a point in the solution area after graphing an inequality to drive this point home.

### Day 3

**Developing Higher Order Thinking**

Open the class period with a discussion question.

*Mathematicians call the solution to a linear inequality in two variables a half-plane. Why do you think they use the terms *half* and *plane*?*

Encourage students to draw pictures—using examples and non-examples—and evaluate the claims of others during the discussion.

After the discussion have students work on their finishing “Modeling with Two-Variable Linear Inequalities” and moving on to “Solving Systems of Linear Inequalities” for the remainder of the class period. Monitor students who are struggling and provide individual attention as needed.

### Day 4

Use data to identify students who did not pass the quiz from the lesson “Modeling with Two-Variable Linear Inequalities.” These students will be Group A. Students who passed the quiz will be Group B. During the first part of the class period, pull Group A together for re-teaching while Group B students work on the next digital lesson (“Solving Systems of Linear Inequalities”). For the remaining time, work with students individually or in small groups as needed.

**Common Misconceptions & Reteaching Strategies**

Students that struggle with representing real-world situations with inequalities may have issues working with language that indicates the lack of equality. Discuss with students how in modeling with linear equations, situations can indicate equality with words like *is, are, or was*. However, with inequalities, students need to pay particular attention to the indications of a lack of equality. Have students complete...
the chart below, discussing and inventing situations that seem to indicate the four different inequality symbols.

| < or > | more than, less than, fewer greater, ... |
| ≤ or ≥ | at least, at most, fewest, greatest, ... |

Be sure to discuss how, depending how they choose to write the inequality, it is only in the reading from left to right that they will know if their inequality accurately represents the situation. So, two different inequalities can represent the same situation! For example, \( y < 5x \) is the same as \( 5x > y \).

Day 5
Some students will need this day to finish the week’s required digital lessons. Other students will be finished. Refer to the work for early finishers for those that have completed the required lessons.

**Developing Higher Order Thinking**
Lead a discussion around the graph of the solutions to \( y > -2x + 1 \). Show students the graph and ask if describing the shaded region as “to the left of the dotted line” and “above the dotted line” are both correct. Then ask students to choose which description provides more relevant information based on the inequality. Explain that while both descriptions are correct, thinking of the shaded region as the part above the dotted line likely does a better job of helping someone think about the graph as a representation of “when \( y \) is greater than \(-2x + 1\).” The \( y\)-axis is the vertical axis, so discussing what is above or below the dotted line is more fitting.

**Modifications for Special Populations**

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<th>High Proficiency</th>
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</table>
| Have students create a picture dictionary of important terms from this unit that are found in the digital lessons students have been exposed to in the digital lessons, including words such as: half, plane, two-variable, place students in small groups and have them write their
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**equality, inequality, less than, more than, boundary line, intercept, and linear system.**

own real-world situation and demonstrate it on a graph. Afterwards, the class will take part in a gallery walk to view all of the situations that have been written and graphed.

### Work for Early Finishers

Challenge students to graph a system of inequalities with no solutions. Ask them to create a real-world situation that could manifest such a system. Have these students explore—via discussion or journaling—what all such systems have in common.

Allow early finishers to begin the first digital lesson from Week 4, in which they will explore how to model real-world situations with a system of linear inequalities and use the model to solve problems.

### Supporting Foundational Math Skills

Students that do not have a firm conceptual understanding of the solution set for a single-variable inequality may struggle with the idea of a half-plane being the solution set to a two-variable inequality. Many students rely on rote memorization for graphing the result of a single-variable inequality, which can be detrimental when transferring this understanding from the number line to the two-dimensional plane. Spend time reviewing the relationship between the open circle and shading on a number line to show the open interval of solutions in single-variable inequalities involving greater than or less than (e.g., $y > 2$). Then relate that to the relationship between the dashed line and shading on a coordinate plane to show the similar open half-plane solutions in a two-variable inequality involving greater than or less than (e.g., $y > 2x$). Talk through the solutions indicated by each graph and how the open circle and the dashed line do not represent solutions to the inequality. Then conduct the same comparison with the closed circle in a single-variable inequality and the solid line at two-variable inequality containing greater than or equation to or less than or equal to symbol (e.g., $y \geq 2$ and $y \geq 2x$). Explore how these graphs include solutions in the closed circle and on the solid line.

### Social Emotional Learning Connections

At this point in the unit, students may be at very different places in the digital lessons. Encourage students to complete a self-evaluation on their progress in these lessons. If they are behind, have them brainstorm two or three things they can do to get caught up. If they are on target, have them set a goal that would push them ahead. Students who are ahead can create something to keep themselves motivated or to motivate others.

Lead students in a journal response regarding their work ethic this week. Questions that could be addressed include: How were you successful this week? Where do you need to improve? What goals can you make for yourself to be a continually growing learner? Who can help you stay accountable and meet these goals?
## Unit 4 Overview

### Week 4 – Modeling with Systems of Linear Inequalities

#### Learning Goals

**Main Task:** Students will finish their exploration of systems of linear inequalities and complete the Unit Review and Unit Test.

- Model a real-world problem with a system of linear inequalities in two-variables and interpret the solution. (A-CED.3)
- Solve a real-world problem that can be modeled by a system of linear inequalities in two variables. (A-REI.12)

#### Edgenuity Digital Lessons

- Modeling with Systems of Linear Inequalities
- Unit Review
- Unit Test

### Week at a Glance

<table>
<thead>
<tr>
<th>Day 1</th>
<th>Students will work independently on the digital lesson “Modeling with Systems of Linear Inequalities.” Monitor students who are struggling and provide individual attention as needed.</th>
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</thead>
<tbody>
<tr>
<td>Day 2</td>
<td>Use data to identify students who did not pass the quiz from the lesson “Modeling with Systems of Linear Inequalities.” These students will be Group A. Students who passed the quiz will be group B. During the first part of the class period, pull Group A together for re-teaching while Group B students work on the Unit Review.</td>
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</tbody>
</table>

#### Common Misconceptions & Reteaching Strategies

Students may have issues with writing the inequalities to represent relationships they need to model. Usually the stumbling block hovers around which inequality symbol to use; especially if these students do not struggle with modeling real-world situations with linear equations. Determine first if students have issues with writing a system of linear equations to represent a real-world situation. If this is the
stumbling block, use resources referred to in Week 2 of this unit. It’s imperative to resolve these issues before asking them to transfer this understanding to modeling with systems of inequalities.

Once you’ve determined that the students are not struggling with writing a system of linear equations, discuss how to determine which inequality symbol to use in a real-world situation that is modeled with a system of inequalities. Have students select an ordered-pair for one of the inequalities that makes sense in the real-world situation to verify that they chose the right symbol. For example, consider a real-world situation where Xavier makes at least $20 per hour plus $10 even if they don’t work any hours at all! Ask students to consider the inequality: \( p > 20h + 10 \). Ask, “Does this inequality accurately represent this scenario? What would happen if Xavier didn’t work any hours, or \( h = 0 \)?” Elicit that if Xavier works zero hours, he will make $10. That leads to an incorrect inequality; 10 is greater than or equal to 10. Thus, the inequality should be written \( p \geq 20h + 10 \).

**Day 3**
Have any students that have yet to complete Unit Review activity do so at the start of the class period. Ask the remaining students to work in small groups to create 3 real-world situations/problems that can be solved with a system of linear equations or inequalities—distributing equations and inequalities evenly amongst the groups. Explain that they need to include an answer key! As students complete the Unit Review, have them join this activity.

**Day 4**
Have students share their work from the previous day with one other group. Invite each group to share positive feedback with the whole class about the other’s group’s work.

**Day 5**
Have all students take the Unit Test.

** Modifications for Special Populations**

<table>
<thead>
<tr>
<th><strong>Supporting English Learners</strong></th>
<th><strong>Low Proficiency</strong></th>
<th><strong>High Proficiency</strong></th>
</tr>
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<tbody>
<tr>
<td>Choose a number of real-life situations that students will have to solve in the exam. As a class, analyze (What I Want to Learn) portions of a KWL chart. Return</td>
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</tr>
</tbody>
</table>
| Work for Early Finishers | If students complete the Unit Test before the entire class is done, encourage them to journal or discuss the questions below with other students:  
- *Can you use the method of substitution and the method of linear combinations to solve a system of linear inequalities? Why or why not?* |

| Supporting Foundational Math Skills | Modeling a real-world scenario with a system of inequalities involves dissecting the context for the relationships essential for representing the situation. This can be incredibly tricky for students that are still grappling with representing less complex real-world situations with a single two-variable inequality. Give students time to examine what makes a system the correct system for a scenario by presenting them with a real-world problem and the correct system of inequalities. Ask students to make connections between the given system and the scenario including any key words in the scenario that lend clues to the use of inequality symbols in the system. Have students pick an ordered pair in the solution from the graph of the system and discuss what this solution means in the context of the scenario. Then do the same thing with an ordered pair that is a solution to one inequality but not the other. Encourage students to restate the problem in their own words and organize the information given. Explain that mathematically proficient problem solvers spend a good deal of time on these steps! Have students practice organizing information in a multitude of ways: making a list, creating a table, drawing a picture, etc. Walk through a series of items asking students to talk through these two steps without creating the inequalities, rewarding them for representing the situation in other ways accurately before moving on to the creation of these inequalities. |

| Social Emotional Learning Connections | Encourage students to take time before and after to reflect on how attitude and preparation can impact success.  
**Before the Unit Test** - Students can spend time considering how any feelings of anxiety about the unit test could influence their performance. Give students time to discuss in small groups how they deal with test anxiety. Encourage students to use the unit review to identify areas of strength and weakness in order to alleviate stress. Work with students to identify resources they have for improving work on specific objectives. Have students |
complete a brief writing task before the unit test in which they list any stress-relieving techniques or content resources they used to get ready for the test.

**After the Unit Test** After students have had a chance to review their results on the unit test, return the writing task to them. Ask students to reflect on what was and was not helpful and to identify ways they can continue success and improve on the next assessment.

Or

After day 3, lead a self-reflection on the group work activity. Have student evaluate their own participation and their groups success as you ask these questions: Did your group accomplish the task? Was there any conflict of ideas in your group? How did your group solve this conflict? What was a successful strategy your groups used to work together? How did you contribute to your group’s success? In the future, how could you be an even better group member?