# Orange Public Schools

Office of Curriculum & Instruction

2020-2021 Mathematics Curriculum Guide

# Advanced Topics in Algebra I

Unit 2 : Systems of Linear Equations & Inequalities

***November 14, 2020 – January 30, 2021***

Board Approved: 1.14.2020

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|---|---|---|---|---|
| Marking Period | MP 1 (9/9/20 – 11/13/20) | MP 2 (11/14/20- 1/30/21) | MP 3 (1/31/21-4/9/21) | MP 4 (4/10/21-6/22/21) |
| Unit Topic | Linear Equations and Inequalities | Systems of Linear Equations/Inequalities & Functions | Quadratic Functions & Equations | Solve Quadratic Equations |
| Description | Create linear equations & inequalities to model situations given and solve related problems | Create systems of equations/inequalities to model real-life situations and solve problems; Identify types of functions with tables and graphs | Identify quadratic functions; find key features for the graphs. Solve quadratic equations by using tables, and graphing and solving algebraically | Interpret, write, and solve quadratic equations |

# Unit Overview

## Unit 2: Linear Functions, Systems, and Inequalities

*Essential Questions*

- How can we use different tools and representations to solve problems?
- How can the same linear relationship be represented in multiple ways?
- When do we use systems of equations and inequalities to model real world problems?
- What are the different types of solutions that a system of equations can have?
- What is the best way to represent solutions to systems of inequalities?

*Enduring Understandings*

- Units can be used to describe and explain steps and solutions of problems that model a real world scenario.
- A linear function and a system of linear functions can be represented in multiple ways and can be used to model and solve problems in a real world context.
- A linear inequality and a system of linear equalities can be used to model and solve problems in a real world context.
- Solutions to inequalities and systems of inequalities are best represented graphically.

**Interdisciplinary Connection:**

*Presentation of Knowledge and Ideas:*

**ELA.LITERACY.SL.9-10.4:** Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line o reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

**HSN.Q.A.1:** Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS>PS1-7)

**Technology**

**8.1: Educational Technology**: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.

*NJSLS*

1) 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.
2) A.REI.6: Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.
3) A.REI.10: Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).
4) A.REI.11: Explain why the $x$-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.
5) 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.
6) 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*.
7) A.CED.2: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

8) A.CED.3: Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods*.
9) A.CED.4: Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law V = IR to highlight resistance R*.
10) N.Q.1: Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
11) N.Q.2: Define appropriate quantities for the purpose of descriptive modeling.
12) F.IF.2: Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.
13) F.IF.4: For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity*.
14) F.IF.5: Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.*[*]
15) F.IF.7a: Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.* Graph linear and quadratic functions and show intercepts, maxima, and minima.
16) F.BF.1a: Write a function that describes a relationship between two quantities. Determine an explicit expression, a recursive process, or steps for calculation from a context.
17) F.LE.5: Interpret the parameters in a linear or exponential function in terms of a context.
18) A.SSE.1: Interpret expressions that represent a quantity in terms of its context.
19) S.ID.6a: Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models.
20) S.ID.6b: Fit a linear function for a scatter plot that suggests a linear association.
21) S.ID.7: Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.
22) S.ID.8: Compute (using technology) and interpret the correlation coefficient of a linear fit.

M : Major Content S: Supporting Content A : Additional Content

## Student Learning Material

**Illustrative math Algebra I** https://curriculum.illustrativemathematics.org/HS/teachers/index.html
These materials were created by Illustrative Mathematics. They were piloted and revised in the 2018–2019 school year.

Units contain between 10 and 25 lesson plans. Each unit has a diagnostic assessment for the beginning of the unit (Check Your Readiness) and an end-of-unit assessment. Longer units also have a mid-unit assessment. In addition to lesson and assessments, modeling prompts are provided to be used throughout the year.

The time estimates in these materials refer to instructional time. Each lesson plan is designed to fit within a class period that is at least 45 minutes long. Some lessons contain optional activities that provide additional scaffolding or practice for teachers to use at their discretion.

There are two ways students can interact with these materials. Students can work solely with printed workbooks or pdfs. Alternatively, if all students have access to an appropriate device, students can look at the task statements on that device and write their responses in a notebook or the print companion for the digital materials. It is recommended that if students are to access the materials this way, they keep the notebook carefully organized so that they can go back to their work later.

Teachers can access the teacher materials either in print or in a browser. A classroom with a digital projector is recommended.

Many activities are written in a card sort, matching, or info gap format that requires teachers to provide students with a set of cards or slips of paper that have been photocopied and cut up ahead of time. Teachers might stock up on two sizes of resealable plastic bags: sandwich size and gallon size. For a given activity, one set of cards can go in each small bag, and then the small bags for one class can be placed in a large bag. If these are labeled and stored in an organized manner, it can facilitate preparing ahead of time and re-using card sets between classes. Additionally, if possible, it is often helpful to print the slips for different parts of an activity on different color paper. This helps facilitate quickly sorting the cards between classes.

## Modifications

| Special Education/ 504: | English Language Learners: |
|---|---|
| -Adhere to all modifications and health concerns stated in each IEP.<br><br>-Give students a MENU options, allowing students to pick assignments from different levels based on difficulty.<br><br>-Accommodate Instructional Strategies: reading aloud text, graphic organizers, one-on-one instruction, class website (Google Classroom), handouts, definition list with visuals, extended time<br><br>-Allow students to demonstrate understanding of a problem by drawing the picture of the answer and then explaining the reasoning orally and/or writing , such as Read-Draw-Write<br><br>-Provide breaks between tasks, use positive reinforcement, use proximity<br><br>-Assure students have experiences that are on the Concrete- Pictorial- Abstract spectrum by using manipulatives<br><br>-Common Core Approach to Differentiate Instruction: Students with Disabilities (pg 17-18)<br><br>-Strategies for Students with 504 Plans | - Use manipulatives to promote conceptual understanding and enhance vocabulary usage<br><br>- Provide graphic representations, gestures, drawings, equations, realia, and pictures during all segments of instruction<br><br>- During ALEKS lessons, click on “Español” to hear specific words in Spanish<br><br>- Utilize graphic organizers which are concrete, pictorial ways of constructing knowledge and organizing information<br><br>- Use sentence frames and questioning strategies so that students will explain their thinking/ process of how to solve word problems<br><br>- Utilize program translations (if available) for L1/ L2 students<br><br>- Reword questions in simpler language<br><br>- Make use of the ELL Mathematical Language Routines (click here for additional information)<br><br>-Scaffolding instruction for ELL Learners<br><br>-Common Core Approach to Differentiate Instruction: Students with Disabilities (pg 16-17) |
| **Gifted and Talented:** | **Students at Risk for Failure:** |
| - Elevated contextual complexity<br><br>- Inquiry based or open ended assignments and projects<br><br>- More time to study concepts with greater depth<br><br>- Promote the synthesis of concepts and making real world connections<br><br>- Provide students with enrichment practice that are imbedded in the curriculum such as: | - Assure students have experiences that are on the Concrete- Pictorial- Abstract spectrum<br><br>- Modify Instructional Strategies, reading aloud text, graphic organizers, one-on-one instruction, class website (Google Classroom), inclusion of more visuals and manipulatives, Field Trips, Google Expeditions, Peer Support, one on one instruction<br><br>- Assure constant parental/ guardian contact throughout |

| | |
|---|---|
| ● Application / Conceptual Development<br>● Are you ready for more?<br>- Common Core Approach to Differentiate Instruction: Students with Disabilities (pg. 20)<br><br>- Provide opportunities for math competitions<br><br>- Alternative instruction pathways available<br><br>-Strategies for Students with 504 Plans | the year with successes/ challenges<br><br>- Provide academic contracts to students and guardians<br><br>- Create an interactive notebook with samples, key vocabulary words, student goals/ objectives.<br><br>- Always plan to address students at risk in your learning tasks, instructions, and directions. Try to anticipate where the needs will be and then address them prior to lessons.<br><br>-Common Core Approach to Differentiate Instruction: Students with Disabilities (pg 19) |

## 21st Century Life and Career Skills:

Career Ready Practices describe the career-ready skills that all educators in all content areas should seek to develop in their students. They are practices that have been linked to increase college, career, and life success. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

https://www.state.nj.us/education/cccs/2014/career/9.pdf

- **CRP1**. Act as a responsible and contributing citizen and employee.
- **CRP2**. Apply appropriate academic and technical skills.
- **CRP3**. Attend to personal health and financial well-being.
- **CRP4**. Communicate clearly and effectively and with reason.
- **CRP5**. Consider the environmental, social and economic impacts of decisions.
- **CRP6**. Demonstrate creativity and innovation.
- **CRP7**. Employ valid and reliable research strategies.
- **CRP8**. Utilize critical thinking to make sense of problems and persevere in solving them.
- **CRP9**. Model integrity, ethical leadership and effective management.
- **CRP10**. Plan education and career paths aligned to personal goals.
- **CRP11**. Use technology to enhance productivity.
- **CRP12**. Work productively in teams while using cultural global competence.

**Students are given an opportunity to communicate with peers effectively, clearly, and with the use of technical language. They are encouraged to reason through experiences that promote critical thinking and emphasize the importance of perseverance. Students are exposed to various mediums of technology, such as digital learning, calculators, and educational websites.**

## Technology Standards:

All students will be prepared to meet the challenge of a dynamic global society in which they participate, contribute, achieve, and flourish through universal access to people, information, and ideas.

https://www.state.nj.us/education/cccs/2014/tech/

### 8.1 Educational Technology:

All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.

A. **Technology Operations and Concepts:** Students demonstrate a sound understanding of technology concepts, systems and operations.
B. **Creativity and Innovation:** Students demonstrate creative thinking, construct knowledge and develop innovative products and process using technology.
C. **Communication and Collaboration:** Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others.
D. **Digital Citizenship:** Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior.
E. **Research and Information Fluency:** Students apply digital tools to gather, evaluate, and use of information.
F. **Critical thinking, problem solving, and decision making:** Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.

### 8.2 Technology Education, Engineering, Design, and Computational Thinking - Programming:

All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.

A. **The Nature of Technology: Creativity and Innovation-** Technology systems impact every aspect of the world in which we live.
B. **Technology and Society:** Knowledge and understanding of human, cultural, and societal values are fundamental when designing technological systems and products in the global society.
C. **Design:** The design process is a systematic approach to solving problems.
D. **Abilities in a Technological World:** The designed world in a product of a design process that provides the means to convert resources into products and systems.
E. **Computational Thinking: Programming-** Computational thinking builds and enhances problem solving, allowing students to move beyond using knowledge to creating knowledge.

| Interdisciplinary Connections: | |
|---|---|
| **English Language Arts:** | |
| NJSLS ELA.LITERACY.RI-9-10.4 | Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze the cumulative impact of specific word choices on meaning and tone (e.g., how the language of a court opinion differs from that of a newspaper). |
| NJSLS ELA-LITERACY.SL.9-10.4 | Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task. |
| NJSLS .ELA-LITERACY.W.9-10.2.A | Introduce a topic; organize complex ideas, concepts, and information to make important connections and distinctions; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension. |

# Pacing Guide

| Overview | | | |
|---|---|---|---|
| Lesson | Topic | NJSLS | Suggesting Pacing |
| 1 | Writing and Graphing Systems of Linear Equations | HAS-REI.A.1; HAS-REI.A.2 HAS-REI.A.3 | 3days |
| 2 | Solving Systems by Substitution | HAS-REI.D.10 | 3 days |
| 3 | Solving Systems by Elimination (Part I) | HAS-REI.C.5 | 2 days |
| 4 | Solving Systems by Elimination (Part 2) | HAS-REI.C.5 | 2 days |
| 5 | Solving Systems by Elimination (Part 3) | HAS-REI.C.5 | 2 days |
| 6 | Systems of Linear Equations and Their Solutions | HAS.REI.C.6 | 3 days |
| 7 | Graphing Linear Inequalities in Two Variables (Part 1) | HAS.REI.D.12 | 2 days |
| 8 | Graphing Linear inequalities in Two variables (Part 2) | HAS-CED.A.3; HAS-REI.D.10 | 2 days |
| 9 | Solving Problems with Inequalities in Two Variables | HAS.REI.D.12 | 2 days |
| 10 | Solutions to Systems of Linear Inequalities in Two Variables | HAS.REI.D.12 | 2 days |
| 11 | Solving Problems with Systems of Linear Inequalities in Two Variables | HAS.REI.D.12 | 3 days |
| 12 | Modeling with Systems of Inequalities in Two Variables | HAS.REI.D.12 | 3 days |

Summary:

29 days on new content (12 lessons/topics)
2 task days
1 review day
1 test day
2-4 flex day
2 NWEA days
1 Benchmark day

**38-40 days in Unit 2**

Spring NWEA window (3rd Assessment): April 19 – 30, 2021

MP 3 Benchmark window : March 29 – April 16, 2021

## Calendar

Please complete the pacing calendar based on the suggested pacing.

| November 2020 | | | | | | |
|---|---|---|---|---|---|---|
| Sun | Mon | Tue | Wed | Thu | Fri | Sat |
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| December 2020 | | | | | | |
|---|---|---|---|---|---|---|
| Sun | Mon | Tue | Wed | Thu | Fri | Sat |
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| January 2021 | | | | | | |
|---|---|---|---|---|---|---|
| Sun | Mon | Tue | Wed | Thu | Fri | Sat |
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## Assessment Framework

| Assessment | NJSLS | Estimated Time | Format | Graded |
|---|---|---|---|---|
| Unit Diagnostic Assessment | 8.EE.B.6, HAS-REI.A, HAS-REI.C.5 ; HAS-REI.C.6 HAS-REI.D.10 ; HAS-REI.D.12 HAS-CED.A.3 | 1 Period | Individual | No |
| *Check point 1 (Formative Assessment)* | HAS-REI.A; HAS-REI.C.5 HAS-REI.C.6; HAS-REI.D.10 | 1 Period | Individual | Yes |
| Check point 2 *(Formative Assessment)* | HAS-REI.D.12; HAS-CED.A.3 | 1 Period | Individual | Yes |
| Performance Task *(Authentic Assessment)* | Task 1: HAS-REI.A, HAS-REI.C.5 ; HAS-REI.C.6 HAS-REI.D.10 Task 2: HAS-REI.D.12; HAS-CED.A.3 | 1 Period | Individual, | Yes |
| Extended Constructed Responded (ECR) | A.CED.2; HAS-EI.D10 | 1 Period | Individual | Yes |
| Benchmark Assessment *(Summative Assessment)* | 8.EE.B.6, HAS-REI.A, HAS-REI.C.5 ; HAS-REI.C.6 HAS-REI.D.10 ; HAS-REI.D.12 HAS-CED.A.3 | 1 Block | Individual | Yes |
| Exit tickets *(Formative Assessment)* | Varies by lesson | 5-10 minutes (Daily) | Individual | Varies |

- Winter NWEA Map test (1-2 days): Test Window: 2nd Assessment: Jan. 4 – Jan. 15, 2021
- MP 2 Benchmark Assessment Window: Jan. 19 – Jan. 29, 2021
- MP 2 ends: January 29, 2021

| Lesson 1: Writing and Graphing Systems of Linear Equations | |
|---|---|
| Objectives | (Teacher Facing)<br>• Solve systems of linear equations by reasoning with tables and by graphing, and explain (orally and in writing) the solution method.<br>• Understand that the solution to a system of equations in two variables is a pair of values that simultaneously make both equations true, and that it is represented by the intersection point of the graphs of the equations.<br>• Understand that two (or more) equations that represent the constraints on the same quantities in the same situation form a system.<br>(Student Facing)<br>• I can explain what we mean by "the solution to a system of linear equations" and can explain how the solution is represented graphically.<br>• I can explain what we mean when we refer to two equations as a system of equations.<br>• I can use tables and graphs to solve systems of equations.<br>Focused Mathematical Practices<br>• MP 2:Reason abstractly and quantitatively.<br>• MP 4: Model with mathematics<br>Vocabulary<br>• System of Equations, Solution of System of Equations |
| Lesson narrative: | This is the first of a series of lessons in which students review what they learned about systems of equations in middle school and develop new techniques for solving them.<br><br>In this lesson, students recall that a system of equations in two variables is a set of equations that represent multiple constraints in the same situation, and that a solution to the system is any pair of values that satisfy all the constraints simultaneously. Students also revisit the idea that the solution, if there is one, can be represented graphically as the intersection of the graphs of the equations.<br><br>Students write a system of equations to represent the quantities and constraints in each of several situations, find a solution that meets multiple constraints by graphing, and then interpret the solution in context. In the process, they reason both abstractly and quantitatively (MP2). As they analyze relationships mathematically and reflect on the results, students also engage in aspects of modeling (MP4). |
| NJSLS: | HAS-CED.A.3: Represent constraints by equations or inequalities, and by systems of equations and/or inequalities and interpret solutions as viable or nonviable options in a modeling context.<br>HSA-REI.A.1<br>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.<br>HSA-REI.A.2<br>Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise. |
| Learning Material | Illustrative Math Algebra I Unit 2 Lesson 12<br>Student Learning Material<br>https://curriculum.illustrativemathematics.org/HS/students/1/2/12/index.html |

## Lesson Analysis

| Lesson 2: Solving Systems by Substitution | |
|---|---|
| Objectives | Teacher's Facing:<br>• Recognize that a system can be efficiently solved by substitution if one variable is already isolated or can be easily isolated.<br>• Recognize that there are multiple ways to perform substitution to solve a system of equations.<br>• Solve systems of linear equations by substituting a variable with a number or an expression, and check solutions by substituting them back into the equations.<br>Student Facing:<br>• I can solve systems of equations by substituting a variable or an expression.<br>• I know more than one way to perform substitution and can decide which way or what to substitute based on how the given equations are written.<br>Focused Mathematical Practices<br>• MP 7: Look for and make use of structure. |
| Lesson narrative: | In a previous lesson, students solved systems of linear equations by graphing. Here, they transition to solving systems algebraically—by substitution—and to reasoning about systems without a context.<br><br>The lesson activates and builds on what students have learned in grade 8 about solving by substitution. Students see that a system can be solved by replacing a variable with a number or with an expression, and that various substitutions can be done to solve the same system. They also begin to build an awareness of the kinds of systems that are conducive to being solved by substitution.<br><br>Students practice looking for and making use of structure as they identify the variables or expressions to substitute and ways to perform substitutions efficiently (MP7). |
| NJSLS: | HSA-REI.C.6<br>Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. |
| Learning Material | Illustrative Math Algebra I Unit 2 Lesson 13<br>Student Learning Material<br>https://curriculum.illustrativemathematics.org/HS/students/1/2/13/index.html |

# Lesson 3: Solving Systems by Elimination (Part I)

| | |
|---|---|
| Objectives | Teacher's Facing:<br>• Recognize that adding or subtracting equations in a system creates a new equation with a solution that coincides with that of the original system, so the new equation can be used to solve the original system.<br>• Solve systems of equations by adding or subtracting the equations strategically to eliminate a variable.<br>• Use graphing technology to graph the sums and differences of the equations in a system, and analyze and describe (orally and in writing) the behaviors of the graphs.<br>Student Facing:<br>• I can solve systems of equations by adding or subtracting them to eliminate a variable.<br>• I know that adding or subtracting equations in a system creates a new equation, where one of the solutions to this equation is the solution to the system.<br>Focused Mathematical Practices<br>• MP 3: Construct viable arguments and critique the reasoning of others.<br><br>Vocabulary:<br>• Elimination |
| Lesson narrative: | This is the first of three lessons that develop the idea of solving systems of linear equations in two variables by elimination.<br><br>Students warm up to the idea of adding equations visually. They examine a diagram of three hangers where the third hanger contains the combined contents of the first two hangers and all three hangers are balanced. Then, they analyze the result of adding two linear equations in standard form and notice that doing so eliminates one of the variables, enabling them to solve for the other variable and, consequently, to solve the system. In studying and testing a new strategy of adding equations and then offering their analyses, students construct viable arguments and critique the reasoning of others (MP3).<br><br>Next, students connect the solution they found using this method to the graphs of the equations in a system and the graph of the third equation (that results from adding or subtracting the original equations). They observe that the solution they found is the solution to the system, and that the graph of the third equation intersects the other two graphs at the exact same point—at the intersection of the first two.<br><br>The foundational idea is that adding or subtracting equations in a system creates a new equation whose solutions coincide with those of the original system. Students begin using this insight to solve systems, but they are not yet expected to construct an argument as to why this approach works. |
| NJSLS: | HSA-REI.C.5<br>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. |
| Learning Material | Illustrative Math Algebra I Unit 2 Lesson 13<br>Student Learning Material<br>https://curriculum.illustrativemathematics.org/HS/students/1/2/14/index.html |

| Lesson 4: Solving Systems by Elimination (Part 2) | |
|---|---|
| Objectives | Teacher's Facing:<br>• Explain (orally and in writing) why adding or subtracting two equations that share a solution results in a new equation that also shares the same solution.<br>• Practice solving systems of linear equations by adding or subtracting equations to eliminate a variable.<br>• Use a context to make sense of an equation that is the sum of two equations in a system, and to reason about why this equation shares a solution with the system.<br>Student Facing:<br>• I can explain why adding or subtracting two equations that share a solution results in a new equation that also shares the same solution.<br>•<br>Focused Mathematical Practice:<br>• MP 3: Construct viable arguments and critique the reasoning of others. |
| Lesson narrative: | In this lesson, students continue to develop their understanding of solving systems by elimination. Students are given a system that represents the quantities and constraints in a situation. They interpret, in context, the solutions to the individual equations and to the system. They then use the context to make sense of the sum of the two equations and why it shares a solution with the equations in the given system. Along the way, students begin to formulate a logical explanation as to why adding (or subtracting) the two equations in a system can be helpful for identifying the solution to the system (MP3).<br><br>Students also practice solving systems by adding and subtracting equations and checking their solutions. They also encounter systems where one variable cannot be easily eliminated (given what they know at this point), motivating the need for another strategy. |
| NJSLS: | HSA-REI.C.5<br>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. |
| Learning Material | Illustrative Math Algebra I Unit 2 Lesson 15<br>Student Learning Material<br>https://curriculum.illustrativemathematics.org/HS/students/1/2/15/index.html |

# Lesson 5: Solving Systems by Elimination (Part 3_

| | |
|---|---|
| Objectives | Teacher's Facing:<br>• Recognize that multiplying an equation by a factor creates an equivalent equation whose graph is the same as that of the original equation.<br>• Solve systems of equations by multiplying one or both equations by a factor and then adding or subtracting the equations to eliminate a variable.<br>• Understand that solving a system by elimination or by substitution entails creating one or more equivalent systems that would enable us to solve the original one.<br>Student Facing:<br>• I can solve systems of equations by multiplying each side of one or both equations by a factor, then adding or subtracting the equations to eliminate a variable.<br>• I understand that multiplying each side of an equation by a factor creates an equivalent equation whose graph and solutions are the same as that of the original equation.<br><br>Focused Mathematical Practice:<br>• MP 3: Construct viable arguments and critique the reasoning of others.<br><br>Vocabulary:<br>• Equivalent system |
| Lesson narrative: | This is the last lesson in a series of three lessons on solving systems of equations by elimination. Two new ideas are introduced here.<br><br>The first idea is that we can multiply one or both equations in the system by a factor to make it possible to eliminate a variable. Prior to this point, students worked only with systems where at least one variable in the equations had the same coefficient or with opposite coefficients, making the variable removable when the equations were added or subtracted.<br><br>Here students see that this is not a requirement for a system to be solvable by elimination. We can first multiply one or both equations by a factor—chosen strategically so that the coefficients of one variable become equal or opposites. Then, the variable can be eliminated by adding an original equation and the new equation, or by subtracting one from the other.<br><br>The second new idea is that, whenever we multiply equations in a system by a factor, add or subtract the equations, or otherwise manipulate the equations, we are essentially creating an equivalent system that would help us get closer to finding the solution of the original system. |
| NJSLS: | HSA-REI.C.5<br>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. |
| Learning Material | Illustrative Math Algebra I Unit 2 Lesson 16<br>Student Learning Material<br>https://curriculum.illustrativemathematics.org/HS/students/1/2/16/index.html |

| Lesson 6: Systems of Linear Equations and Their Solutions | |
|---|---|
| Objectives | Teacher's Facing:<br>• Determine whether a system of equations will have 0, 1, or infinitely many solutions by analyzing their structure or by graphing.<br>• Recognize that a system of linear equations can have 0, 1, or infinitely many solutions.<br>• Use the structure of the equations in a linear system to make sense of the properties of their graphs.<br>Student Facing:<br>• Let's find out how many solutions a system of equations could have.<br>Focused Mathematical Practices: |
| Lesson narrative: | In this lesson, students learn that equivalent equations are equations with the exact same solutions. Students see that the moves that generate equivalent expressions (for example, applying the distributive property or combining like terms) can also create equivalent equations. Additionally, an equivalent equation can be created by adding the same number to both sides or multiplying both sides by the same non-zero number. Students have seen moves like this before, when solving one-variable equations in middle school. What is new here is an awareness that each of the equations created as a part of the solving process is equivalent to the original equation.<br><br>Students also regard equivalent equations as synonymous statements about a relationship. They use context to interpret the solution to equivalent equations, and to think about why it makes sense that equivalent equations have the same solution. In doing so, students reason abstractly and quantitatively (MP2).<br><br>The emphasis of this lesson is on equations in one variable. Students will have many opportunities to study equivalent equations in two variables in future lessons. |
| NJSLS: | HSA-CED.A.3<br>Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.<br>HSA-REI.C.6<br>Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. |
| Learning Material | Illustrative Math Algebra I Unit 2 Lesson 17<br>Student Learning Material<br>https://curriculum.illustrativemathematics.org/HS/students/1/2/17/index.html |

| Lesson 7: Graphing Linear Inequalities in Two Variables (Part I) | |
|---|---|
| Objectives | Teacher's Facing:<br>• Given the graph of a related equation, determine the solution region to an inequality in two variables by testing the points on the line and on either side of the line.<br>• Understand that the solutions to a linear inequality in two variables are represented graphically as a half-plane bounded by a line.<br>Student Facing:<br>• Given a two-variable inequality and the graph of the related equation, I can determine which side of the line the solutions to the inequality will fall.<br>• I can describe the graph that represents the solutions to a linear inequality in two variables.<br><br>Focused Mathematical Practices:<br>• MP 1: Make sense of problems and persevere in solving them. |
| Lesson narrative: | In earlier lessons, students wrote and solved linear inequalities in one variable. In this lesson, they transition to linear inequalities in two variables.<br><br>Previously, students learned that the solutions to an equation in two variables are all pairs of values that make the equation true, and that, when graphed, the solutions are points on a line. Here, they learn that the solutions to inequalities in two variables also involve pairs of values. When graphed, the solutions are no longer points on a single line, but comprise a region that is bounded by a line. This region consists of all points in a plane on one side of a boundary line. That boundary line is the graph of an equation related to the inequality.<br><br>Students begin by noticing that the plots of solutions and non-solutions occupy different parts of a coordinate plane. Next, they think about the boundary line between the two regions and whether it is a part of the solution. Finally, students write some inequalities given graphs that represent solution regions. |
| NJSLS: | HSA-REI.D.12<br>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. |
| Learning Material | Illustrative Math Algebra I Unit 2 Lesson 21<br>Student Learning Material<br>https://curriculum.illustrativemathematics.org/HS/students/1/2/21/index.html |

# Lesson 8: Graphing Linear Inequalities in Two Variables (Part 2)

| | |
|---|---|
| Objectives | Teacher's Facing:<br>• Find the solution to a two-variable inequality by graphing a related two-variable equation and determining the correct region for the solution.<br>• Interpret, in context, points on the graphs of equations and in the solution region of inequalities in two variables.<br>• Write inequalities in two variables to represent the constraints in a situation and identify possible solutions by reasoning.<br>Student Facing:<br>• Given a two-variable inequality that represents a situation, I can interpret points in the coordinate plane and decide if they are solutions to the inequality.<br>• I can find the solutions to a two-variable inequality by using the graph of a related two-variable equation.<br>• I can write inequalities to describe the constraints in a situation.<br><br>Focused Mathematical Practice:<br>• MP2: Reason abstractly and quantitatively.<br>• MP4: Model with mathematics |
| Lesson narrative: | In a previous lesson, students learned to graphically represent the set of solutions to a linear inequality in two variables. They made a connection between the solutions to a linear inequality and the solutions to a related linear equation.<br><br>In this lesson, students deepen their understanding of the solutions to linear inequalities by studying them in context. They write inequalities in two variables to represent constraints, and interpret the points on a boundary line and on either side of it in terms of the situation.<br><br>The work here illustrates that the solution region represents the set of values that satisfy the constraint in a situation (MP2). Interpreting the solutions contextually also engages students in an aspect of mathematical modeling (MP4). It enables students to see that, while some values might make an inequality true, they might not be feasible or appropriate in the situation. The activity Rethinking Landscaping is an opportunity to make a generalization based on repeated reasoning (MP8), since students first find numbers that meet a constraint, and then use variables in place of those numbers to write an equation and an inequality.<br><br>Because reasoning about the solution region of an inequality is important here, graphing technology should not be used. Students will have opportunities to use graphing technology to solve inequalities in two variables in upcoming lessons. |
| NJSLS: | HSA-REI.D.12<br>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.<br>HSA-REI.D.10<br>Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).<br>HSA-CED.A.3<br>Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods. |

| | |
|---|---|
| Learning Material | Illustrative Math Algebra I Unit 2 Lesson 22<br>Student Learning Material<br>https://curriculum.illustrativemathematics.org/HS/students/1/2/22/index.html |

| Lesson 9: Solving Problems with Inequalities in Two Variables | |
|---|---|
| Objectives | Teacher's Facing:<br>• Identify an inequality, a graph, an ordered pair, and a description that represent the constraints and possible solutions in a situation.<br>• Understand that a constraint on two variables can be represented by an inequality, a graph (a half-plane), and a verbal description.<br>• Write inequalities in two variables to represent the constraints in a situation and use technology to graph the solution set to answer questions about the situation.<br>Student Facing:<br>• Let's practice writing, interpreting, and graphing solutions to inequalities in two variables.<br><br>Focused Mathematical Practice:<br>• MP2: Reason abstractly and quantitatively. |
| Lesson narrative: | By now students recognize that solutions to linear inequalities can be found by graphing, and that this can be done by first graphing a related equation and deciding on the solution region. In this lesson, they learn to use graphing technology to find the solution set of a linear inequality in two variables.<br><br>Students then use this skill to solve problems that involve inequalities. They write linear inequalities to represent the constraints in situations and then use the representations (including the graphs of the solutions) to answer questions about the situations. As they write inequalities from descriptions, decide on the solution sets, and interpret points in a solution region, students engage in quantitative and abstract reasoning (MP2). |
| NJSLS: | HSA-REI.D.12<br>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.<br>HSA-CED.A.3<br>Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. For example, represent |
| Learning Material | Illustrative Math Algebra I Unit 2 Lesson 23<br>Student Learning Material<br>https://curriculum.illustrativemathematics.org/HS/students/1/2/23/index.html |

# Lesson 10: Solutions to Systems of Linear Inequalities in Two Variables

| | |
|---|---|
| Objectives | Teacher's Facing:<br>• Given descriptions and graphs that represent two constraints, identify values that satisfy each constraint and those that satisfy both constraints simultaneously.<br>• Understand that the solution set of a system of inequalities in two variables is comprised of any pair of values that make both inequalities true, and that it is represented graphically by the region where the graphs overlap.<br>• Write systems of inequalities in two variables, use technology to graph the solutions, and interpret the solutions in context.<br>Student Facing:<br>• Let's look at situations where two constraints (that can be expressed by inequalities) must be met simultaneously.<br><br>Focused Mathematical Standards:<br>• MP 2: Reason abstractly and quantitatively.<br><br>Vocabulary: System of Inequality |
| Lesson narrative: | Earlier in the unit, students solved systems of linear equations in two variables. They also found solutions to linear inequalities in two variables. In this lesson, students build on those understandings to find the solutions to systems of linear inequalities in two variables.<br><br>Students learn that two linear inequalities that represent the constraints in the same situation form a system of inequalities, and that the solutions to the system include all numbers that satisfy both constraints simultaneously. Graphically, the solution set of the system is represented by the region where the graphs of the individual inequalities overlap.<br><br>Throughout the lesson, students endeavor to find values that satisfy multiple constraints, both in terms of a situation and in absence of one. The process requires that students make sense of problems and persevere in solving them (MP1) and to reason quantitatively and abstractly (MP2). |
| NJSLS: | HSA-REI.D.12<br>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.<br>HSA-CED.A.3<br>Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. For example, represent |
| Learning Material | Illustrative Math Algebra I Unit 2 Lesson 24<br>Student Learning Material<br>https://curriculum.illustrativemathematics.org/HS/students/1/2/24/index.html |

## Lesson 11: Solving Problems with Systems of Linear Inequalities in Two Variables

| | |
|---|---|
| Objectives | Teacher's Facing:<br>• Analyze given information about a situation involving multiple constraints and determine what additional information is needed to solve problems.<br>• Given a system of inequalities and their graphs, explain (orally and in writing) how to tell if a pair of values is a solution to the system.<br>• Practice writing systems of inequalities in two variables and finding the solution sets by reasoning or by graphing.<br>Student Facing:<br>• I can explain how to tell if a point on the boundary of the graph of the solutions to a system of inequalities is a solution or not.<br><br>Focused Mathematical Practice:<br>• MP 1: Make sense of problems and persevere in solving them. |
| Lesson narrative: | In a previous lesson, students learned that the solutions to a system of linear inequalities can be represented graphically with overlapping regions.<br><br>In this lesson, students take a closer look at whether points on the boundary lines of the system's solution region are included in the solutions. Analyzing graphs and communicating observations about them require attention to precision (MP6). Students also apply these insights to solve more challenging contextual problems. This work involves making sense of the information needed to solve the problems (MP1). |
| NJSLS: | HSA-REI.D.12<br>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. |
| Learning Material | Illustrative Math Algebra I Unit 2 Lesson 25<br>Student Learning Material<br>https://curriculum.illustrativemathematics.org/HS/students/1/2/25/index.html |

## Lesson 12: Modeling with Systems of Inequalities in Two Variables

| | |
|---|---|
| Objectives | Teacher's Facing:<br>• Define the constraints in a situation and create a mathematical model to represent them.<br>• Interpret a mathematical model, presented as inequalities and graphs, that represents a situation.<br>Student Facing:<br>• I can interpret inequalities and graphs in a mathematical model.<br>• I know how to choose variables, specify the constraints, and write inequalities to create a mathematical model.<br><br>Focused Mathematical Practice:<br>• MP 4: Model with mathematics |
| Lesson narrative: | In this culminating lesson, students integrate the ideas from the unit and engage in multiple aspects of mathematical modeling (MP4).<br><br>In the first activity, they interpret and analyze given models that represent the constraints and conditions in a situation. In the second activity, they create their own models after specifying quantities of interest, identifying relevant information, and setting the constraints. |
| NJSLS: | HSA-REI.D.12<br>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.<br>HSA-CED.A.3<br>Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. For example, represent<br>HSN-Q.A.2<br>Define appropriate quantities for the purpose of descriptive modeling. |
| Learning Material | Illustrative Math Algebra I Unit 2 Lesson 26<br>Student Learning Material<br>https://curriculum.illustrativemathematics.org/HS/students/1/2/26/index.html |

| 5 Practices for Orchestrating Productive Mathematics Discussions | |
|---|---|
| Practice | Description/ Questions |
| 1. Anticipating | What strategies are students likely to use to approach or solve a challenging high-level mathematical task?<br>How do you respond to the work that students are likely to produce?<br>Which strategies from student work will be most useful in addressing the mathematical goals? |
| 2. Monitoring | Paying attention to what and how students are thinking during the lesson.<br>Students working in pairs or groups<br>Listening to and making note of what students are discussing and the strategies they are using<br>Asking students questions that will help them stay on track or help them think more deeply about the task. (Promote productive struggle) |
| 3. Selecting | This is the process of deciding the ***what*** and the ***who*** to focus on during the discussion. |
| 4. Sequencing | What order will the solutions be shared with the class? |
| 5. Connecting | Asking the questions that will make the mathematics explicit and understandable.<br>Focus must be on mathematical meaning and relationships; making links between mathematical ideas and representations. |

# Ideal Math Block

*The following outline is the department approved ideal math block for grades 9-12.*

1) Do Now (7-10 min)
    a. Serves as review from last class' or of prerequisite material
    b. Provides multiple entry points so that it is accessible by all students and quickly scaffolds up

2) Starter/Launch (5-10 min)
    a. Designed to introduce the lesson
    b. Uses concrete or pictorial examples
    c. Attempts to bridge the gap between grade level deficits and rigorous, on grade level content
    d. Provides multiple entry points so that it is accessible by all students and quickly scaffolds up

3) Mini-Lesson /Task(15-20 min)
    a. Design varies based on content
    b. May include an investigative approach, direct instruction approach, whole class discussion led approach, etc.
    c. Includes CFU's
    d. Anticipates misconceptions and addresses common mistakes

4) Guided Practice (25-30 min)
    a. Design varies based on content
    b. May include partner work, group work/project, experiments, investigations, game based activities, etc.

5) Independent Practice (7-10 min)
    a. Provides students an opportunity to work/think independently

6) Closure (5-10 min)
    a. Connects lesson/activities to big ideas
    b. Allows students to reflect and summarize what they have learned
    c. May occur after the activity or independent practice depending on the content and objective

7) DOL (5 min)
    a. Exit ticket

# Ideal Math Block with Intervention Stations

| | | | | |
|---|---|---|---|---|
| Whole Group Instruction | 50 min | INSTRUCTION (Grades 9 – 12)<br>Daily Routine:<br>Mathematical Content or Language Routine<br><br>Anchor Task: Anticipate, Monitor, Select, Sequence, Connect<br><br>Collaborative Work*<br>Guided Practice<br><br>Independent Work (Demonstration of Student Thinking) | | TOOLS<br>Manipulatives<br><br>RESOURCES<br>Agile Mind |
| Rotation Stations (Student Notebooks & Chromebooks Needed) | 1-2X 35 min | STATION 1:<br>Focus on current Grade Level Content<br><br>STUDENT EXPLORATION*<br>Independent or groups of 2-3<br>Emphasis on MP's 3, 6 (Reasoning and Precision) And MP's 1 & 4 (Problem Solving and Application)<br><br>TOOLS/RESOURCES<br>Agile Mind<br>Math Journals | STATION 2:<br>Focus on Student Needs<br><br>TECH STATION<br>Independent<br><br>TOOLS/ RESOURCES<br>Khan Academy<br>Approved Digital Provider<br>Fluency Practice | TEACHER STATION:<br>Focus on Grade Level Content; heavily scaffolded to connect deficiencies<br><br>TARGETED INSTRUCTION<br>4 – 5 Students<br><br>TOOLS/ RESOURCES<br>Agile<br>Homework<br>Manipulatives |
| | 5 min | INSTRUCTION<br>Exit Ticket (Demonstration of Student Thinking)<br><br>TOOLS/RESOURCES<br>Notebooks or Exit Ticket Slips | | |

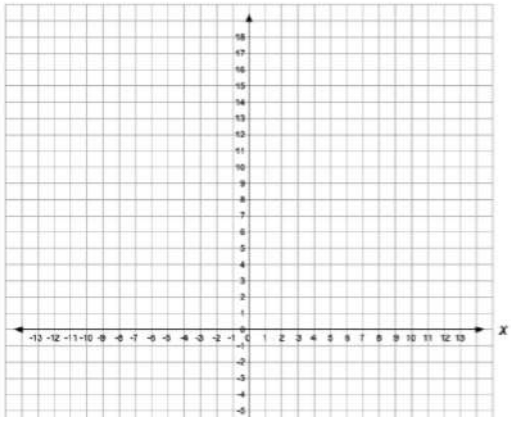
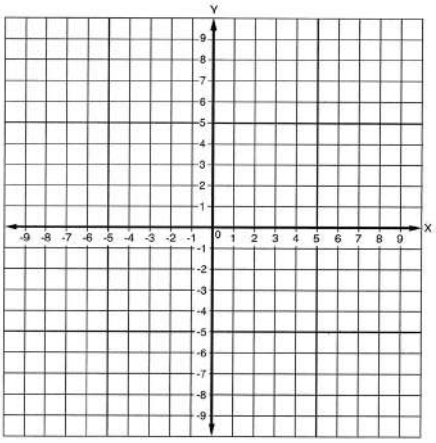
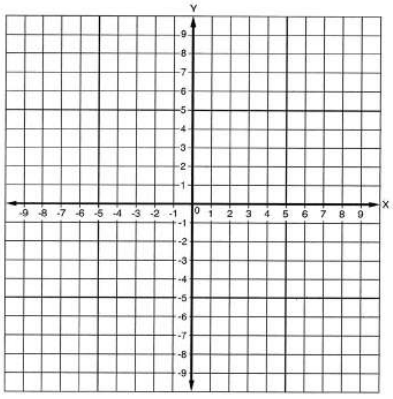
# Sample of Authentic Assessments

## Reasoning Task (Systems of Linear Equations)—Calculator Allowed

Evidence Statement: HS.C.5.6 Domain: Algebra

NJSLS: A.RED.5

Part A: Solve each system of equation below (Show your work). In each case, explain how their graphs support the answer and provide a sketch (Note: graphs do not need to be accurate, just need to reflect the nature of the solutions). Be sure to support your explanation with correct vocabulary and mathematical reasoning.

| System | Solution | Explanation of graphs |
|---|---|---|
| $y = \frac{1}{2}x + 9$<br>$y = \frac{5}{2}x - 3$ | |  |
| $y = 2x + 1$<br>$6x - 3y = 14$ | |  |
| $4x + 5y = 8$<br>$12x + 15y = 24$ | |  |

Part B: A system of two linear equations contains the following equation

$2x - 3y = 9$

If this system has "infinite solutions" what is a possible second equation to this system? Create a second equation, in standard form, which is different from the first but produces a system with infinite solutions.

Explain, in detail, how you were able to determine this second equation. Also verify or show how you know that your system now has infinite solutions.

Advanced Topics in Algebra 1 - Unit 2 November - January

# Reasoning Task PLD (Systems of linear Equations) Rubric

Name: _____ Date: _

Evidence Statement: HS.C.5.6 Domain: Algebra

NJSLS: A.REI.5

| | | | | | |
|---|---|---|---|---|---|
| **Task Description** | • Clearly constructs and communicates a complete response based on a chain of reasoning to justify or refute algebraic, function, or linear-equation propositions<br>• Clearly constructs and communicates a complete response by<br>➢ using a logical approach based on a conjecture and/or stated assumptions, utilizing mathematical connections (when appropriate)<br>➢ providing an efficient and logical progression of steps or chain of reasoning with appropriate justification<br>➢ performing precise calculations<br>➢ using grade-level vocabulary, symbols, and labels<br>➢ providing a justification of a conclusion<br>➢ evaluating, interpreting and critiquing the validity and efficiency of others' responses | | | | |
| **Command Level Description** | ***Level 5: Distinguished Command***<br>Using a logical steps or chain of reasoning of their explanation; and use grade-level vocabulary, symbols, and labels. | ***Level 4: Strong Command***<br>Using a logical steps or chain of reasoning or their explanation | ***Level 3: Moderate Command***<br>Providing a logical, but incomplete, progression of steps or chain of reasoning | ***Level 2: Partial Command***<br>Providing an incomplete or illogical progression of steps or chain of reasoning. | ***Level 1: No Command***<br>Using incorrect approach and provide illogical progression or chain of reasoning. |
| **Score range** | 12 | 9 – 11 | 6 – 8 | 3 – 5 | 0 – 2 |
| **Task Score & PLD Assigned** | | | | | |
| **HS Portfolio Appeal conversion Score (circle one)** | 3 | | 2 | 1 | 0 |

# Extended Constructed Response (ECR)

## Math Department ECR Protocol

### ECR Protocol

(Extended Constructed Response)

*Issuing*

- Moving forward ECR'S will be disseminated by the first of each month and collected by the end of each month
- Method of Issuing: email and post on the website

*Dissemination*

- Teachers can elect to print copies for each student or use the Smartboard to project the ECR. (Note: Student work will be included in Student Portfolios)
- Students should be given up to 30 minutes depending on the complexity of the ECR
- Assure appropriate testing environment
- ECR should be completed independently

*Scoring*

- Conversion tables are available in the *Assessment & Data in Mathematics Bulletin* for genesis inputting purposes
- ECR's will count as Authentic Assessments
- Naming Protocol "Course Month ECR" (ex: Grade 6 October ECR)

*Collection*

- ECR's will be collected & kept in student portfolios
- Student work will be reviewed during CPT's

**Link of Unit 2 ECRs**

https://www.dropbox.com/sh/rpt9bt360dgbq38/AADBiZYLWJweqmKWypY3VAFPa?dl=0

**ECR Conversion Chart**

| Points | Genesis Conversion | Points | Genesis Conversion | Points | Genesis Conversion |
|---|---|---|---|---|---|
| 0 | 55 | 0 | 55 | 0 | 55 |
| 1 | 59 | 1 | 69 | 1 | 69 |
| 2 | 69 | 2 | 79 | 2 | 89 |
| 3 | 79 | 3 | 89 | 3 | 100 |
| 4 | 89 | 4 | 100 | | |
| 5 | 100 | | | | |

## Sample of ECR Scoring Rubric

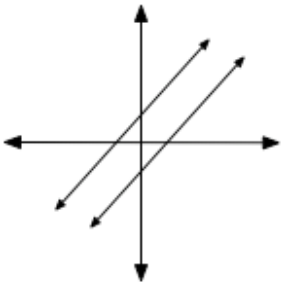
| Part A | |
|---|---|
| Score | Description |
| 3 | Student response includes the following 3 elements.<br>Modeling component: 2 pts<br>* Valid equation<br>* Logical work to find the price per ticket<br>Computation: 1 pt<br>* Correct computation for finding the price of per ticket<br>Sample Student Response<br>The total cost of the prizes is 349 + 42 + 25 + 18 + 16 = 450.<br>For 75 tickets to make $450, they must each cost 450 ÷ 75 = $6.<br>Equation:<br>n= 6x – 450 |
| 2 | Student response includes 2 of the 3 elements |
| 1 | Student response includes 1 of the 3 elements |
| 0 | Student response is incorrect or irrelevant. |
| **Part B** | |
| Score | Description |
| 2 | Student response includes the following elements:<br>* Logical progression toward problem solving<br>* Correct computation to find the number of tickets and determine the reasonable solution<br>Sample of student work:<br>6x-450 >= 850<br>6x >= 1300<br>x >= 216.6666<br>Answer: the minimum number of tickets is 217 |
| 1 | Student response includes 1 of 2 elements |
| 0 | Student response is incorrect or irrelevant |

# Multiple Representations

## System of Equations

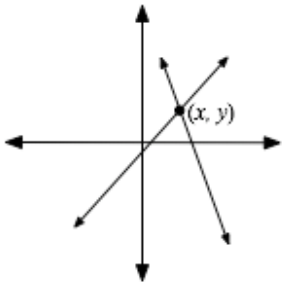
### Pictorial

**Parallel Lines**



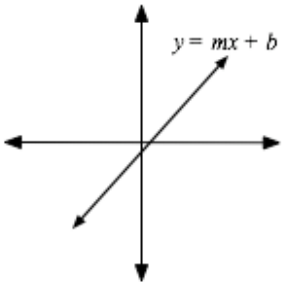
No points in common.
Solution: $\varnothing$

**Intersecting Lines**




One point in common.
Solution: $(x, y)$

**Coincident Lines**




Infinitely many points in common.
Solution: $\{(x, y): y = mx + b\}$

### Abstract

Determine whether the solution set of the given system is the empty set, an infinite set, or a set with exactly one member: $\begin{cases} 3x = -3y - 9 \\ -4y = 4x + 12 \end{cases}$

First, we must find the slope and y-intercept for each equation:

| **Equation 1:** | | | **Steps:** |
|---|---|---|---|
| $3x$ | $=$ | $-3y-9$ | 1. Given |
| $3x+9$ | $=$ | $-3y$ | 2. Add 9 to both sides |
| $-x-3$ | $=$ | $y$ | 3. Divide both sides by 3 |
| $y$ | $=$ | $-x-3$ | 4. Place into slope-intercept form |
| slope | $=$ | $-1$ | 5. State the slope |
| y-int. | $=$ | $-3$ | 6. State the y-intercept |

| **Equation 2:** | | | **Steps:** |
|---|---|---|---|
| $-4y$ | $=$ | $4x+12$ | 1. Given |
| $y$ | $=$ | $-x-3$ | 2. Divide both sides by -4 |
| slope | $=$ | $-1$ | 3. State the slope |
| y-int. | $=$ | $-3$ | 4. State the y-intercept |

Since the slopes and y-intercepts are the same, the lines are coincident. Therefore there are infinitely many solutions.

Determine whether the solution set of the given system is the empty set, an infinite set, or a set with exactly one member: $\begin{cases} 3x + y = -4 \\ 3x + y = 2 \end{cases}$

First, we must find the slope and y-intercept for each equation:

| **Equation 1:** | | | **Steps:** |
|---|---|---|---|
| $3x+y$ | $=$ | $-4$ | 1. Given |
| $y$ | $=$ | $-3x-4$ | 2. Subtract $3x$ from both sides |
| slope | $=$ | $-3$ | 3. State the slope |
| y-int. | $=$ | $-4$ | 4. State the y-intercept |

| **Equation 2:** | | | **Steps:** |
|---|---|---|---|
| $3x+y$ | $=$ | $2$ | 1. Given |
| $y$ | $=$ | $-3x+2$ | 2. Subtract $3x$ from both sides |
| slope | $=$ | $-3$ | 3. State the slope |
| y-int. | $=$ | $2$ | 4. State the y-intercept |

Since the slopes are the same but the y-intercepts are different, the lines are parallel. Therefore there is no solution.

Determine whether the solution set of the given system is the empty set, an infinite set, or a s

with exactly one member: $\begin{cases} y = 3x + 1 \\ 4y - x = 4 \end{cases}$

First, we must find the slope and y-intercept for each equation:

| **Equation 1:** | | | **Steps:** |
|---|---|---|---|
| $y$ | $=$ | $3x+1$ | 1. Given |
| slope | $=$ | $3$ | 2. State the slope |
| y-int. | $=$ | $1$ | 3. State the y-intercept |

| **Equation 2:** | | | **Steps:** |
|---|---|---|---|
| $4y - x$ | $=$ | $4$ | 1. Given |
| $4y$ | $=$ | $x+4$ | 2. Add $x$ to both sides |
| $y$ | $=$ | $\frac{1}{4}x+1$ | 3. Divide both sides by 4 |
| slope | $=$ | $\frac{1}{4}$ | 4. State the slope |
| y-int. | $=$ | $1$ | 5. State the y-intercept |

Since the slopes and y-intercepts are different, the lines are intersecting. Therefore there is exactly one solution.

# NJSLA Sample Assessment Items/ Unit Assessment Question Bank

https://www.dropbox.com/sh/fqrnxtgo5j0j5gf/AABDW5WZPBJe4p9cQ3Pi-FvOa?dl=0

| Unit Assessment/PARCC aligned Tasks | | |
|---|---|---|
| # | Dropbox location and filename | Task Type |
| 1 | Orange 9-12 Math > Algebra 1 > Unit 2 > Additional Resources > **Task 2.1** | I (1 pt) |
| 2 | Orange 9-12 Math > Algebra 1 > Unit 2 > Additional Resources > **Task 2.2** | I (1 pt) |
| 3 | Orange 9-12 Math > Algebra 1 > Unit 2 > Additional Resources > **Task 2.3** | I (1 pt) |
| 4 | Orange 9-12 Math > Algebra 1 > Unit 2 > Additional Resources > **Task 2.4** | I (1 pt) |
| 5 | Orange 9-12 Math > Algebra 1 > Unit 2 > Additional Resources > **Task 2.5** | I (2 pts) |
| 6 | Orange 9-12 Math > Algebra 1 > Unit 2 > Additional Resources > **Task 2.6** | I (2 pts) |
| 7 | Orange 9-12 Math > Algebra 1 > Unit 2 > Additional Resources > **Task 2.7** | I (2 pts) |
| 8 | Orange 9-12 Math > Algebra 1 > Unit 2 > Additional Resources > **Task 2.8** | I (4 pts) |
| 9 | Orange 9-12 Math > Algebra 1 > Unit 2 > Additional Resources > **Task 2.9** | II (3 pts) |
| 10 | Orange 9-12 Math > Algebra 1 > Unit 2 > Additional Resources > **Task 2.10** | II (4 pts) |
| 11 | Orange 9-12 Math > Algebra 1 > Unit 2 > Additional Resources > **Task 2.11** | III (3 pts) |
| 12 | Orange 9-12 Math > Algebra 1 > Unit 2 > Additional Resources > **Task 2.12** | III (6 pts) |