Algebra 1

**2-Variable Equations & Inequalities**

**Unit Summary:** In this unit, you will learn multiple methods to solve equations and inequalities with two variables. You will determine if given solutions are valid and use graphs to find solutions of two equations or inequalities.

**GeoGebra Review Activities**

* Learn and practice solving equations and systems of linear equations with [interactive resources](https://www.geogebra.org/math/equations) from GeoGebra.
* Graph or identify simple inequalities using symbol notation >, <, ≤, ≥, and ≠ in number and word problems with [interactive resources](https://www.geogebra.org/math/inequalities) from GeoGebra.

**Lesson 2 – Equations in Two Variables**

**Key Words:**

* **equation** – a usually formal statement of the equality or equivalence of mathematical or logical expressions
* **ordered pair** – two values written in a specific order, where x is the first value and y is the second value to be substituted for the variables in an equation; written as (x, y)
* **solution** – a set of values of the variables that satisfies an equation; for an equation with one variable, a value (number) that, when substituted in for the variable, makes a true statement
* **solution set** – the set of values that satisfy an equation
* **variable** – a quantity that may assume any one of a set of values, typically represented by a letter

**Objective 1:** In this section, you willdetermine if a given set of values will make a two-variable equation true.

*Mathematical Practice Standard: Construct viable arguments and critique the reasoning of others.*

**Big Ideas**:

* Recall how to check a *solution* for a one-variable equation by **substituting** the *variable* with your *solution*.
* When checking the *solution* for two-variable equations, you can use the same method, but instead of **substituting** for one variable you will **substitute** for two *variables*.
* The values you **substitute** for two-variable equations are called *ordered pairs* .
  + For example, is an ordered pair where is 2 and is 3.
* Two-variable equations can have none, one, or multiple *solutions*.

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| **Example:** Sergei wants to find possible solutions for the equation . He comes up with the following ordered pairs: . Are all the ordered pairs solutions to the equation? | |
| **Step 1:** Check the first ordered pair using substitution. | Equation:  Ordered pair:  Substitute and solve:  The statement is true because both sides equal 15. Yes, (0, -5) is a solution. |
| **Step 2:** Check the next ordered pair using substitution. | Equation:  Ordered pair:  Substitute and solve:  The statement is false because –13 does not equal 15. No, (2, 5) is not a solution. |
| **Step 3:** Check the last ordered pair using substitution. | Equation:  Ordered pair:  Substitute and solve:  The statement is true because both sides equal 15. Yes, (0, -5) is a solution. |

**Objective 2:** In this section, you will show the solution set of a two-variable equation is the set of all points that lie on the curve, which could also be a line.

*Mathematical Practice Standard: Model with mathematics.*

**Big Ideas:**

* If an *ordered pair* makes the *solution* true, the values are one part of a set of total *solutions* for the *equation*.
* The *ordered pair* is also a point on a line that represents the equation.
  + The line that represents an equation also represents all *solutions* of the equation.
* If the *ordered pair* is NOT on the line of the graph that represents the equation, then it is NOT a *solution*.

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| **Example:** The following graph represents the equation . Which of the ordered pairs listed are solutions to the equation? Use substitution to check your answers.     * are on the line that represents the equation. They are solutions. * is not on the line and is therefore not a solution. |
| **Check your work:** |

* Quadratic equations are like linear equations in the way that graphs represent them. The curve of a quadratic equation (parabola) represents all solutions of a quadratic equation.

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| **Example:** The quadratic equation is represented in the graph. Is (0,3) a solution to the equation? | |
| **Step 1:** Examine the graph and locate the ordered pair. | Notice that the ordered pair (0,3) does not lie on the curve. Therefore, it can’t be a solution. |
| **Step 2:** Check the solution. | Substituting the ordered pair does not make a true statement. Therefore, it is not a solution. |

**Practice Questions and Answers**

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|  | Question | Answer |
| P 1 | Determine which of the following ordered pairs is a solution to the equation .  Option #1: (0,8)  Option #2: (−1,2)  Option #3: (4,0)  Option #\_\_\_\_ is a solution to the equation. | 2 |
| P 2 | Ms. Smith asked her students to determine a solution for . Which of the following students found the correct solution?  Student #1: Linda believes (1,−4) is a solution to the equation.  Student #2: Nathan believes (5,3) is a solution to the equation.  Student #3: Gary believes (4,1) is a solution to the equation.  Student #\_\_\_\_ is correct. | 3 |
| P 3 | *Use the image to answer the question.*  Which of the following ordered pairs is part of the solution set for the equation ?  Option #1: (−1,0)  Option #2: (0,−4)  Option #3: (3,4)  Option #\_\_\_\_ is part of the solution set for the equation. | 2 |
| P 4 | *Use the image to answer the question.*  Which of the following ordered pairs is part of the solution set for the equation ?  Option #1: (−2,−8)  Option #2: (2,8)  Option #3: (−4,0)  Option #\_\_\_\_ is part of the solution set for the equation. | 2 |
| P 5 | *Use the image to answer the question.*  Which of the following ordered pairs is part of the solution set for the equation ?  Option #1: (−1,1)  Option #2: (0,3)  Option #3: (3,1)  Option #\_\_\_\_is part of the solution set for the equation. | 1 |

**Quick Check Questions and Answers**

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|  | Question | Answer |
| Q 1 | Determine which of the following ordered pairs is a solution to the equation . | (0, 2) |
| Q 2 | The math teacher asked his students to determine a solution for . Which solution below is the correct one? | Sam believes (-4, -7) is a solution. |
| Q 3 | Select the option below that correctly shows which of the following ordered pairs is part of the solution set for the equation . | (3, 14) |
| Q 4 | Use the image to answer the question.  Which of the following ordered pairs is part of the solution set for the equation ? | (1, 7) |
| Q 5 | Use the image to answer the question.  Which of the following ordered pairs is part of the solution set for the equation ? | (-1, 3) |

**Lesson 3 – Creating Two-Variable Equations**

**Key Words:**

* **constant** – a quantity having a fixed value that does not change or vary, such as a number
* **continuous data** – a kind of data that is measured on an infinite scale between points, no matter how small an increment
* **dependent variable** – a mathematical variable (often represented by y) whose value is determined by one or more other variables in a function
* **discrete data** – a numerical type of data that includes whole, concrete numbers with specific and fixed data values determined by counting
* **domain** – is the set of all possible inputs (x-values) of a function
* **independent variable** – a mathematical variable (often represented by x) that is independent of the other variables in an expression or function and whose value determines one or more of the values of the other variables
* **inequality** – a statement of inequality between two quantities that are separated by a sign of inequality, such as < (is less than), > (is greater than), or ≠ (is not equal to)
* **rate of change (slope)** – a value that results from dividing the change in a function of a variable by the change in the variable
* **range** – is the set of all outputs (y-values) of a function
* ***x*-intercept** – the x-coordinate of a point where a line, curve, or surface intersects the *x*-axis
* ***y*-intercept** – the y-coordinate of a point where a line, curve, or surface intersects the *y*-axis

**Formulas:**

* Slope-Intercept Form:

**Objective 1:** In this section, you will use equations created in two variables to solve problems.

*Mathematical Practice Standard: Model with mathematics.*

**Big Ideas**:

* A two-variable linear equation is made up of different components.
  + *x* represents the *independent variable* – the value of *x* determines the value of *y*
  + *y* represents the *dependent variable* – the value of *y* depends on the value of *x*
  + *rate of change or slope* – ratio between changes in two different quantities, the term with the variable *x*
  + *constant –* the term with no variable – a fixed value
* Creating a table to generate data points is one method to create and solve two-variable equations.
  + Recall that the ordered pairs (*x,y*) are the different solutions to the equation and also represent points on the graphed line that represents the equation.

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| **Example:** Jumping Jamboree charges a $6 entry fee and $2 for every hour spent jumping.   1. Write a two-variable equation that represents the cost for jumping at Jumping Jamboree (*y*) in relation to the number of hours spent jumping (*x*). 2. Create a table to generate data points that represent the relationship between the cost and the hours. 3. Use the tables generated points to represent the equation on a graph. | |
| **Step 1:** Write an equation that represents the scenario. | Let x be the number of hours spent jumping.  Let y be the total cost.  Rate of Change: $2 per hour  Constant: $6 entry fee  The total cost (y) is the sum of the entry fee ($6) and the cost per hour spent jumping. |
| **Step 2:** Create a table and generate data points. | The table illustrates the starting cost of $6 when the hour is at zero, and the price increases $2 for each hour spent jumping. |
| **Step 3:** Use the table to identify ordered pairs on the graphed equation line. |  |
| **Step 4:** Graph each ordered pair on the coordinate plane to represent the equation. | Notice how each point from the table is on the line that represents the equation , because they are all solutions to the equation. |

**Objective 2:** In this section, you will represent constraints of a contextual situation by interpreting solutions of two-variable equations as viable or nonviable.

*Mathematical Practice Standard: Modeling with mathematics.*

**Big Ideas:**

* Recall that linear equations can have an infinite number of solutions.
* However, sometimes the problem's context limits the number of solutions that make sense.
  + *Viable solutions* – make sense in the situation
  + *Nonviable solutions* – do not make sense in the situation
* To ensure solutions make sense, you must understand the *constraints* of the problem.
  + *Constraints* are the minimum and maximum values that the possible viable solutions can be.
  + For example, if you are working with a problem that deals with a certain number of people, it’s not possible to have solutions with fractions or negative numbers because you can’t have part of a person or negative people.
* Using a graph to represent constraints helps visualize the viable solutions of a problem.
  + A *discrete* graph represents whole number solutions only
  + A *continuous* graph represents all possible solutions (whole, decimal, etc.)
* Recall the intercepts of a graph and how they can represent solutions.
  + *x-intercepts* – the y value is zero, where the line crosses the *x*-axis
  + *y-intercepts* – the x value is zero, where the line crosses the *y*-axis

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| **Example:** You are stocking up to serve hamburgers **and** hotdogs at a cookout. The store where you buy the meat sells hot dogs and hamburgers only in one-pound increments. You have a total of $30 to spend on meat. The equation represents the situation, where *x* is the pounds of hamburgers and *y* is the pounds of hotdogs. Use the graph of the equation to identify the four viable solutions in this situation that would represent how many pounds of each you can buy. | |
| **Step 1:** Identify the constraints of the problem. | * The meat is only sold in one-pound increments. You can’t purchase fractions or parts of a pound. So, the solutions must be whole numbers only. * You must purchase both types of meat to have both options available at the cookout. So, zero pounds of either meat is not a viable solution. |
| **Step 2:** Use the graph to find the possible solutions. | The solutions must fall on the line and must be whole numbers. Here is the same graph, with the whole number solutions that fall on the line. |
| **Step 3:** List the viable options. | The viable solutions are:   * You can purchase 2 pounds of hamburger and 12 pounds of hotdogs. * You can purchase 4 pounds of hamburger and 9 pounds of hotdogs. * You can purchase 6 pounds of hamburger and 6 pounds of hotdogs. * You can purchase 8 pounds of hamburger and 3 pounds of hotdogs.   The intercepts, are NOT viable solutions because you must purchase a mix of both meats. |

**Practice Questions and Answers**

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|  | Question | Answer |
| P 1 | A local arcade charges $15.00 for unlimited play time for the first hour, then $5.00 per additional hour. On a piece of paper, write an equation that represents the cost to play, 𝐶, based on the number of hours played, h. Then use the equation to calculate how much it would cost to play for three hours. Enter your answer for 𝐶, including cents. | 25.00 |
| P 2 | The bowling alley charges a flat rate for a lane, plus a fee per shoe rental. Use the equation  to solve for the cost of getting a lane and four shoe rentals. Enter your answer, including cents. | 27.00 |
| P 3 | Which of the following types of measurement would need a discrete data (whole number) constraint?  Option #1: weight  Option #2: height  Option #3: numerical birth month  Option #\_\_\_ would need a whole-number constraint. | 3 |
| P 4 | Which of the following options uses intercepts that have viable solutions?  Option #1: (number of quarters, number of dimes)  Option #2: (human age, human weight)  Option #3: (height, shoe size)  Option #\_\_\_ uses intercepts that have viable solutions. | 1 |
| P 5 | Xithlaly is in charge of selecting the prom committee for her school. The committee must consist of 15 upperclassmen (juniors and seniors), with at least one student from each grade. Which of the following is a viable solution?  Option #1: 4 juniors and 12 seniors  Option #2: 15 juniors and 0 seniors  Option #3: 6 juniors and 9 seniors  Option #\_\_\_ is a viable solution. | 3 |

**Quick Check Questions and Answers**

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|  | Question | Answer |
| Q 1 | For a large group of students, the Boston Ballet charges a flat rate of $50.00, plus $15.00 per ticket. How much would a school need to take a class of 25 students to see The Nutcracker? Use an equation with two variables to solve this problem. | $425.00 |
| Q 2 | The school soccer team is selling chips to fundraise for new jerseys. If they charge $2.50 per bag of chips, how many bags would they need to sell in order to raise $1,000.00? | 400 bags |
| Q 3 | Which of the following examples represents a discrete data constraint with viable solutions? | number of tests passed |
| Q 4 | Which of the following options could use both intercepts to produce viable solutions? | (temperature, number of car rentals) |
| Q 5 | Cindy won $50.00 for getting first place in the Science Fair. She spent her winnings on robotics kits and chemistry sets. Each robotics kit (y) costs $10.00, while each chemistry set costs $8.00 (x). Which of the following is a viable solution to the number of robotics kits and chemistry sets Cindy can purchase, assuming she spends her entire winnings? | (5, 1) |

**Lesson 4 – Inequalities in Two Variables**

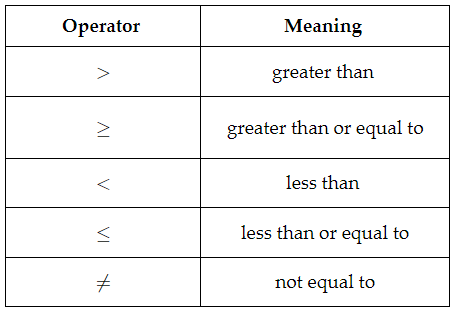
**Key Words:**

* **inequality** – a statement of inequality between two quantities that are separated by a sign of inequality, such as < (is less than), > (is greater than), or ≠ (is not equal to)
* **strict inequality** – an inequality for which adding “or equal to” to “less than” or “greater than” signs can never give a true expression

**Objective 1:** In this section, you will determine if given values are solutions to two-variable linear inequalities.

*Mathematical Practice Standard: Make sense of problems and persevere in solving them.*

**Big Ideas**:

* Recall the inequality symbols and meanings:
  + 
* When an equal sign in a linear statement is replaced with an inequality sign, it becomes a *linear inequality*.
* Like linear equations, linear *inequalities* can have multiple solutions. Any ordered pair that makes the *inequality* true is a solution.

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| **Linear Equation** | **Linear Inequality** |
| * Linear equations have an infinite number of solutions along the line that is created. | * Linear inequalities have an infinite number of solutions within a defined region and, in some cases, along the line that is created. |
| **Example:**   * The solution forms a line that consists of an infinite number of points that make the equation true. * Only the points on the line can be solutions to this equation. | **Example:**   * The shaded region of the graph represents all solutions to the inequality. * The solution forms a region, or half plane, with the line as the border. * All points in the shaded region will be a solution to the inequality. |

* To determine if a given data point is the solution to a *linear inequality*, you will use the same method to determine solutions for linear equations, substitution.
* For *linear inequalities*, it’s important to note the type of *inequality* symbol used.
  + use a dashed line when graphed, which indicates that the solutions to the linear *inequality* **do NOT fall on that line**.
  + use a solid line when graphed, which indicates that the solutions to the linear *inequality* **DO fall on the line**, as well as in the shaded regions.

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| **Example:** Graph each of the following equations and inequalities. Use substitution to determine if the point is a solution for each. | | |
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|  | This statement is not true because –5 is not greater than –5; therefore (0, -5) is not a solution. | This statement is true because although –5 is not greater than –5, it is equal to –5. So, (0, -5) is a part of the solution set. |

**Objective 2:** In this section, you will show the solution of a two-variable linear inequality is the set of all points that lie on a half-plane bounded by the line (and may or may not include the line).

*Mathematical Practice Standard: Make sense of problems and persevere in solving them.*

**Big Ideas:**

* Recall that linear *inequalities* are like linear equations but have inequality symbols .
* Recall that the shaded region of a linear *inequality* represents the set of all points that are solutions to the linear inequality.
* Recall that the boundary line is determined by the type of *inequality* used.
* The key features of graphs of linear *inequalities*:

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| **Inequality Symbol** | **Boundary Line** | **Shading** | **Example** |
|  | dotted or dashed line  (points on the line are NOT included in the solution set) | shade above |  |
|  | solid line  (points on the line are included in the solution set) | shade above |  |
|  | dotted or dashed line  (points on the line are NOT included in the solution set) | shade below |  |
|  | solid line  (points on the line are included in the solution set) | shade below |  |

* You can use the graph of a linear *inequality* or the substitution method to determine if specific points are part of the solution set.

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| **Example:** Which of the following ordered pairs are solutions to the inequality ? | |
| **Step 1:** Substitute point A into the equation to determine if true or false. | The statement is true because 4 is less than 5.  is part of the solution set. |
| **Step 2:** Substitute point B into the equation to determine if true or false. | The statement is not true because 2 is not less than 1.  is not part of the solution set. |
| **Step 3:** Substitute point C into the equation to determine if true or false. | This statement is true because 0 is less than 3.  is part of the solution set. |
| **Step 4:** Substitute point D into the equation to determine if true or false. | The statement is not true because 15 is not less than 9.  is not part of the solution set. |
| **Step 5:** Substitute point E into the equation to determine if true or false. | The statement is true because 5 is less than 11.  is part of the solution set. |
| **Step 6:** Show the points on a graph. |  |

**Objective 3:** In this section, you will represent constraints of a contextual situation by interpreting solutions of two-variable inequalities as viable or nonviable.

*Mathematical Practice Standard: Model with mathematics.*

**Big Ideas:**

* [Recall](#Bookmark1) in previous lessons that you used *constraints* to represent limits to solutions in contextual problems.
* *Constraints* are represented using *inequality* symbols and are used to determine which solutions are *viable* or *nonviable*.
* A *viable* solution must fall in the shaded area of the graph of the inequality AND meet the constraints of the problem.
* When representing an inequality, think about the difference between the possible solutions to the equation and the limits the *inequality* places on the range of possible solutions.

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| **Example:** Marian has money amounting to a minimum of $1.50. All her money is in nickels and dimes.  1. Write an inequality.  2. Determine the constraints when finding how many nickels and dimes Marian has.  3. Interpret the constraints of the solutions by examining the graph of the inequality. | |
| **Step 1:** Write an inequality. | The problem states that the total amount of money is a minimum of $1.50. This means, the total is greater than or equal to $1.50.  total money  Let *x* represent the number of nickels (worth 5 cents each).  Let *y* represent the number of dimes (worth 10 cents each). |
| **Step 2:** Determine the constraints. | * You can only have a positive number of coins. * You can only use whole numbers to represent the number of each type of coin. |
| **Step 3:** Identify viable solutions using a graph. | * The graph below represents *some* of the **viable** solutions for this problem. * Notice the graph has been adjusted to exclude negative numbers because you can’t have negative coins. * These are not all possible solutions, and there are several solutions within the shaded area that are nonviable due to constraints, such as decimals or fractions. |
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* Recall that you can use graphs and substitution to represent viable solutions.

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| **Example:** You want to take your friends to the state fair. Admission is free, but you must purchase games and rides tickets. Tickets for games cost $3 each, and tickets for rides cost $5 each. You can spend up to $50.  Can you purchase 10 tickets for games and 10 tickets for rides and still be within $50? | |
| **Step 1:** Write the inequality. | You can spend up to $50. This means that you can spend less than or equal to $50.  total cost  Let *x* be the number of game tickets.  Let *y* be the number of ride tickets. |
| **Step 2:** Determine the constraints. | You can’t purchase partial or negative tickets, so the viable solutions must be positive whole numbers. |
| **Step 3:** Substitute the possible solution to see if it is viable. | You are trying to determine if 10 game tickets and 10 ride tickets is a viable solution.    Represented graphically: |
| **Step 4:** State the answer. | This is not a solution because you would spend $80 for 10 ride tickets and 10 game tickets. You only have $50 to spend and you will not have enough money.  You can see this represented in the graph as well. The point (10, 10) is outside of the shaded region. |

**Practice Questions and Answers**

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|  | Question | Answer |
| P 1 | Use the image to answer the question.  Is the point (12,−112) a solution to the inequality , as shown on the graph? Enter 1 for yes or 2 for no. | 1 |
| P 2 | *Use the image to answer the question.*  Which of the following points is a solution to the linear inequality , as shown on the graph?  Option #1:  Option #2: (2,−3)  Option #3: (3,2)  The point in Option #\_\_\_ is a solution to the linear inequality . | 3 |
| P 3 | Use the image to answer the question.  The graph shows the inequality . Is the point (−1,4) part of the solution set? Enter 1 for yes or 2 for no. | 2 |
| P 4 | Sally’s Seashore Rentals has snorkels available for $2 and fins for $1. Josiah has $10 to spend on rentals for himself and his parents. Write a two-variable inequality to determine if the point (3,3) represents a viable solution in this case. Enter 1 for yes or 2 for no. | 1 |
| P 5 | *Use the image to answer the question.*  The image shows an inequality representing the possible number of adults and children in attendance at a party. Which of the labeled points represents a viable solution in this context? Enter the coordinates exactly as they appear above, in the form (𝑥,𝑦).  (\_\_\_,\_\_\_) | 10; 5 |

**Quick Check Questions and Answers**

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|  | Question | Answer |
| Q 1 | Which of the following points is a solution to the linear inequality ? |  |
| Q 2 | Use the image to answer the question.  Is the point (0,−3) a solution to the inequality , as shown on the graph? | No, because (0,−3) falls on the boundary line. |
| Q 3 | Show which of the following points is part of the solution set for the inequality . | (10, 4) |
| Q 4 | Kiani is shopping at a bookstore with a budget of $60. Hardbacks cost $12 and paperbacks cost $5. Write a two-variable inequality and determine the constraints of the problem. Which of the following points represents a viable solution? | (2, 4) |
| Q 5 | *Use the image to answer the question.*  This graph shows the inequality , and represents Lina’s earnings for lawn mowing and dog walking where *x* represents the number of lawns mowed and *y* represents the number of dogs walked. Which of the labeled points is a viable solution in this context? | (10, 10) |

**Lesson 5 – Solution Sets of Simultaneous Equations**

**Key Words:**

* **parallel line** – a straight line that always remains the same distance from another line and, therefore, never intersects it
* **quadratic equation** – any equation containing one term in which the unknown is squared and no term in which it is raised to a higher power
* **system of equations** – two or more linear equations with the same variables

**Formulas:**

* Quadratic Equation: , or,
* Slope-Intercept Form:

**Objective 1:** In this section, you will determine if given coordinate pairs are solutions to systems of equations.

*Mathematical Practice Standard: Make sense of problems and persevere in solving them.*

**Big Ideas**:

* *Systems of equations* are a collection of equations that share the same variables.
  + For example, the following are a *system of equations* because they share the variable *x* and *y*.
  + 
* Because they share the same variables, it is possible for one or more coordinate pairs to be solutions to all the equations in the system.
* Solutions to *systems of equations* are ordered pairs that **satisfy both equations** and can be found graphically or algebraically (using substitution).
  + Graphically: If the ordered pair marks the same point on all the equations in the system, then the ordered pair is the solution to the system of equation.
    - When a system has one solution, it is at the **point of intersection,** where all lines in the system intersect.
  + Algebraically: When substituting, if the coordinate pair makes all the equations in the system true, it is a solution.

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| **Example:** Determine whether the coordinate (2,7) is a solution to the system of equations and . | |
| **Graphically**  The graph shows that the coordinate point (2,7) is not a solution to this system of equations.  It falls only on the line of the equation and not on .  To be a system solution, the coordinate pair must fall on both lines at the point of intersection. |  |
| **Algebraically**  The ordered pair (2,7) satisfies the equation and not .  The ordered pair is not a solution to the system of equations. |  |
| **What is the solution?**  From the graph, it looks like the intersection point is at (-1,1). Use substitution to check if the ordered pair is a solution to the system.  The ordered pair (-1,1) satisfies both equations, therefore it is the solution to the system of equations. |  |

**Objective 2:** In this section, you will use tables and graphs to identify the solutions to systems of equations.

*Mathematical Practice Standard: Make sense of problems and persevere in solving them.*

**Big Ideas:**

* When using a table to identify the solution to a *system of equations*, you identify the values that are the same for both *x* and *y* and satisfy all equations in the system.

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| **Example:** What is the solution to the system of equations and ? Use the data from the table.     * The solution to the system of equation is (3, -4). You can identify the solution by examining the columns in which the *x* value gives the same value for *y* in both equation columns. * In this case, when *x* is 3, the *y* value in both equations is –4. |

* Recall that the solution to a *system of equations*, from a graph, are anywhere the lines intersect a specific point or at multiple, even infinite points.
* Sometimes a *system of equation* contains one linear equation and one *quadratic equation*.
* Recall that a *quadratic equation* is in the form and creates a parabola when graphed.
* When a quadratic equation is part of a system, you can have two solutions.

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| **Example:** Based on the graph, what is the solution to the system of equation and ?     * The systems intersect at two points and therefore there are two solutions. * The solutions are (1,2) and (3,6) because both points satisfy both equations. |

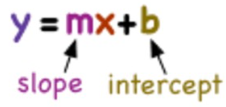
**Objective 3:** In this section, you will describe systems of equations with zero solutions or with infinite solutions.

*Mathematical Practice Standard: Make sense of problems and persevere in solving them.*

**Big Ideas:**

* [Recall](#Bookmark2) that a *system of equations* can have one, zero, or infinite solutions.

|  |  |
| --- | --- |
| **One Solution**  Where only one coordinate pair will satisfy the system.  The solution is the point where all lines in the system intersect, also called the point of intersection.  Example System: |  |
| **Infinite Solutions**  Where all points along the line will satisfy a system of equations.  This occurs when the equations in the system create the exact same line, making the graph look like it is just one line.  Example System: |  |
| **None or Zero Solutions**  Where no coordinate pair can satisfy a system of equations.  This occurs when the system of equations creates parallel lines (**same slope, different intercepts**) that never cross.  Example System: |  |

* Before determining the solution of a system, you need to ensure that all equations in the system are in slope-intercept form. Sometimes this requires you to rearrange an equation.
  + 

|  |  |
| --- | --- |
| **Example:** Determine the solution for the following system: | |
| **Step 1:** Rearrange the second equation into slope-intercept form. |  |
| **Step 2:** Rewrite the system. |  |
| **Step 3:** Analyze the equations. | Notice that the slopes are the same for each equation, but the *y*-intercept is different.  Without graphing, you know that these equations will create parallel lines on a graph and therefore never intersect. |
| **Step 4:** Confirm by graphing the lines. |  |
| **Step 5:** State the answer. | The graph demonstrates that these lines are indeed parallel. Therefore, this system of equations has zero solutions. |

**Practice Questions and Answers**

|  |  |  |
| --- | --- | --- |
|  | Question | Answer |
| P 1 | *Use the image to answer the question.*  What is the solution of  and ?  The ordered pair (\_\_\_,\_\_\_) is the solution to the system of equations because it is the point at which both lines intersect, so both lines share this point. | -2; -5 |
| P 2 | *Use the image to answer the question.*  Mya and Liliana are analyzing a system of equations,  and . Mya says there is no solution and Liliana says there are an infinite number of solutions. Which option best explains what is going on?  Option #1: Only Mya is correct. Two parallel lines do not intersect in any of the points  Option #2: Only Liliana is correct. Because the two equations are parallel, there are an infinite number of solutions.  Option #3: They are both wrong. The solution to the system of equations is (0,4).  Option #4: Only Mya is correct because both equations intersect the *y*-axis.  Option #\_\_\_ best explains what is going on. | 1 |
| P 3 | *Use the table to answer the question.*   |  |  |  | | --- | --- | --- | | ***x*-value** | ***y*-value if**𝑦=𝑥+6 | ***y*-value if**𝑦=2𝑥+3 | | 0 | 6 | 3 | | 1 | 7 | 5 | | 2 | 8 | 7 | | 3 | 9 | 9 | | 4 | 10 | 11 |   A system of equations is displayed in the table. What is the solution for the system?  (\_\_\_, \_\_\_) | 3; 9 |
| P 4 | Use the image to answer the question.  How many solutions does this system of equations have? | 2 |
| P 5 | Does the system of equations  and  describe a zero solution system or an infinite solution system? Enter 1 for zero or 2 for infinite. | 1 |

**Quick Check Questions and Answers**

|  |  |  |
| --- | --- | --- |
|  | Question | Answer |
| Q 1 | Which graph shows the solution of  and ? | Two parallel lines are graphed across a coordinate plane. One line is dotted while the other is solid. |
| Q 2 | Use the image to answer the question.  In math class, Emma and Angelle pair as a group. Emma’s task is to graph  and Angelle’s task is to graph . After they complete their graphs, they compare their work. They both get exactly the same graph. What is the solution of   and ? | an infinite number of solutions |
| Q 3 | Use the table to answer the question.   |  |  |  | | --- | --- | --- | | **x-value** | **y-value if** | **y-value if** | | 0 | −5 | −3 | | 1 | −3 | −2 | | 2 | −1 | −1 | | 3 | 1 | 0 |   Jian made a table showing some x- and y-values in a system of equations. Use his table to identify the solution for the system. | (2, -1) |
| Q 4 | Use the image to answer the question.  Which of the following shows the solution(s) for this system of equations? | (-2, 4) and (2, 4) |
| Q 5 | Which equation describes an infinite solution system with the equation ? |  |

**Lesson 6 – Solving Simultaneous Equations Using Substitution**

**Key Words:**

* **substitution** – to replace a term with another term or expression
* **system of equations** – two or more linear equations with the same variables

**Formulas:**

* Quadratic Equation: , or

**Objective 1:** In this section, you will use the substitution method to solve systems of linear equations.

*Mathematical Practice Standard: Make sense of problems and persevere in solving them.*

**Big Ideas**:

* Previously, you used graphing to determine the solution to a *system of equations*. There are several other methods that can be used to solve a *system of equations*. This lesson will focus on *substitution*.
* Recall that *substitution* is when you are given the value of a missing term or variable, and you place it into the original equation to make it a true statement.
* Follow these steps to solve a system of equations using *substitution*:
  + 1. Isolate a variable in one equation. You may need to rearrange an equation to isolate a variable yourself.
  + 2. *Substitute* the result found in step one into the other equation to determine the value of the variable.
  + 3. *Substitute* the value of the variable found in step two into any equation in the system to determine the value of the second variable.

|  |  |
| --- | --- |
| **Example:** Using substitution, solve the following system: | |
| **Step 1:** Isolate a variable in one equation. | In the first equation, *y* is already isolated and is equal to . |
| **Step 2:** Substitute the result found in step one into the other equation. | Substitute into the second equation for y. Make sure you use parentheses! |
| **Step 3:** Solve for *x*. |  |
| **Step 4:** Substitute the value for the variable, *x*, found in the previous step, into any equation in the system.  In this case, the easiest one would be the first equation, since *y* is already isolated. |  |
| **Step 5:** Combine the answers from steps three and four to identify the solution. | and  The solution to the system is . |

* The result of *substitution* looks different if the system has zero or infinite solutions. Observe the substitution method in the two situations below.

|  |  |
| --- | --- |
| **Infinite Solutions** | **Zero Solutions** |
| Since y is already isolated in the second equation, substitute this value for *y* into the first equation.    Notice that the *x*-values have canceled out, making the equation equal to itself. Any value placed in for *x* and *y* would make it equal to each other.  This result shows that the system has infinite solutions. | Substitute the value of the *y* from the second equation into the first.    Notice that the values do not equal each other. Since this is not a true statement there are no solutions to this system of equations. |

**Objective 2:** In this section, you will use the substitution method to solve simultaneous linear and quadratic equations.

*Mathematical Practice Standard: Make sense of problems and persevere in solving them.*

**Big Ideas:**

* Recall that a *system of equations* can be made up of a linear equation and a quadratic equation, called a linear-quadratic system.
* [Recall](#Bookmark4) the steps for using the *substitution* method to solve systems.
* The process for *substitution* changes when working with a linear-quadratic system.
  + To begin, you want both equations to equal *y*. Which means you will isolate *y* for both equations.
  + By completing this first step, it allows you to set each equation equal to one another.
  + Then, move all the terms to the right side to create a quadratic equation.
  + Factor the resulting quadratic and solve for *x.*
  + Substitute the value found for *x* into the linear equation to solve for *y.*

|  |  |
| --- | --- |
| **Example:** Solve the following system of equations: | |
| **Step 1:** Isolate *y* in both equations. | In both equations, *y* is isolated already. |
| **Step 2:** Set the linear equation equal to the quadratic equation. |  |
| **Step 3:** Move all terms to the right side to create a quadratic equation. |  |
| **Step 4:** Factor the resulting quadratic equation to find the values for *x*. | The quadratic equation factors out to . |
| **Step 5:** Solve for *x* from the factored form of the quadratic. |  |
| **Step 6:** Substitute the value of *x* into the linear equation to determine the value of *y*. |  |
| **Step 7:** State the answer. | The solution is (-3,12). If you check this in a graph, it will show that the linear equation only goes through the parabola at (-3,12). |

**Practice Questions and Answers**

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| --- | --- | --- |
|  | Question | Answer |
| P 1 | Use the substitution method to solve the system .  (\_\_\_\_) | (-2, -3) |
| P 2 | Use the substitution method to solve the system .  (\_\_\_\_) | (3, 0) |
| P 3 | Use the substitution method to solve the system .  (\_\_\_\_) | (-2, -10) |
| P 4 | Use the substitution method to determine whether the linear-quadratic system  has 0, 1, or 2 solutions.  This system has \_\_\_ solution(s). | 0 |
| P 5 | Use the substitution method to determine whether the linear-quadratic system  has 0, 1, or 2 solutions.  This system has \_\_\_ solution(s). | 1 |

**Quick Check Questions and Answers**

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| --- | --- | --- |
|  | Question | Answer |
| Q 1 | Use the substitution method to solve the system . | infinite solutions |
| Q 2 | Use the substitution method to solve the system . |  |
| Q 3 | Use the substitution method to solve the system . | (-2, 3) |
| Q 4 | Which of the following uses the substitution method to solve linear-quadratic system ? | (4, 8) and (3, 5) |
| Q 5 | Use the substitution method to find the solutions to the linear-quadratic system ? | (5, -20) and (-7, 16) |

**Lesson 7 – Solving Simultaneous Equations Using Elimination**

**Key Words:**

* **elimination method** – to remove a variable from consideration
* **equivalent systems** - systems of equations that have the same solution
* **system of equations** – two or more linear equations with the same variables

**Formulas:**

* Standard Form of an Equation:
* Quadratic Equation: , or,

**Objective 1:** In this section, you will show that replacing one equation in a system with the sum of that equation and a multiple of the other produces an equivalent system.

*Mathematical Practice Standard: Construct viable arguments and critique the reasoning of others.*

**Big Ideas**:

* When two sets of *systems of equations* have the same solution, they are *equivalent systems*.
* You can compare two systems to determine if they are *equivalent* using the sum and multiple of an equation.
* When determining whether two systems are *equivalent* using multiplication, you need to determine the least common multiple for the coefficients so you can multiply by the correct factor.

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| **Example:** Determine whether the following two systems are equivalent. | |
| **Step 1:** Analyze each system. | The first equation in each system is the same.  The second equations are different. |
| **Step 2:** Find the least common multiple between the second equations in each system. | The values in the second equations appear to be different by a factor of 2, which is the least common multiple of the *x*-values. |
| **Step 3:** Multiply the second equation in System B by the least common multiple. | Notice that the equation is now equivalent to the second equation in System A. |
| **Step 4:** Graph each system. | Notice that both systems intersect at the exact same point, making the systems equivalent. |

* Sometimes, the equations do not have common multiples and another method is needed.
* Another way to determine whether two systems are equivalent is by using the sum of one system.
  + If the sum of the two equations in the first system is equal to the different equation in the second system, then the systems are equivalent.

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| **Example:** Determine if the two systems are equivalent. | |
| **Step 1:** Add the two equations in System A. |  |
| **Step 2:** Is the sum the same as the first equation in System B? | The sum is the same as the first equation in System B. |
| **Step 3:** State the answer. | The sum of the equations in System A is the same as the first equation in System B. Therefore, these two systems are equivalent. |

**Objective 2:** In this section, you will use the elimination method to solve a system of equations.

*Mathematical Practice Standard: Make sense of problems and persevere in solving them.*

**Big Ideas:**

* Solving a *system of equations* using the *elimination method* will eliminate one of the variables by combining the opposite of that same variable.
  + By *eliminating* one variable, you are left with just one variable to solve for.
  + You can then substitute the value of the remaining variable back into the equations to determine the solution to the system.
* You can use addition or multiplication to *eliminate* a variable, like the steps in the [previous lesson](#Bookmark5).
* The *elimination method* works best when both equations are in standard form: . Sometimes, this means you will need to rearrange equations in the system to match the form.
* When using the *elimination method*, you are looking for like terms that are opposites of each other, which makes them easy to *eliminate*.
  + You should use addition when the variables can be easily *eliminated* by adding, like in the following example.

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| --- | --- |
| **Example:** Solve the following system using the elimination method. | |
| **Step 1:** Make sure both equations are in standard form. | Both equations are already in standard form, making it easier to use the elimination method. |
| **Step 2:** Compare the like terms in the equations. | * Notice there is a *2x* and *4x* as well as *–3y* and *3y*. * The coefficient values of the *y* terms are **opposites of one another**. |
| **Step 3:** Add the system of equations together. | Notice that, because the y terms were opposites of each other, they were eliminated. |
| **Step 4:** Solve for *x*. |  |
| **Step 5:** Substitute the value of *x* into **either** equation to solve for *y*. |  |
| **Step 6:** State the answer. | The solution to the system is . |

* Often, the coefficients of a system cannot be easily *eliminated* from the given equations.
* In this case, you can use multiplication to find opposite multiples of a coefficient so we can *eliminate* a variable.

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| **Example:** Solve the following system using the elimination method. | |
| **Step 1:** Make sure both equations are in standard form. | Both equations are in standard form already, making it easier to use the elimination method. |
| **Step 2:** Compare the like terms in the equations. | * Notice that there are not like terms that have opposite coefficients. * The second equation has the variable *y* with a coefficient of 1. This makes it easier to work with because the corresponding *y* term in the first equation has a coefficient of 2. |
| **Step 3:** Use multiplication to change the second equation so that you have opposite coefficients for the *y* term. | To make the *y*-value in the second equation the opposite of the first, you need to multiply the second equation by 2.  \*Note that you must multiply both sides of the equation by 2. |
| **Step 4:** Rewrite the system. | Notice that the *y* terms are now opposites of each other and can be eliminated in the next step. |
| **Step 5:** Use addition to eliminate the *y*-value. |  |
| **Step 6:** Solve for *x*. |  |
| **Step 7:** Substitute the *x* value into one of the equations in the system to solve for *y*. |  |
| **Step 8:** State the answer. | The solution to the system is . |

* You will find systems that require multiplication on both equations to create an opposite.

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| * The coefficients of the *x*-value are 3 and 2. * The least common multiple of these coefficients is 6. * You will multiply the first equation by 2 so you get positive 6. * You will multiply the second equation by –3 so you get negative 6.      * The result is a system of equations where the x-values are opposite and can now be eliminated using addition. |

**Objective 3:** In this section, you will use the elimination method to solve systems of linear and quadratic equations.

*Mathematical Practice Standard: Make sense of problems and persevere in solving them.*

**Big Ideas:**

* [Recall](#Bookmark3) that a linear-quadratic system is made up of a linear equation and a quadratic equation.
* [Recall](#Bookmark6) the *elimination method*, which can also be used to solve linear-quadratic systems.
* Recall that a quadratic equation is in the form of .
* Recall that the slope-intercept form of a linear equation is in the form of .
* There is a different set of steps when using the *elimination method* for linear-quadratic systems, outlined in the example below.

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| **Example:** Use elimination to solve the following system: and . | |
| **Step 1:** Set up the system with the quadratic equation on top and the linear equation in slope-intercept form. |  |
| **Step 2:** Since the linear equation does not have an value, put in its place to help with the process. |  |
| **Step 3:** Subtract the linear equation from the quadratic equation.    *\*Remember that you must change the sign in front of each term in the linear equation as you would when subtracting integers. This does not mean you should change every term into a negative! Just simply switch each term to the opposite sign.* |  |
| **Step 4:** Factor the resulting quadratic equation. |  |
| **Step 5:** Solve for *x* by setting each expression equal to zero. |  |
| **Step 6:** Substitute both values of *x* into any of the original equations to determine the values of *y*. |  |
| **Step 7:** State the answer. | The solution to the system is (3,9) and (-2, -1).  The linear equation’s line will pass through the quadratic equation’s parabola at these two points on a graph. |

* Most of the time there will be two solutions when solving linear-quadratic systems.
* The factoring step in the *elimination method* will determine if there are one or two solutions, depending on how many zeros the quadratic has.

**Practice Questions and Answers**

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| --- | --- | --- |
|  | Question | Answer |
| P 1 | Use the table to answer the question.   |  |  | | --- | --- | | **System A** | **System B** | |  |  |   True or false: The systems in the table are equivalent. Enter 1 for true or 2 for false. | 1 |
| P 2 | Use the table to answer the question.   |  |  | | --- | --- | | **System A** | **System B** | |  |  |   True or false: The systems in the table are equivalent. Enter 1 for true or 2 for false. | 1 |
| P 3 | Solve the following system of equations using the elimination method.  (\_\_\_, \_\_\_) | 4; -2 |
| P 4 | Use the elimination method to determine whether the linear-quadratic system  has zero, one, or two solutions.  Enter 0 for zero solutions.  Enter 1 for one solution.  Enter 2 for two solutions.  This system has \_\_\_ solution(s). | 0 |
| P 5 | Use the elimination method to solve the linear-quadratic system .  The solutions are (−1,−5) and (\_\_\_). | (-2, -4) |

**Quick Check Questions and Answers**

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| --- | --- | --- |
|  | Question | Answer |
| Q 1 | *Use the table to answer the question.*   |  |  | | --- | --- | | **System A** | **System B** | |  | ? |   Which of the following shows the equation that creates a true equivalent system? |  |
| Q 2 | *Use the table to answer the question.*   |  |  | | --- | --- | | **System A** | **System B** | |  | ? |   Which of the following terms will make the systems equivalent? |  |
| Q 3 | Solve the following system of equations using the elimination method. | (-4, -2) |
| Q 4 | Use the elimination method to solve the linear-quadratic system . | (-3, 19) and (-4, 26) |
| Q 5 | Use the elimination method to solve the linear-quadratic system . | (2, -2) |

**Lesson 8 – Solution Sets of Simultaneous Inequalities**

**Key Words:**

* **inequality** – a statement of inequality between two quantities that are separated by a sign of inequality, such as < (is less than), > (is greater than), or ≠ (is not equal to)
* **linear inequality** – expression in which two linear expressions are compared using the inequality symbols (>, <, ≥, ≤, ≠)
* **strict inequality** – an inequality for which adding “or equal to” to “less than” or “greater than” signs can never give a true expression
* **system of inequalities** – a set of two or more inequalities with the same variables, where the inequalities define conditions to be considered simultaneously

**Formulas:**

* Slope-Intercept Form: , or,
  + “...” represents an inequality symbol

**Objective 1:** In this section, you will determine if given coordinate pairs are solutions to simultaneous inequalities.

*Mathematical Practice Standard: Make sense of problems and persevere in solving them.*

**Big Ideas**:

* A *system of inequalities* consists of a set of two or more *inequalities* with the same variables.
  + For example:
  + 
* Recall that an inequality contains an infinity of ordered pairs or solutions, defined by a shaded region in the coordinate plane.
* When two inequalities are taken together (a system of inequalities), the intersection of their solution sets will define the set of ordered pairs that make up their solutions.
  + [Recall](#Bookmark7) that all the points that lie within the shaded region of a graph are solutions to an inequality.
* [Recall](#Bookmark9) how to graph linear inequalities.
* Let’s observe the graphs of the following system to better understand the solution to a *system of inequalities*.

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| --- | --- |
|  | |
| The graph and solution region of .  This is a *strict inequality* because only the points within the shaded region are solutions to the inequality (noted by the dashed line). | The graph and solution region of .  This is *not a strict inequality* because it includes all points within the shaded region AND on the line (noted by the solid line). |
| When you graph the two linear inequalities on the same coordinate plane, the graph looks like this:     * The green shaded area represents where the graphs overlap. * **All points that fall within the overlapping greed shaded area, and the solid boundary line bordering that area, are solutions to the system of inequalities.** | |

* Given an ordered pair , you can use graphs and the substitution method to identify if they are solutions to a system of inequalities.

|  |
| --- |
| **Example:** Using the graph, determine whether the ordered pairs (1,3), (0,0), (-4,1), and (1,-3) are solutions to the system of inequalities.     * (0,0) is a solution because it falls within the overlapping green shaded region. * (1,4) is a solution because it falls on the solid boundary line next to the overlapped shaded region. * (-4,1) falls outside of the overlapping green shaded region so it is not a solution. * (1, -3) falls on a strict inequality, dashed line so it is not a solution. |
| **Verify Using Substitution** |
| Recall that you can also use the substitution method to verify that an ordered pair is a solution to a system.  For example, let’s verify that (0,0) is a solution to the system of inequalities from above by substituting the *x* and *y* values of the ordered pair into each inequality.    Both statements are true, which verifies that (0,0) is a solution to the system. |

**Objective 2:** In this section, you will show that the solution set of simultaneous two-variable linear inequalities is the intersection of the half-planes containing the solutions to each inequality and possibly one or both sections of the lines themselves.

*Mathematical Practice Standard: Make sense of problems and persevere in solving them.*

**Big Ideas:**

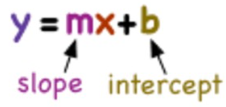
* [Recall](#Bookmark8) that the solution to a *system of inequalities* is defined by the overlapping shaded regions of their solution sets when graphed.
  + All points within the overlapping area on a graph must satisfy both equations in a *system of inequalities*, in other words, this region shows their shared solutions.
* [Recall](#Bookmark9) how to graph linear inequalities.
* Recall that dashed inequality lines are *strict inequalities*. Ordered pairs on a dashed line are not solutions to the *inequality*.

|  |
| --- |
| **Example:** If the graph of the inequality were also added to this graph, which of the listed point(s) would be solutions to the system?  Let’s use [GeoGebra to represent this problem](https://www.geogebra.org/calculator/kcteghaw). |

**Objective 3:** In this section, you will describe simultaneous inequalities that have zero solutions.

*Mathematical Practice Standard: Make sense of problems and persevere in solving them.*

**Big Ideas:**

* Sometime, *systems of inequalities* have no overlap or no pairs that make the inequalities true statements.
* [Recall](#Bookmark9) how to graph linear inequalities.
* A *system of linear inequalities* with zero solutions, when graphed, will have the following features:
  + The two boundary lines are parallel.
  + The shaded portions are shaded away from each other, and the solution sets do not intersect.
  + This results in the solution set of the system being an **empty set**.
* You can also determine if a *system of inequalities* has zero solutions by examining the inequalities themselves.
* [Recall](#Bookmark10) that when a system of equations has zero solutions, the slope is the same, but the intercept is different. The same concept applies to *systems of inequalities*.
  + 

|  |
| --- |
| **Example:** Consider the example below.     * Both inequalities share a slope of . * The intercepts for each are different, 2 and 1. * This means that the system will have no solutions, or the system is an empty set. * This can be observed by graphing the inequalities. |

* Sometimes, inequalities are not in slope-intercept form and must be rearranged by solving for *y*.
  + Recall that solving an inequality for a given variable is almost the same as solving an equation.
  + Use inverse operations and properties of equality to isolate the desired variable, *y*.
  + An important rule to remember for solving inequalities is that when you multiply or divide by a negative number, you must flip the inequality symbol.
* You will also come across systems that have more than two inequalities.
  + The solution to these systems work the same, but you are looking for the area where ALL equations have an overlapping region.
  + If you graph all the inequalities, and there is no place where all regions overlap, there is no solution.

|  |  |
| --- | --- |
| **Example:** Describe the solution set of the following system of inequalities. | |
| **Step 1:** Graph the inequalities. |  |
| **Step 2:** Examine the graph for overlapping regions. | * The graph shows areas of intersection for some of the inequalities in the system. * There is no area where all three inequalities have a common overlap. |
| **Step 3:** State the answer. | No ordered pair satisfies all three inequalities and therefore there is no solution. |

**Practice Questions and Answers**

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| --- | --- | --- |
|  | Question | Answer |
| P 1 | Use the image to answer the question.  Is the point shown on the graph a solution for the simultaneous inequalities  and ? Enter 1 for yes or 2 for no. | 2 |
| P 2 | Use the image to answer the question.  Which of the points shown on the graph is a solution to the simultaneous inequalities  and ? Write the x-value first and the y-value second.  (\_\_\_, \_\_\_\_) | -1; 2 |
| P 3 | Use the image to answer the question.  Which of the points on the graph is a solution to the simultaneous inequalities  and ? Enter the x-value followed by the y-value.  (\_\_\_, \_\_\_\_) | -10; -1 |
| P 4 | Use the image to answer the question.  Which of the descriptions is true about the graph of the system of inequalities?  Option #1: no solutions  Option #2: one solution  Option #3: infinite solutions | 1 |
| P 5 | Determine which option is a system of inequalities that has no solutions.   |  |  |  | | --- | --- | --- | | **Option #1** | **Option #2** | **Option #3** | |  |  |  | |  |  |  |   The system of inequalities in Option #\_\_\_ has no solutions. | 2 |

**Quick Check Questions and Answers**

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| --- | --- | --- |
|  | Question | Answer |
| Q 1 | Determine if the point (3,8) is a solution to the simultaneous inequalities y>x+5 and y≤6x−3. Select the response that gives the correct answer as well as the correct reasoning. | No, it is in the solution set for y≤6x−3, but on the line for y>x+5 |
| Q 2 | Use the image to answer the question.  Which point is a solution to the simultaneous inequalities  and? | (25, 12) |
| Q 3 | Which of the following points shows a solution to the simultaneous inequalities  and ? | (-5, 5) |
| Q 4 | Use the image to answer the question.  Select a true statement to describe the graphed system of inequalities. | The system has no solutions. |
| Q 5 | Determine which of the graphs is the graph of a system of inequalities with no solutions. | Two dashed lines and four points are graphed on a coordinate plane. The x-axis ranges from negative 6 to 30 in increments of 2. The y-axis ranges from negative 5 to 15 in increments of 1. |