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| **Unit** | A1 |
| **Title** | Linear Equations, Inequalities and Systems |
| **Target Standards** | A.REI.1, A.REI.3, A.REI.5, A.REI.6, A.REI.12, A.CED.1, A.CED.2, A.CED.3 |
| **Mathematical Goals** | Students will…* explain each step in solving a simple equation A.REI.1
* write and graph linear equations and inequalities, and discuss their meaning in a real-world context A.CED.2
* solve linear equations in one variable, including equations with coefficients represented by letters A.REI.3
* create and solve linear inequalities in one variable A.CED.1
* represent constraints by systems of equations and inequalities and interpret solutions as viable or nonviable A.CED.3
* solve linear systems of equations by substitution A.REI.6
* solve linear systems of equations by graphing both exactly and approximately A.REI. 6
* 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
* graph solutions to a linear inequality in two variables as a half-plane A.REI.12
* graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes A.REI.12
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| ***The story before this unit (including prior******knowledge)*** | Students began learning about proportional relationships in Grade 7, when they were introduced to basic relationships of the form y = kx, where k represented the constant of proportionality. In Grade 8 they formalized their understanding of linear equations written in the form **y = mx + b**, where m represented the slope of the line and b represented the y-intercept, or the value of y when x = 0.By this point in their mathematical trajectory, then, students should be fairly comfortable with linear equations. They should be able to write, evaluate, and solve them, and describe real-world situations that exhibit linearity. Just as importantly, students should be able to describe the fundamental characteristic of linear relationships, namely constant rate of change: *for each additional x, y increases/decreases by a constant amount*. For each additional gallon of gas that you buy, the total price increases by the same amount. For each additional hour that you exercise, the number of calories remaining from your Thanksgiving dinner decreases by the same amount.Additionally, in 8th grade, students analyzed and solved pairs of simultaneous linear equations [8.EE.C.8]. Students should:* know that the solutions to a system of two linear equations in two variables correspond to points of intersections of their graphs, because points of intersection satisfy both equations simultaneously [8.EE.C.8.A]
* know how to solve two linear equations in two variables algebraically [8.EE.C.8.B]
* be able to estimate solutions by graphing the equations [8.EE.C.8.B]
* know how to solve real-world and mathematical problems leading to two linear equations in two variables [8.EE.C.8.C]
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| ***The part of the story happening in this unit*** | In this unit, students will review much of what they [should] already know about linear relationships, and expand their understanding of linear equations to include linear inequalities as well. The major goals of the unit are to increase students’ familiarity of and facility with linear equations -- writing, graphing, and solving -- and to add to this an understanding of linear inequalities. Students will use various strategies to solve systems of simultaneous linear equations, and identify the solution as a discrete (x,y) point on the coordinate plane. For linear inequalities, they will identify the solution as the *set* of points that collectively constitute the shaded region above/below a line. For *systems* of linear inequalities, they will recognize the solution as the *intersection* of two shaded regions. |
| ***The story after this unit*** | Students will later encounter relations that are not linear, like exponential functions that increase by a constant ratio, and quadratic functions whose *change* has a constant rate of change. They will come to view linear functions as an example of one of many function families that display predictable characteristics. The algebraic substitution technique, learned to find values where two linear equations are simultaneously true, will prove useful for as long as they are learning mathematics, and even for as long as they have a need to reason quantitatively. For students who study calculus, linear functions will play a starring role in their work with derivatives and differentiation- the derivative of a function is the slope of the tangent line to the graph of the function at a point. |

**UNIT FLOW SUMMARY**

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| **UNIT A1** (17 - 22 days) | **Linear Equations, Inequalities and Systems** |
| **Section 0** (1 day) | **Diagnostic Pre-Unit Assessment** |
| **Section 1** (1 day) | Overview of linear equations and inequalities |
| **Section 2** (2 days) | Solve linear equations and inequalities |
| **Section 3** (2 -3 days) | Solve basic linear systems of equations  |
| **Section 4** (.5 - 1 day) | **Mid-Unit Assessment** |
| **Section 4** (5 - 7 days) | Solve linear systems of equations in two variables |
| **Section 5** (4 - 6 days) | Graphing Inequalities and Systems of Inequalities |
| **Section 6** (1 day) | **Summative Assessment** |

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| **Section 0:** 1 day | **Diagnostic Pre-assessment** |
| **Mathematical Goal** | Determine students’ skill in working with equations and inequalities that will be important moving forward in learning about equations and inequalities with non-numerical coefficients and systems of linear equations and inequalities. |
| **Narrative overview of section**(and how the standards are achieved) | Assess students’ ability to* solve basic linear equations 8.EE.7.b
* solve word problems leading to inequalities 7.EE.4.b
* graph lines in the form y=mx+b 8.F.3
* read, understand and attempt a basic systems of equations problem 8.EE.8
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| **Sample Target Items** | [*Diagnostic Pre-assessment*](https://docs.google.com/document/d/1vNuTmIPjgpdQ-sGWzgzxjOPQuMxeK7IEsN1S3mANo5Q/edit?usp=sharing) |

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| **Section 1:** 1 day | Overview of linear equations and inequalities (Hook Lesson) |
| **Mathematical Goal** | Students will:* write and graph linear equations and inequalities, and discuss their meaning in a real-world context A.CED.1, A.CED.3, A.REI.3.
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| **Narrative overview of section**(and how the standards are achieved) | Over the course of this unit, students will be responsible for a wide range of mathematical skills, from writing linear equations and inequalities to solving simultaneous linear systems. By the end of the unit, students will have a variety of tools at their disposal to explore these linear relationships, and will develop a deep and mathematically abstract understanding of them. In order to do that, though, it is useful to begin with a concrete situation. This will allow students to explore the mathematics of the unit in a way that makes sense to them, i.e. a context that allows students multiple ways to approach and solve a given problem, and thereby develop the conceptual understanding that will serve as the platform for further abstraction later in the unit. |
| **Sample Activity 1.1** | [*Datelines*](http://mathalicious.com/lessons/datelines), Mathalicious**WHAT:** In this introductory activity, students construct linear equations and inequalities to explore the mathematics of dating A.CED.1. Using the old rule-of-thumb “half plus seven,” students determine the age of the youngest person someone can date, and use this to identify the range of permissible ages A.CED.3. They then invert the rule, and come up with an equation to represent the age of the oldest person someone can date and, like before, amend this to include the inequality region. When they put these two inequalities together, they find that the shaded intersection represents the total acceptable dating region, or the “Romance Cone” A.REI.12. Students use this to determine whether famous celebrity couples such as Tom Cruise and Katie Holmes were within the “RoCo” on their wedding date and, if not, use strategies to determine how long they would have to wait until they were A.REI.3. This lesson is intended to be the hook of this unit; at this point when students see this problem, although students will solve the problems posed in the lesson, it is unlikely that they will all be viewing this as “solving a system of linear inequalities”. The problem can be referenced at the end of the unit when students have gained the full set of skills to solve systems of linear inequalities.**WHY:** This lesson has several qualities that make it a good “hook” lesson:1. The context is generally engaging
2. The problem is easy to understand, but the answers are not immediately obvious, providing students an opportunity to reason abstractly and quantitatively MP.2
3. Students can *begin* work at a basic level (the “half plus seven rule” is fairly basic arithmetic) but will need to eventually understand graphs of systems of linear inequalities to model and analyze the full situation. This is intended to *motivate* the work of the unit MP.4
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| **Target Standards** | A.CED.1 Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.A.CED.3 Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.A.REI.3 Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.A.REI.12 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. |
| **Mathematical Practices** | MP.2, MP.4 |

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| **Section 2:** 2 days | Solve linear equations and inequalities |
| **Mathematical Goals** | Students will...* Solve linear equations in one variable, including equations with coefficients represented by letters A.REI.3
* Solve linear inequalities in one variable A.REI.3
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| **Narrative overview of section**(and how the standards are achieved) | In this unit, students are working towards creating, understanding and solving systems of equations and inequalities. In order to do so, students must have a strong foundation in working with equations and inequalities. This section gives students opportunities to practice their skills with reasoning, manipulating and solving equations and inequalities through various examples. |
| **Sample Activity 2.1** | [*How Does the Solution Change*](http://www.illustrativemathematics.org/illustrations/614), Illustrative Mathematics**WHAT:** Students are given four equations with the variable *x* and the constant *a*. Assuming *a* is positive, students are asked to explain, for each equation, what would happen to the solution if *a* were increased. **WHY:** In middle school, students worked to solve one variable equations. By having students reason about the equations without explicitly solving them, this problem expands the students understanding of what an equation is and how changing different components of an equation affects the other parts of the equation along with the solution to the equation A.REI.1. This also allows them an opportunity to reason abstractly and quantitatively MP.2.  |
| **Sample Activity 2.2** | [*Same Solutions*](http://www.illustrativemathematics.org/illustrations/613), Illustrative Mathematics**WHAT:** Students are given six one-variable equations and are asked to find which equations have the same solution with the instruction to give reasons that are not dependent on solving the equations A.REI.1. **WHY:** It is easy for the meaning of equivalence to be lost when students are trained to immediately take steps to solve equations, in other words, find values that make them true. This task helps to bring awareness to the nature of equivalence statements, while actively discouraging immediately solving them. In order to verify their reasoning, though, students can practice their solving skills to check their reasoning MP.6. |
| **Sample Activity 2.3** | [Reasoning with Linear Inequalities](http://www.illustrativemathematics.org/illustrations/807), Illustrative Mathematics**WHAT:** In this task, a sample student solution is given to an inequality. There are, however, two mistakes in the solution and students must find the mistakes and explain why they are mathematically incorrect MP.8. Lastly, students must correctly solve the initial inequality A.REI.3.**WHY:** As described in the task commentary, the purpose of this tasks is to focus students on seeing the process of solving an equation or inequality as a special kind of proof A.REI.1. This task provides an opportunity for students to understand why multiplying both sides of an inequality by a negative number changes the direction of the inequality. The errors presented in this activity are logical missteps in the deduction, not just a failure to follow rules.  |
| **Target Standards** | A. REI.1 Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.A.REI.3 Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. |
| **Mathematical Practices** | MP.2, MP.6, MP.8 |

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| **Section 3:** 2 - 3 days | **Solve basic linear systems of equations**  |
| **Mathematical Goals** | Students will...* Solve linear systems of equations by graphing both approximately and exactly A.REI.6
* Solve basic linear systems of equations algebraically A.REI.6
 |
| **Narrative overview of section**(and how the standards are achieved) | Students have seen systems of equations before in middle school. This section will help students to recall what they saw in middle school with an emphasis on setting up and solving basic linear systems of equations both graphically and algebraically. The equations used in this section have simple positive integer values that are quickly derived from the given scenarios. With this, the emphasis of this section is on truly understanding the idea of systems of equations and the meaning of a solution to a system. |
| **Sample Activity 3.1** | [Flick$](http://mathalicious.com/lessons/flick), Mathalicious**WHAT:** In this problem, students compare the cost difference of using different services to watch movies (Netflix, Apple TV and Redbox). Students initially only look at the cost per movie then build on from there adding in the cost for equipment, number of movies, etc. to create and model more realistic cost equations for each movie service MP.4. Students graph the different costs and initially estimate where the cost is the same and follow this up by calculating where exactly the cost is the same. The final stage of this task has students construct an argument based on their equations, graphs and real-world usage of movies about which service is best for them MP.3. The equations that students write and solve here are very simplistic (y=1.2x, y=5x, y=9) so the emphasis is on understanding the meaning of the equation in context, the graph and the points of intersection.**WHY:** This is a great problem to reintroduce systems of equations graphically A.CED.2. It leverages student’s familiarity with graphing, so the emphasis can be on relating the different situations to each other and what a “solution” to a system means MP.2. Additionally, this problem calls for first approximating and then calculating exactly where the solution is helping students draw connections between graphing and algebraic solutions.  |
| **Sample Activity 3.2** | [Estimating a Solution via Graphs](https://www.illustrativemathematics.org/illustrations/1833), Illustrative Mathematics**WHAT:**  In this activity, two linear equations are given along with a possible student answer. Students are initially asked to investigate the possible solution in terms of the slopes and y-intercept of the given linear equations. In the third part of the activity, students graph the two equations and are asked to explain their ideas about the solution to the system from the observations made in the graph. **WHY:** The purpose of this task is to examine, via graphing, whether or not a solution to a system of two equations is accurate or not A.REI.6. Significant calculations are required in order to algebraically solve this given system allowing students to make observations and focus on the graphical solution to this system. |
| **Sample Activity 3.3** | [*Optimization Problems: Boomerangs*](http://map.mathshell.org/materials/lessons.php?taskid=207&subpage=problem), MARS**WHAT:** In this task, students are given information about the time it takes and cost of creating both small and large boomerangs as well as constraints on how much time there is to construct the boomerangs. The goal of the task is for students to create a model MP.4 that outlines how many of each type of boomerang should be made to maximize profit MP.2 (in the context of this problem it is money to donate to charity). Additionally, there are four student work samples provided, each outlining a different method for solving (paragraph, table, graph, equation A.CED.2), that the teacher can use to model different methods for solving systems of equations A.REI.6. **WHY:** This task is very open-ended in nature and allows students an opportunity to make sense of the problem and begin solving it in the way that makes most sense to them initially (table, graph, equation) MP.1. Students demonstrate an understanding of the given data by first constructing a model and then a viable argument about how many of each type of boomerang should be made and why MP.3. |
| **Target Standards** | A.CED.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.A.REI.6 Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. |
| **Mathematical Practices** | MP.1, MP.2, MP.3, MP.4 |

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| **Section 4:** .5 - 1 day | **Diagnostic Mid-unit assessment**  |
| **Pre-Unit Assessment Targets** | Assess students’ ability to* solve basic single variable equations and inequalities [A.REI.3]
* explain the steps in solving a simple equation [A.REI.1]
* connect between the algebraic and graphic solutions of systems of equations [A.REI.6]
* set up and solve systems of equations word problems [A.CED.2]
* understand the meaning of a solution to a systems of equations problem [A.REI.6]
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| **Sample Assessment Items** | [**MID-ASSESSMENT**](https://docs.google.com/a/hightechhigh.org/file/d/0B784Ztw6k5CsaUNfTGtsUUtkR00/edit)  |

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| **Section 5:** 5-7 days | Solve linear systems of equations in two variables |
| **Mathematical Goals** | Students will...* Solve linear systems of equations by substitution A.REI.6
* Solve linear systems of equations by graphing both exactly and approximately A.REI.6
* 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
 |
| **Narrative overview of section**(and how the standards are achieved) | Students were introduced to the basic methods of solving systems of equations both graphically and algebraically in middle school and in section 3 of this unit, they revisited these ideas. The systems that students saw in the previous section were of an elementary form (y=5x and y=1.20x); in this section, they will see more complicated systems (x+y=50 and 3.11*x*+2.50*y*=138.42). Additionally, in this section, students will see more complex ways to manipulate equations in order to solve more difficult systems. |
| **Sample Activity 5.1** | [*Cash Box*](http://www.illustrativemathematics.org/illustrations/462), Illustrative Mathematics**WHAT:** In this task, students are given information about the cost of dance tickets ($5 for individuals and $8 for a couple), how much money is in the cash box at the door of the dance and how many folks are in attendance. A $1 bill is found on the ground and students must decide if the $1 should be in the cash box or not. This problem has students build the systems A.REI.6 and solve them within the specific constraints of the problem (must be non-negative solutions and the number of couples tickets must be even) A.CED.3.**WHY:** This problem is very concrete and has multiple entry points; while it can be solved using systems of equations, students can also create a table or use quantitative reasoning MP.2 based on the given assumptions to get to a solution. It is recommended that if students solve this problem without using systems, the teacher use these models to discuss the problem and then lead them through the steps of solving it using systems to ensure that all students see this process.This problem serves as a great transition from the more basic systems seen in section 3 of this unit to the more complex problems students will see later on in this section for two reasons:1. The equations are more complex (s + c = 47, 5s + 4c = 200)2. Students must fully understand the meaning of a solution to a system of equations - students must know that when they get a solution, couples tickets can only be sold in pairs so an odd-valued solution for couples tickets is incorrect because of the restrictions given in the problem MP.4.  |
| **Sample Activity 5.2** | [*Accurately Weighing Pennies I*](http://www.illustrativemathematics.org/illustrations/761)*,* Illustrative Mathematics**WHAT:** In 1982 the weight of the penny changed from 3.11 grams to 2.50 grams. The first part of this problem revolves around the premise of the changing penny weight; giving students 50 pennies with a weight of 138.42 grams and having them solve for how many old and new pennies there are in the 50 A.REI.6. The second and third parts of this problem limit what the scale can read so that it now only tells you either grams or tenth of grams, not hundredths. Given certain measurements from the limited scale readings, students must now figure out how many pennies could be in the given rolls. **WHY:** While this problem can also be solved by trial and error, the type of numbers given would make “guess and check” very tedious and time-consuming. This motivates writing and solving a system of equations as a much more expeditious method MP 7. Once two equations are written, students can make choices about their solution method (substitution vs. elimination vs. graphing) MP 8, and compare and draw connections between different solution methods. Through this process, they can also discover how they best like to work with systems of equations to arrive at a solution. |
| **Sample Activity 5.3** | [Quinoa Pasta 2](http://www.illustrativemathematics.org/illustrations/935), Illustrative Mathematics**WHAT:** In this problem, students must read and make sense of nutrition labels in order to figure out much quinoa and how much corn there is in a certain type of pasta MP.1. The only information given in this problem are nutrition labels about quinoa and the suggestion to “use the protein content of each ingredient to find out how much quinoa and how much corn is in one serving of the pasta.”This problem builds off of the [Quinoa Pasta 1](http://www.illustrativemathematics.org/illustrations/934) problem (seen in middle school) where all relevant information is given. If students struggle with reading nutrition labels, it is suggested that students complete the Quinoa Pasta 1 problem before the Quinoa Pasta 2 problem as this will help to guide them in understanding what to look for on the nutrition labels. The math for both problems is the same but they have to figure out the equations in Quinoa Pasta 2.**WHY:** This problem does not explicitly give students the information needed to come to a solution, rather, students must use mathematical reasoning and modeling MP 4 to pull relevant information from the given nutrition labels. Because of the difficulty in reading, understanding and pulling information from the nutrition labels in order to create the equations needed to solve this problem, it is best completed after the students have had some experience with systems. The math to solve this system is a simple substitution problem, the difficulty lies completely in reading and setting up the two equations in the system A.REI.6. |
| **Sample Activity 5.4** | [Solving Two Equations in Two Unknowns](https://www.illustrativemathematics.org/illustrations/1903), Illustrative Mathematics **WHAT:** In this problem students analyze the elimination method used to solve a system of two equations with two unknowns. Students also look at the results of solving the same system through different steps noticing that the solution doesn’t change.**WHY:** This task provides a concrete context for students to experiment with the elimination method when one of the equations is multiplied by a factor and then subtracted to solve a system of two equations with two unknowns A.REI.5.  |
| **Sample Activity 5.5** | [Accurately Weighing Pennies II](http://www.illustrativemathematics.org/illustrations/763), Illustrative Mathematics**WHAT:** In this problem, students are given the weights of three different pennies; those made from between 1859 & 1864, those made between 1865 & 1982 and those made between 1983 & present-day. Similar to the [*Accurately Weighing Pennies I*](http://www.illustrativemathematics.org/illustrations/761) above, in the first part of the problem, students are given a roll of 50 pennies with a weight of 145 grams and must figure out how many of each type of penny is in the roll A.REI.6. The second and third parts look at the possibilities of two rolls having the same weight with a different make-up of pennies.**WHY:** This problem is last in this section as the systems of equations here have three variables yet there are still only two equations given; an underdetermined system. Students must use numerical reasoning and informed guess-and-check in order to solve this problem MP 1. Additionally, using the given information and restrictions of the problem (non-negative integers) some reasonable inequalities can be created to help in the guess-and-check process A.CED.3. As stated in the task commentary “This task is intended for instructional use only. The awkward numbers and level of difficulty make it unsuitable for assessment purposes.” |
| **Target Standards** | A.REI.5 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.6 Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.A.CED. 3 Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods. |
| **Mathematical Practices** | MP.1, MP.2, MP.4, MP.7, MP.8 |

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| **Section 6:** 4 - 6 days | Graphing Inequalities and Systems of Inequalities |
| **Mathematical Goals** | Students will...* Graph solutions to a linear inequality in two variables as a half-plane A.REI.12
* Graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes A.REI.12
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| **Narrative overview of section**(and how the standards are achieved) | In middle school, students graphed linear inequalities in one variable. Students have now worked with systems of equations both graphically and algebraically. This section ties all of the above together; students now graph linear inequalities in two variables and then move to graphing linear systems of inequalities. |
| **Sample Activity 6.1** | [Graphic Exploration of Linear Systems of Inequalities](https://docs.google.com/a/hightechhigh.org/file/d/0B784Ztw6k5CsTU1sTHVkQWZBbm8/edit), High Tech High**WHAT:** In this exploration, students use Desmos to construct different linear inequality relationships. This activity gives students certain constraints about a system and they must find another inequality/inequalities to fit the given conditions A.CED.3.**WHY:** This is a good activity to begin section 5 of this unit as the focus is on understanding the different possible graphic solutions to systems of linear inequalities A.REI.12. In pairs, students can discuss and experiment with the different conditions. Additionally, adding the graphing program here allows students to visually see the mathematics of this section MP 5. |
| **Sample Activity 6.2** | [Fishing Adventures 3](http://www.illustrativemathematics.org/illustrations/644), Illustrative Mathematics**WHAT:** In this problem, students are given a situation about a tourist fishing boat. There are constraints given with regards to the maximum number of people that can be aboard and the maximum allowable weight of the boat. Students must take this given information to create two linear inequalities. First, students graph the solution set given these two inequalities A.REI.12. Secondly, students are given information about three different groups that wish to rent the boat and they must decide which, if any, of the groups can safely rent the boat A.CED.3. **WHY:** This problem ties together most of the big ideas from this unit; students must create inequalities to represent the given situation, solve a systems of inequalities to arrive at a solution set and must make sense of non-realistic solutions (cannot have negative or non-whole number people on the boat). Students can use modeling MP.4 to initially make sense of some possible solutions but ultimately must graph the two inequalities to find the entire solution set. The second part of the problem requires some basic math skills to determine whether certain groups can rent the boat or not. While not explicitly asked in the question, students can check their work from part b with the graph created in part a to connect the meaning of an algebraic solution with their graphic solution. |
| **Sample Activity 6.3** | [Defining Regions Using Inequalities](http://map.mathshell.org/materials/lessons.php?taskid=219&subpage=concept), MARS**WHAT:**  In the initial part of this activity, students are told that there is buried treasure somewhere on a map. Their quest is to figure out at what coordinate the treasure lies. Several linear inequalities are given and as students graph the various inequalities, they find the unshaded region where the treasure is A.REI.12. The second part of this activity is that students play the game *Give Us The Clue!* where they set the location of a treasure and their partner has to find its location based on the student generated clues.**WHY:**  There are both individual and partner components to this activity. The unique part of this problem/game is that students are looking for the only bounded unshaded region created by the linear inequalities. For the second portion of this activity, students are creating their own unique treasure locations and must be able to describe this to their partner. The partners must be able to comprehend, graph and understanding their work in order to be able to solve where the treasure is hidden. In creating and solving the *Give Us The Clue!* game, students must make sense of the problem and persevere in solving them MP.1. |
| **Sample Activity 6.4** | [Solution Sets](http://www.illustrativemathematics.org/illustrations/1205), Illustrative Mathematics**WHAT:** In this problem, students are given a graph that shows two lines along with four shaded regions and two marked coordinates. In the first part, students must write a system of equations or inequalities to represent each of the four shaded regions and the two labeled points. The second part has students verify that one of the coordinates in each shaded region is in fact a solution to that system of inequalities A.REI.12. Lastly, students build on what they did in part two by explaining why all the points in a specific quadrant must satisfy a specific system of inequalities.**WHY:** This task presents the typical system of inequality problem in a less conventional manner by presenting the solution set graphically and asks students to identify the corresponding system. This task gives students a chance to go beyond the basic solving of a systems of inequalities by having them make connections between points in the coordinate plane and solutions to inequalities and equations. Students must truly understand and focus on what the graph is showing. Additionally, the last part of the problem requires the student to make a general argument without using specific numbers MP.4 and instead must recognize the structure of the inequalities MP.7. As stated in the task commentary “The task could be used in many instructional settings, but having students share their thinking and respond to each others' arguments would provide a rich learning experience.” MP.3 |
| **Target Standards** | A.REI.12 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.CED.3 Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non- viable options in a modeling context. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods. |
| **Mathematical Practices** | MP.1, MP.3, MP.4, MP.5, MP.7 |

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| **Section 7:** 1 day | **Summative Assessment** |
| **Mathematical Goal** | Assess students’ ability to* Compare the values of variable expressions using <, >, and =. A-REI.3
* write linear equations with given constraints and a common intersection point, A-REI.6
* create a graph, in a real-world context, with two equations and describe/understand the meaning of the lines in relation to each other A-CED.2, A-REI.6
* given inequalities, graph a system and make meaningful conclusions about the graph A-REI.12
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| **Sample Activity** | [*Summative Assessment*](https://docs.google.com/document/d/1hANe-bSInsERsHDRnikbSVMLCQFnSDf15UlIZ27qz1k/edit?usp=sharing) |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 1.1 | 2.1 | 2.2 | 2.3 | 3.1 | 3.2 | 3.3 | 5.1 | 5.2 | 5.3 | 5.4 | 5.5 | 6.1 | 6.2 | 6.3 | 6.4 |
| A.REI.1 |  | **X** | **X** | **X** |  |  |  |  |  |  |  |  |  |  |  |  |
| A.REI.3 | **X** |  |  | **X** |  |  |  |  |  |  |  |  |  |  |  |  |
| A.REI.5 |  |  |  |  |  |  |  |  |  |  | **X** |  |  |  |  |  |
| A.REI.6 |  |  |  |  |  | **X** | **X** | **X** | **X** | **X** |  | **X** |  |  |  |  |
| A.REI.12 | **X** |  |  |  |  |  |  |  |  |  |  |  | **X** | **X** | **X** | **X** |
| A.CED.1 | **X** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| A.CED.2 |  |  |  |  | **X** |  | **X** |  |  |  |  |  |  |  |  |  |
| A.CED.3 | **X** |  |  |  |  |  |  | **X** |  |  |  | **X** | **X** | **X** |  |  |

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|  | 1.1 | 2.1 | 2.2 | 2.3 | 3.1 | 3.2 | 3.3 | 5.1 | 5.2 | 5.3 | 5.4 | 5.5 | 6.1 | 6.2 | 6.3 | 6.4 |
| MP.1 |  |  |  |  |  |  | **X** |  |  | **X** |  | **X** |  |  | **X** |  |
| MP.2 | **X** | **X** |  |  | **X** |  | **X** | **X** |  |  |  |  |  |  |  |  |
| MP.3 |  |  |  |  | **X** |  | **X** |  |  |  |  |  |  |  |  | **X** |
| MP.4 | **X** |  |  |  | **X** |  | **X** | **X** |  | **X** |  |  |  | **X** |  | **X** |
| MP.5 |  |  |  |  |  |  |  |  |  |  |  |  | **X** |  |  |  |
| MP.6 |  |  | **X** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| MP.7 |  |  |  |  |  |  |  |  | **X** |  |  |  |  |  |  | **X** |
| MP.8 |  |  |  | **X** |  |  |  |  | **X** |  |  |  |  |  |  |  |