Unit 2 - Linear Relationships

Content Area: **Mathematics**
Course(s): **Honors Algebra I 8**
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Unit Overview

The work in unit 2 will build on the grade 8 concepts for linear and exponential relationships. Success in unit 2 will lay the groundwork for later units where the students will extend this knowledge to quadratic and exponential functions. Solving and interpreting pairs of linear equations and inequalities are core skill in higher mathematics and important concepts in the study of economics applications like linear programming. This unit introduces the basic tools for working with linear equations in two variables. Solution sets of linear equations are represented graphically using the coordinate plane. The slope of a line is defined, and the standard and slope-intercept forms of a line's equation are examined. Lines are graphed from given equations, and equations are determineed from given facts about a line.

In this unit students will learn how to graph linear equations in 2 variables and identify intercepts and rate of change

In this unit students will learn how to solve systems of linear equations using various methods and how many solutions those systems have

In this unit students will learn how to solve and graph inequalities with one and two variables and compound inequalities

Enduring Understandings

- Linear inequalities have many solutions; they need to be shown on a graph.
- Absolute value inequalities create combined inequalities.
- Apply rules that builds a function that models a relationship between two quantities
- Linear equations can have zero, one, or two solutions.
- Linear Equations in two variables have infinitely many solutions which can be graphed on the coordinate plane.
- Represent equations and inequalities in one variable in various ways and use them to extend the properties of exponents to rational exponents.
- Systems of equations compare at least two different functions.
- Systems of linear equations can be solved by substitution, elimination, and other methods.
- Understand the relationship between quantities of two systems of equations and the methods to solve two system of linear equations.
- Write in equivalent forms that represent both linear and exponential functions and construct functions to describe the situation and to find solutions.

Essential Questions

- How can you recognize parallel or perpendicular lines without graphing them?
- How do you solve and graph linear inequalities with one or two variables?
- What does it mean when the system does not have a single solution?
- Why is it important to analyze functions using different representations?
- Does the system have one, no or infinitely many solutions?
- How do I analyze algebraic equations/inequalities to solve problems?
- How do you graph the solutions of a linear equation in two variables?
- How do you know which method to use in solving a system of equations?
- How do you solve a system of inequalities with two variables?
- How do you solve and graph a linear inequality with one or two variables?
- How do you solve and graph compound inequalities and inequalities containing absolute value?
- How do you solve and graph inequalities involving absolute value?
- How many solutions does a linear equation with two variables have?
- How will students identify the different parts of a twosystem equation and explain their meaning within the context of the problem?
- Is the solution to a system of equations reasonable?
- What are x & y intercepts and how do you find them?
- What does it mean if two lines intersect?
- What is a system of linear equations and how do you solve it?
- What is slope and how is it related to solutions of a system of linear equations?
- What is the importance of identifying the structure of functions and using different ways to represent them?
- What is the slope of the line?
- What method would be most appropriate to solve the system of equations?
- When do students decide the best method to solve an inequality?
- Why is it important to identify and extend the properties of exponents to rational exponents?

Student Learning Objectives (SLOs)

- Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).
- Explain and interpret the definition of functions including domain and range and how they are related; correctly use function notation in a context and evaluate functions for inputs and their corresponding outputs.
- Find approximate solutions of linear equations by making a table of values, using technology to graph and successive approximations.
- Graph equations, inequalities, and systems of inequalities in two variables and explain that the solution to an equation is all points along the curve, the solution to a system of linear functions is the point of intersection, and the solution to a system of inequalities is the intersection of the corresponding half-planes.
- Graph functions by hand (in simple cases) and with technology (in complex cases) to describe linear

relationships between two quantities and identify, describe, and compare domain and other key features in one or multiple representations.

- Solve systems of linear equations in two variables graphically and algebraically. Include solutions that have been found by replacing one equation by the sum of that equation and a multiple of the other.

- Write a function for a geometric sequence defined recursively, whose domain is a subset of the integers.

Standards/Indicators

MA.K-12.1	Make sense of problems and persevere in solving them.
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-12.3	Construct viable arguments and critique the reasoning of others.
MA.F-IF.A.3	Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers.
MA.K-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically.
MA.F-IF.B.5	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
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.K-12.8	Look for and express regularity in repeated reasoning.
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.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.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.

Lesson Titles

- Determining an Equation of a Line
- Equations in Two Variables
- Functions Defined by Equations
- Functions Defined by Tables and Graphs
- Graphing Linear Inequalities
- Linear and Quadratic Functions
- Points, Lines, and Their Graphs
- Slope of a Line
- Systems of Linear Inequalities
- The Slope-Intercept Form of a Linear Equation

Career Readiness, Life Literacies & Key Skills

WRK.K-12.P.1	Act as a responsible and contributing community members and employee.
WRK.K-12.P.4	Demonstrate creativity and innovation.
WRK.K-12.P.5	Utilize critical thinking to make sense of problems and persevere in solving them.
WRK.K-12.P.8	Use technology to enhance productivity increase collaboration and communicate effectively.
WRK.K-12.P.9	Work productively in teams while using cultural/global competence.

Inter-Disciplinary Connections

English

World languages

Arts

Mathematics

Economics

Science

Geography

History

Government

Civics

LA.RL.8	Reading Literature

LA.RST.6-8.4	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6-8 texts and topics.
LA.RST.6-8.7	Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).
LA.WHST.6-8.1.B	Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.
LA.WHST.6-8.2.D	Use precise language and domain-specific vocabulary to inform about or explain the topic.
LA.WHST.6-8.7	Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.
LA.WHST.6-8.9	Draw evidence from informational texts to support analysis, reflection, and research.
	Vocabulary Acquisition and Use
SCI.7-8.5.1.8	All students will understand that science is both a body of knowledge and an evidence-based, model-building enterprise that continually extends, refines, and revises knowledge. The four Science Practices strands encompass the knowledge and reasoning skills that students must acquire to be proficient in science.
SOC.6.1.8	U.S. History: America in the World: All students will acquire the knowledge and skills to think analytically about how past and present interactions of people, cultures, and the environment shape the American heritage. Such knowledge and skills enable students to make informed decisions that reflect fundamental rights and core democratic values as productive citizens in local, national, and global communities.

Instructional Strategies, Learning Activities, and Levels of Blooms/DOK

- Conclude whether a system has one, no or many solutions.
- Decide which method is the most appropriate for a given problem.
- Explain how the graphical intersection of 2 lines relates to the algebraic solution of all systems.
- Find slope given two points and write a linear equation using slope and points
- Graph multiple equations on extra large graph paper and discuss results
- Use substitution, elimination and graphing to solve a system of equations.
- Write a word problem involving a system of linear equations for a partner to solve

Modifications

ELL Modifications

- Frontload information in native language
- Graphic Organizer
- Modify assessments
- Native language support

- Provide completed problems for practice work and homework
- Repeat, reword, clarify
- teaching key aspects of a topic. Eliminate nonessential information
- Vocabulary System, equation, graphically, algebraically
- Word bank

IEP & 504 Modifications

- allow us of calculator
- less questions per page
- make formulas available on assessments
- Provide completed problems for practice work and homework
- reduce homework length
- reword questions so that there are not higher level vocabulary
- Use of visual interactive websites that through the manipulation of graphs represent inequalities.
- Use real-word context examples to demonstrate the meaning of the parts of a system of equations for the students.

G&T Modifications

- Student will create a real world problem where students will build a function that model a relationship between two quantities.
- Students will compare and contrast the properties of a linear equation and linear inequality equation.
- Students will design a word problem that reflects the use of graphing inequalities.
- Students will write a real-life scenario and explain the process needed to solve a system of linear equations with two variables.

At Risk Modifications

- additional help during Academic Enrichment
- breaking larger assignments into shorter tasks
- guided notes
- reducing homework length
- review, restate, reword directions
- slower pacing of materials
- study guides

Formative Assessment

- 5 Questions

- challenge problem
- current events
- mathematics history
- Pair share
- relate to prior knowledge
- senteo
- Stand up
- Thumbs up
- video clips

Summative Assessment

- Project - Line Design
- Quiz - Slope Intercept Form
- Quiz - Solving Multi Step Equations
- Quiz - Writing an Equation of a Line
- Test - Functions
- Test - Solving Equations
- Test - Systems of Equations

Alternative Assessments

Performance tasks
Project-based assignments
Problem-based assignments
Presentations

Benchmark Assessments

Skills-based assessment- math practice

Resources & Materials

- PMI - Functions
- PMI - Systems of Equations
- Structures and Method - Book 1

Technology

- absolute value functions https://www.youtube.com/watch?v=sou8m7HYRiQ
- Chromebook
- desmos.com
- Equatio
- https://www.youtube.com/watch?v=1qHTmxlaZWQ&list=PLg3ARlqF7eXY77EKDmhFnYkok-LBR7XeF
- Interactive Promethean Board
- IXL
- MathXL
- peardeck
- PMI - Functions
- PMI - Systems of Linear Equations
- Slope-Intercept Song https://www.youtube.com/watch?v=_YCwGdiUnKE&t=65s
- Systems by elimination https://www.youtube.com/watch?v=8kRG7jlBMAY
- systems by elimination https://www.youtube.com/watch?v=tphSgpilNv8

TECH.8.1.8	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.
TECH.8.1.8.A.1	Demonstrate knowledge of a real world problem using digital tools.
TECH.8.1.8.A.CS1	Understand and use technology systems.
TECH.8.1.8.A.CS2	Select and use applications effectively and productively.
TECH.8.1.8.B.CS2	Create original works as a means of personal or group expression.
TECH.8.2.8	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.