Unit 1 - Relationships Between Quantities and Reasoning with Equations

Content Area: **Mathematics**
Course(s): **Honors Algebra I 8**
Time Period: **September**
Length: **1**
Status: **Published**

Unit Overview

Unit 1 begins with setting the stage for work with expressions and equations through understanding quantities and the relationships between them. This unit focuses on the use of equations and inequalities to model and solve meaningful problem situations. In previous math courses, students solved problems involving one-and two-step equations and inequalities. In this unit, students solve problems using more complex equations and inequalities. Problem solving situations that involve absolute value are introduced. The students' focus should be on recognizing the need to solve equations and inequalities and extending their ability to apply algebra by making connections to prior knowledge.

In this unit students will learn about variables and symbols how to manipulate them

In this unit students will learn how to solve equations using one step, two steps, or multiple steps, to write unit rates, to solve proportions and to solve a variety of percent problems.

- Represent and solve equations and inequalities graphically.
- Solve equations and inequalities in one variable.
- Solve systems of equations.
- Understand solving equations as a process of reasoning and explain the reasoning.

Enduring Understandings

- The values that define inequalities are graphically represented by either: a set of linear values or the areas represented above or below the linear values.
- Understand the structure of algebraic expressions and polynomials.
- A variable can be used to represent an unknown value, and a sequence of steps can be used to solve for an unknown.
- Algebra techniques can be used to set up equations, translate words into symbols, and translate problems into equations.
- Solve equations and inequalities give all the values of a variable that make the equation/inequality true.
- The order of operations that is used to solve an equation is critical and can drastically change the solutions.
- Understand general linear equations ($y=mx+b$, $m\neq0$) and their graphs and extend this to work with absolute value equations, linear inequalities, and systems of linear equations.
- Understand that numbers in real world applications often have units attached to them, and they are considered quantities.
- Use properties of equality and order of operation to solve an equation by using inverse operations.

Essential Questions

- How can a problem be translated into an equation?
- How do you graphically represent the values that define linear inequalities?
- How would you describe the difference between an expression and an equation?
- In what ways can the skill of solving equations be applied to solve real world problems?
- Why is it important to be able to solve linear equations and inequalities in one variable?
- How are verbal and algebraic models and formulas used to represent real life situations?
- How can an equation be solved when there is a variable on both sides?
- How can rates, ratios, percents, and proportions be applied to problem solving?
- How can the result of an equation be checked?
- How can variables be used to solve problems dealing with consecutive integers?
- How can you apply the rules of multiplication and division?
- How do the properties of equality and order of operations extend to support the solving of an equation?
- How do you graphically represent the solutions to a linear equation?
- How is the distributive property used in an algebraic equation or expression?
- What are linear equations and inequalities?
- What are number operations and algebraic expressions?
- What are relations and functions and how are they related to graphs?
- What are the "pieces" of an algebraic expression?
- What are the steps to solving an equation that involves one or more transformations?
- What do the parts of an expression tell us in a real-world context?
- What do they represent in the context of the real-world situation?
- Why are equations and inequalities useful?

Student Learning Objectives (SLOs)

- Create linear equations and inequalities in one variable and use them to solve problems. Justify each step in the process and the solution.
- Create linear equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
- Interpret terms, factors, coefficients and expressions (including complex linear and exponential expressions) in terms of context.
- Model and describe constraints with linear equations and inequalities and systems of equations and/or inequalities to determine if solutions are viable or non-viable.
- Solve linear equations and inequalities in one variable (Including literal equations). Justify each step in the process and solution.
- Solve multi-step problems that can be represented algebraically with accurate and appropriately defined units, scales, and models (such as graphs, tables, and data displays).

Standards/Indicators

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.A-SSE.A.1	Interpret expressions that represent a quantity in terms of its context.
MA.A-SSE.A.1a	Interpret parts of an expression, such as terms, factors, and coefficients.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.A-SSE.A.1b	Interpret complicated expressions by viewing one or more of their parts as a single entity.
MA.K-12.4	Model with mathematics.
MA.A-SSE.A.2	Use the structure of an expression to identify ways to rewrite it. For example, see $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 - y^2)(x^2 + y^2)$.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.K-12.8	Look for and express regularity in repeated reasoning.
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.
MA.A-CED.A.4	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.
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.B.3	Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
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).

Lesson Titles

- Absolute Value in Open Sentences
- Absolute Values of Products in Open Sentences
- Cost, Income and Value Problems
- Order of Real Numbers
- Problem Solving: Consecutive Integers
- Problem Solving: Using Charts
- Solving Combined Inequalities
- Solving Inequalities
- Solving Problems Involving Inequalities
- Transforming Equations: Addition/Subtraction/Multiplication and Division

- Translating Problems into Equations
- Translating Words into Symbols and Equations
- Using Addition, Subtraction,Multiplication and Division of Real Numbers
- Using Equations to Solve Problems
- Using Equations with the Variable on both Sides
- Using Several Tranformations
- Variables, Grouping Symbols and Equations

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

Vocabulary ---

constant - number

consecutive integers - whole numbers that are all in a row

equation - contains numbers and/or variables and Must contain an Equal sign

inequality - contains numbers and/or variables and uses four inequality symbols

integer - positive or negative whole number

numerical expression - numbers separated by mathematical operations

Order of operations - order that must be followed when there is more than 1 mathematical operation present;

variable - letter or symbol that stands for a number

algebraic expression -variable or number or both separated by mathematical operations

term – number or variable or product or quotient of numbers and variables

power – x to the n

coefficient – numerical factor of a term

solution – replacement value for an equation

identity – an equation that is true for every value of the variable

relation – set of ordered pairs

domain – first set of numbers in ordered pairs of a relation

range – second set of numbers in ordered pairs of a relation

independent variable – value of the variable that determines the output in a relation

dependent variable – variable with a value that is dependent on the value of the independent variable

function – set of points where each input value has only one output value

intercept – point where a graph intersects an axis

line symmetry – each half of a graph one either side of the line matches exactly

end behavior – describes the values of a function at the positive and negative extremes in the domain

formula – rule for the relationship between two quantities

equivalent equations – equations that have the same solution

solve an equation – to find the value of the variable that makes the equation true

ratio – comparison of two numbers using division

proportion - two fractions set equal to each other

unit rate – rate telling how many of one item is being compared to one of another

scale model – proportional model of something too large or too small to use the actual size

percent of change – ratio of change of an amount compared to the original and expressed as a percent

literal equation – equation involving several variables

dimensional analysis – carrying units throughout a computation

weighted average – multiplying the data value by its weight and then find the average

percent - something out of 100

- Vocabulary --- constant - number consecutive integers - whole numbers that are all in a row equation - contains numbers and/or variables and Must contain an Equal sign inequality - contains numbers and/or variables and uses four inequality symbols integer - positive or negative whole number numerical expression - numbers separated by mathematical operations Order of operations - order that must be followed when there is more than 1 mathematical operation present; variable - letter or symbol that stands for a number algebraic expression -variable or number or both separated by mathematical operations term – number or variable or product or quotient of numbers and variables power – x to the n coefficient – numerical factor of a term solution – replacement value for an equation identity – an equation that is true for every value of the variable relation – set of ordered pairs domain – first set of numbers in ordered pairs of a relation range – second set of numbers in ordered pairs of a relation independent variable – value of the variable that determines the output in a relation dependent variable – variable with a value that is dependent on the value of the independent variable function – set of points where each input value has only one output value intercept – point where a graph intersects an

axis line symmetry – each half of a graph one either side of the line matches exactly end behavior – describes the values of a function at the positive and negative extremes in the domain formula – rule for the relationship between two quantities equivalent equations – equations that have the same solution solve an equation – to find the value of the variable that makes the equation true ratio – comparison of two numbers using division proportion - two fractions set equal to each other unit rate – rate telling how many of one item is being compared to one of another scale model – proportional model of something too large or too small to use the actual size percent of change – ratio of change of an amount compared to the original and expressed as a percent literal equation – equation involving several variables dimensional analysis – carrying units throughout a computation weighted average – multiplying the data value by its weight and then find the average percent - something out of 100

LA.RL.8.1	Cite the textual evidence and make relevant connections that most strongly supports an analysis of what the text says explicitly as well as inferences drawn from the text.
LA.RH.6-8.4	Determine the meaning of words and phrases as they are used in a text, including vocabulary specific to domains related to history/social studies.
LA.RH.6-8.5	Describe how a text presents information (e.g., sequentially, comparatively, causally).
LA.RH.6-8.7	Integrate visual information (e.g., in charts, graphs, photographs, videos, or maps) with other information in print and digital texts.
LA.RST.6-8.2	Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.
LA.RST.6-8.3	Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
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	Write arguments focused on discipline-specific content.
LA.WHST.6-8.2	Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.
LA.WHST.6-8.6	Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently.
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.6-8.8	Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.
LA.WHST.6-8.9	Draw evidence from informational texts to support analysis, reflection, and research.
LA.WHST.6-8.10	Write routinely over extended time frames (time for research, reflection, metacognition/self correction, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.
LA.L.8.4	Determine or clarify the meaning of unknown and multiple-meaning words or phrases based on grade 8 reading and content, choosing flexibly from a range of strategies.

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

- Apply the distributive property to find the area and perimeter of figures with sides of variable lengths.
- Apply the distributive property to simplify an expression
- Decide whether a given value is a solution of an equation

- Generalize solutions of equations to solve literal equations involving physical, geometric, and scientific formulas.
- Have students write phrases and pass to a partner to write symbols
- Justify each step in the solution of an equation
- Set up and solve word problems
- Set up word problems with consecutive integers as well as consecutive odd and even integers.
- Students will be able to use mathematical vocabulary to explain orally and in writing parts of an expression/equation/inequality.
- Students will construct response to word problems using sequential words.
- Students will describe the relationship between a linear equation and a system of linear equations.
- Students will explain orally and in writing how to solve equations and will paraphrase another student's explanation of how to solve the same problem.
- SWBAT create and solve equations
- SWBAT create and solve inequalities.
- Translate problems into equations
- Translate words into symbols
- Use absolute value
- Use rates, ratios and percents to model and solve real-life problems
- Use tables and graphs to organize data

Modifications

ELL Modifications

- allowing students to correct errors
- allowing students to select from given choices
- Content specific vocabulary important for ELL students to understand include: expression, equation, coefficient, constant, inverse, opposite, combine, distribute, solution, infinite, each, every, per, altogether, fractions, numerator, denominator, least common denominator (LCD), cross simplify
- Content specific vocabulary important for ELL students to understand include: linear, non-linear, x-values, y-values, vertical, table, graph, equation, interval, slope, relationship
- decreasing the amount of work presented or required
- Familiarity with order of operations, exponents, variables, coefficients, functions, domain, quadrants, x-axis, y-axis, line, fractions, integers, equations, rational numbers, irrational numbers, real numbers, expressions by utilizing sentence stems, language frames, visuals, and cloze reading.
- having peers take notes or providing a copy of the teacher's notes
- KHAN Academy
- reducing the number of answer choices on a multiple choice test .
- Students should become proficient in the use of scientific calculators and graphing calculators to enhance their understanding of mathematical ideas and concepts.

- teaching key aspects of a topic. Eliminate nonessential information .

IEP & 504 Modifications

- An abstract concept is represented in a variety of ways, such as concrete examples, words, symbols, drawings, and acting it out
- Students are encouraged to restate word problems in their own words
- Students are placed in heterogeneous groups for peer assistance and modeling
- Students verbalize what they are doing through words, pictures, and numbers.
- Teachers utilize concrete models such as Algebra tiles for an extended period of time.

G&T Modifications

- Different test items.
- Due to their intuitive understanding of mathematical function and processes, students who are mathematically gifted may skip over steps and be unable to explain how they arrived at the correct answer to a problem. Utilize Math Practice 3 with them often.
- Provide additional rigorous challenge problems for advanced students
- Provide students with a variety of learning/assessment options.
- The increased complexity of the problems should require higher order thinking skills and provide opportunities for open-ended responses.

At Risk Modifications

- additional help during tutoring/Academic Enrichment/HW Clinic
- breaking larger assignments/projects into shorter tasks with clear deadlines for each section
- frequent guidance contact
- frequent parent contact
- guided notes
- modeling
- modeling and showing lots of examples
- review, restate, reword directions
- study guides

Formative Assessment

- 5 Questions
- Challenge Problem
- Current Events
- Math History

- Open-ended Questuins
- Pair share
- PARCC Questions
- Quick Quizzes
- Relate to prior knowledge
- senteo
- Stand up
- Thumbs up
- Video Clips

Summative Assessment

- Marking Period Assessment
- Quiz - Converting word problems into equations
- Quiz - Operations with Real Numbers
- Quiz - Simplifying Expressions
- Quiz - Solving Equations
- Unit Test - Solving Equations and Problems

Alternative Assessments

Performance tasks
Project-based assignments
Problem-based assignments
Presentations

Benchmark Assessments

Skills-based assessment- math practice

Resources & Materials

- Algebra: Structure and Method: Book 1
- PMI - Inequalities
- PMI - System of Equations

Technology

- All I Do Is Solve https://www.youtube.com/watch?v=1qHTmxlaZWQ
- Chromebook
- desmos.com
- dividing monomials https://www.youtube.com/watch?v=fARzeMdPbsk
- Equatio
- graphing calculator
- https://www.youtube.com/watch?v=xfXGgqgJyDE solve equations
- Interactive Promethean Board
- IXL
- MathXL
- PMI - Inequalities
- PMI - System of Equations
- Systems of Equations

https://www.youtube.com/watch?v=1qHTmxlaZWQ&list=PLg3ARlqF7eXY77EKDmhFnYkok-LBR7XeF

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.4	Graph and calculate data within a spreadsheet and present a summary of the results.
TECH.8.1.8.C.CS1	Interact, collaborate, and publish with peers, experts, or others by employing a variety of digital environments and media.
TECH.8.1.8.D.CS1	Advocate and practice safe, legal, and responsible use of information and technology.
TECH.8.1.8.D.CS2	Demonstrate personal responsibility for lifelong learning.
TECH.8.1.8.D.CS3	Exhibit leadership for digital citizenship.
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.