*Unit 3 Systems of Linear Equations and Inequalities

Content Area: **Mathematics**
Course(s): **Algebra 1 CP**
Time Period: **November**
Length: **12 blocks**
Status: **Published**

Transfer Skills

In this unit students will extend upon work with linear equations including graphing linear equations, solving linear systems of equations using graphing, substitution and elimination and will extend to linear inequalities and systems of linear inequalities. Students will graph and analyze the solution set of linear equations and inequalities and systems of linear equations and inequalities. Students will write systems of linear equations and inequalities given a context. Students will interpret the solutions in the real world context. Technology will also be used to find solutions and approximate solutions of two functions.

Instructional Notes:

Prior Knowledge: Systems of linear equations and systems of linear inequalities begin in the 8th grade standards. Students should already have an understanding of solving using substitution, elimination, and graphing and the meaning of the solutions, and sketching linear inequalities and systems of linear inequalities. The skill should be pre-assessed and remediated. Emphasis should be placed on solving systems with multiple steps and applications of systems.

Graphing Calculator Integration: Teacher will model the usage of the graphing calculator throughout the unit. Students will become comfortable with navigating and using the graphing calculator to solve a variety of problems efficiently.

i.e. Calculating Line of Best Fit and Correlation Coefficient, Solving Systems Linear and Non-Linear Using the Table and Trace-intersect

Enduring Understandings

Properties of numbers and equality can be used to transform an equation (or inequality) into equivalent, simpler equations (or inequalities) in order to find solutions

Useful information about equations and inequalities (including solutions) can be found by analyzing graphs.

The numbers and types of solutions vary predictably, based on the type of equation.

Many real-world mathematical problems can be represented algebraically.

Essential Questions

How can we use equations to predict future occurrences?

What does the solution of a system of equations represent? System of Inequalities?

How do I know when a result is reasonable?

Content

Vocabulary

linear, non-linear, model, slope, y-intercept, standard form, slope-intercept form, origin, scale, axes, coordinate plane , scatter plot, line of best fit , correlation, correlation coefficient, prediction equation, association, linear regression , system , system of linear equations, system of linear inequalities, elimination/linear combination method, substitution method, graphing method, successive approximations, linear inequalities, boundary line, half-plane, viable/ non-viable solutions

Skills

Note: Not all content should be emphasized equally. Skills that are starred are Major Standards and should be prioritized. However, the supporting and additonal clusters are necessary to be taught and should be embedded in instruction

Graph equations on coordinate axes, including labels and scales.

- Identify and describe the solutions in the graph of an equation.

- Interpret the origin in graphs.

Create a scatterplot and sketch a line of best fit.

Fit a linear function to data using technology.

Distinguish linear models representing approximately linear data from linear.

- Distinguish between correlation and causation

- Solve problems using prediction equations.

- Interpret the slope and the intercepts of the linear model in context.

- Determine the correlation coefficient of the linear model using technoogy.

- Determine the direction and strength of the linear association between two variables.

- Explain why the solutions of the equation $f(x)=g(x)$ are the x-coordinates of the points where the graphs of the linear equations $y=f(x)$ and $y=g(x)$

- Find approximate solutions to the system by making a table of values, graphing and finding successive approximations.

Solve systems of linear equations by graphing, elimination and substitution.

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.

Model real world situations by creating a system of linear equations.

Identify and define variables representing essential features for the model.

Interpret the solution(s) in context.

Graph linear inequalities and systems of linear inequalities represent the solution set as the intersection of the corresponding half planes.

Model real world situations by creating a system of linear inequalities given a context.

Interpret given solutions as viable or non-viable solutions in a real world context (i.e. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods)

Resources

Quizlet.com : Flashcard practice for Academic Vocabulary

NJSLS - New Jersey Student Learning Standards

Teacher Resources by Standard

https://www.illustrativemathematics.org/

https://illuminations.nctm.org/

https://nj.pbslearningmedia.org/

Online Teaching Websites

Khan Academy

MATH IXL

Standards

NJSLS 2016

Creating Equations

A -CED A. Create equations that describe numbers or relationships

1. Create equations and inequalities in one variable and use them to solve problems.

2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

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

Reasoning with Equations and Inequalities

REI. C. Solve systems of equations

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.

6. Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.

REI. D. Represent and solve equations and inequalities graphically

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).

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.

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.

Interpreting Functions

F-IF.B Interpret functions that arise in applications in terms of the context

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.

F-IF.C. Analyze functions using different representations.

7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.

a. Graph linear and quadratic functions and show intercepts, maxima, and minima.

Mathematics | Standards for Mathematical Practice □

1 Make sense of problems and persevere in solving them.

Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

4 Model with mathematics.

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

5 Use appropriate tools strategically.

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a

computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

6 Attend to precision.

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

MA.F-IF	Interpreting Functions
MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.4	Model with mathematics.
MA.F-IF.B	Interpret functions that arise in applications in terms of the context
MA.F-IF.B.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.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.7	Look for and make use of structure.
MA.F-IF.C	Analyze functions using different representations
MA.F-IF.C.7	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.
MA.F-IF.C.7a	Graph linear and quadratic functions and show intercepts, maxima, and minima.
MA.A-CED.A	Create equations that describe numbers or relationships
MA.A-CED.A.1	Create equations and inequalities in one variable and use them to solve problems.
MA.A-CED.A.2	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
MA.A-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. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.
MA.A-REI	Reasoning with Equations and Inequalities
MA.A-REI.C.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.
MA.A-REI.C.6	Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.
MA.A-REI.D	Represent and solve equations and inequalities graphically
MA.A-REI.D.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).
MA.A-REI.D.11	Explain why the □-coordinates of the points where the graphs of the equations □ = □(□) and □ = □(□) intersect are the solutions of the equation□(□) = □(□); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where □(□) and/or □(□) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.
MA.A-REI.D.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.