Unit #03: Linear Equations and Functions

Content Area: **Mathematics**
Course(s): **English I, Algebra II**
Time Period: **October**
Length: **3 weeks**
Status: **Published**

Unit Overview

The first part of this unit deals with linear equations and their graphs. Open sentences in two variables are presented with regard to their form and their solution sets. Finding the slope and using the slope of the equation of a line are main ideas in the first part of this unit. The second part of this unit continues with linear equations and systems of linear equations and inequalities. In the final part of this unit, functions and relations are defined and compared with emphasis on linear functions and identifying relations that are also functions.

Enduring Understandings

Students will develop critical thinking by graphing linear equations and inequalities.

Students will identify functions that reveal patterns to solve real-world problems.

Essential Questions

- How can formulas be used in everyday life?
- How do you graph a system of linear equations and inequalities?
- How might you solve a real-world math problem using a system of linear functionss?

Lesson Titles/Objectives

- Describe the domain and range of a function.
- Determine if a relation is a function.
- Find an equation of a line given its slope and a point on the line.
- Find an equation of a line given its slope and the y-intercept.
- Find an equation of a line given two points on the line.
- Find equations of linear functions.
- Find solutions of open sentences in two variables.
- Find the slope of a line.

- Find the values of functions.
- Graph a line given its slope and a point on the line.
- Graph functions.
- Graph linear equations in two variables.
- Graph linear inequalities in two variables.
- Graph systems of linear inequalities.
- Solve problems involving open sentences in two variables.
- Solve Systems of Linear Equations in 3 Variables
- Solve systems of linear equations in two variables.
- Use systems of equations to solve problems.

Standards

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.F-IF.A	Understand the concept of a function and use function notation
MA.K-12.2	Reason abstractly and quantitatively.
MA.F-IF.A.1	Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then $f(x)$ denotes the output of f corresponding to the input x. The graph of f is the graph of the equation $y = f(x)$.
MA.F-IF.A.2	Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.
MA.K-12.4	Model with mathematics.
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.F-IF.B.5	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.
MA.F-IF.B.6	Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.
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.S-ID.C.7	Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.
MA.S-ID.C.8	Compute (using technology) and interpret the correlation coefficient of a linear fit.
MA.F-IF.C.8	Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.
MA.F-IF.C.9	Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).
MA.F-BF.A	Build a function that models a relationship between two quantities
MA.F-BF.A.1	Write a function that describes a relationship between two quantities.
MA.A-REI.A.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.

MA.A-REI.A.2	Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.
MA.A-REI.B.3	Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
MA.F-LE.A	Construct and compare linear and exponential models and solve problems
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.C.8	Represent a system of linear equations as a single matrix equation in a vector variable.
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 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.
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.
MA.G-GPE.B.5	Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point).

Indicators

	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.
MA.F-IF.A	Understand the concept of a function and use function notation
	Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a

	coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.
MA.F-IF.B	Interpret functions that arise in applications in terms of the context
	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.
MA.S-ID.B.6a	Fit a function to the data (including with the use of technology); use functions fitted to data to solve problems in the context of the data.
MA.S-ID.B.6b	Informally assess the fit of a function by plotting and analyzing residuals, including with the use of technology.
MA.S-ID.B.6c	Fit a linear function for a scatter plot that suggests a linear association.
MA.F-IF.C	Analyze functions using different representations
MA.A-REI.B	Solve equations and inequalities in one variable
MA.A-REI.C	Solve systems of equations
MA.A-REI.D	Represent and solve equations and inequalities graphically

21st Century Skills and Career Ready Practices

CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP.K-12.CRP9	Model integrity, ethical leadership and effective management.
CRP.K-12.CRP11	Use technology to enhance productivity.
CRP.K-12.CRP12	Work productively in teams while using cultural global competence.

Inter-Disciplinary Connections

LA.RI.11-12.3	Analyze a complex set of ideas or sequence of events and explain how specific individuals, ideas, or events interact and develop over the course of the text.
LA.RI.11-12.4	Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze how an author uses and refines the meaning of a key term or terms over the course of a text (e.g., how Madison defines faction in Federalist No. 10).
LA.W.11-12.2	Write informative/explanatory texts to examine and convey complex ideas, concepts, and

	information clearly and accurately through the effective selection, organization, and analysis of content.
LA.SL.11-12.1	Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with peers on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.
LA.SL.11-12.1.C	Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives.
LA.L.11-12.6	Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression.
12.9.3.ST.2	Use technology to acquire, manipulate, analyze and report data.
12.9.3.ST.4	Understand the nature and scope of the Science, Technology, Engineering & Mathematics Career Cluster and the role of STEM in society and the economy.
TECH.8.1.12.A	Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations.
TECH.8.1.12.A.CS2	Select and use applications effectively and productively.

Warm-Up

- Kahoot!
- Sample PARCC item
- Sample SAT question
- Socrative

Anticipatory Set

- Discuss vertical line test
- Discussion on graphing methods
- Discussion on slope of horizontal lines and vertical lines

Instructional Strategies/Learning Activities

- Intro how to write an equation of a line that passes through a given point and is parallel or perpendicular to the given slope
- Intro lesson composition of functions
- Intro lesson on evaluating functions
- Intro lesson on graphing linear equations in two variables
- Intro solving systems of equations by elimination method
- Intro solving systems of equations by linear combination method
- Intro vocab terms: domain, range, abscissa, ordinate and review the coordinate plane

- Lesson on relations and functions
- Notes will be taken using Power Point
- Review homework
- Review how to find the slope between two points and from a graphed line
- Review solving equations for y and graphing on coordinate plane
- Review solving systems of equations by graphing
- Review warm up
- Review writing an equation of a line given two points
- Review writing equations of a line given the slope and a point
- Students will present solutions on the board
- Students will work independently on examples
- Students will work together on a worksheet

Closure

- Discussion on today's lesson
- Exit ticket
- Journal Entry
- Kahoot!
- Oral Questioning
- Poll the class to self-analyze their comfort level of the lesson
- Socrative
- Vocab Review
- What did you learn today?

Modifications-G&T, LES, Special Education

- Collaborate with after-school programs or clubs to extend learning opportunities.
- Engage students with a variety of Mathematical Practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.
- Provide ELL students with multiple literacy strategies.
- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).
- Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies).
- Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).
- Restructure lesson using UDL principals (http://www.cast.org/our-work/about-udl.html#.VXmoXcfD_UA)

- Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.
- Structure the learning around explaining or solving a social or community-based issue.
- Use project-based math learning to connect math with observable phenomena.

Formative Assessment

- Composition of Functions Quiz
- Group Work
- Guided Practice
- Individual Practice
- Kahoot!
- Observation
- Oral Responses
- Slope and Writing Equations Quiz
- Socrative
- Systems of Equations Quiz
- Teacher Observation

Summative Assessment

- Unit Test on Relations and Functions
- Unit Test on Systems of Equations

Resources & Technology

- chromebook
- Desmos online graphing calculator
- Graphing Calculator
- Kahoot!
- mathxlforschool.com
- PowerPoint
- Smart Board
- Socrative.com
- Teacher generated worksheets
- Textbook: Algebra and Trigonometry Structure and Method Book 2 (McDougal Littell)
- Video to introduce or demonstrate concepts