Algebra 1 Unit 2 (HS): Linear Equations, Inequalities & Systems

Unit Focus

The unit begins with students learning to think of equations as a way to represent constraints or limitations on quantities. Students also see that graphs of equations can help us make sense of constraints and identify values that satisfy them. Next, students investigate different ways to express the same relationship or constraint - by analyzing and writing equivalent equations. They look at moves than can transform one equation to an equivalent equation, recognizing that these are the moves we make to solve equations. The focus here is not only on identifying acceptable moves for solving, but also on explaining why these moves keep each subsequent equation true and maintain the solutions of the original equation.

Next, students encounter situations that involve two or more constraints and realize that systems of equations are helpful for representing these constraints. Students learn to solve systems of equations by elimination and explain why the steps taken to eliminate a variable are valid. Additionally, students reinforce their awareness that a system of equations could have one solution, no solutions, or infinitely many solutions.

Finally, students explore inequalities in one and two variables. They see that inequalities are a handy way to express constraints and can be satisfied by a range of values rather than a single value. Students see that a solution to an inequality is a value or a pair of values that make the inequality true and that the solution to a system of inequalities is any pair of values that make both inequalities to the system true.

Stage 1: Desired Results - Key Understandings

Standard(s)

Common Core

Mathematics: 8

- Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form x = a, a = a, or a = b results (where a and b are different numbers). (CCSS.MATH.CONTENT.8.EE.C. 7A)
- Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms. (CCSS.MATH.CONTENT.8.EE.C.7B)

Mathematics: 9-12

- Interpret parts of an expression, such as terms, factors, and coefficients. (CCSS.MATH.CONTENT.HSA.SSE.A.1.A)
- 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. (CCSS.MATH.CONTENT.HSA.CED.A.1)

Transfer

Students will be able to independently use their learning to...

T1 Apply models to solve problems.

T2 Represent situations using mathematical reasoning and symbols

Meaning

Understanding(s)	Essential Question(s)
Students will understand that... **U1** Mathematicians attend to the underlying meaning of quantities and symbols. **U2** Mathematicians create or use models to generalize, represent, and solve problems.	*Students will keep considering...* **Q1** What model best represents this problem? **Q2** What does my solution mean?

Acquisition of Knowledge and Skill

Knowledge	Skill(s)
Students will know... **K1** Vocabulary: constraint, model, equivalent equations, solution, system of equations,	*Students will be skilled at...* **S1** Writing expressions/equations with numbers and letters to represent the quantities in a situation.

Stage 1: Desired Results - Key Understandings

- Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. (CCSS.MATH.CONTENT.HSA.CED.A.2)
- 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. (CCSS.MATH.CONTENT.HSA.CED.A.3)
- 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. (CCSS.MATH.CONTENT.HSA.CED.A.4)
- 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. (CCSS.MATH.CONTENT.HSA.REI.A.1)
- Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. (CCSS.MATH.CONTENT.HSA.REI.B.3)
- 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. (CCSS.MATH.CONTENT.HSA.REI.C.5)
- Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. (CCSS.MATH.CONTENT.HSA.REI.C.6)
- 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). (CCSS.MATH.CONTENT.HSA.REI.D.10)
- Reason abstractly and quantitatively. (CCSS.MATH.MP.2) Model with mathematics. (CCSS.MATH.MP.4)

Madison Public Schools Profile of a Graduate

- Product Creation: Effectively use a medium to communicate important information. (POG.3.2)

substitution, elimination, equivalent systems, system of inequalities

K2 Which quantities in a situation can vary and which ones cannot.

K3 What it means for a value or pair of values to be a solution.

K4 The meaning of each point on a graph of a linear equation.

K5 Whether two expressions are equivalent or not.

K6 Which moves can be made to transform an equation into an equivalent one.

K7 That equations that are not true for any value of the variable(s) do not have solutions.

K8 Rewriting the equation for a line in different forms can make it easier to find certain kinds of information.

K9 That there are multiple ways to perform substitution to solve a system of equations.

K10 That adding or subtracting equations in a system creates a new equation with a solution that coincides with the original system.

K11 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.

K12 That a system of equations could have one solution, no solutions, or infinitely many solutions.

K13 That the solution to an inequality is a range of values.

K14 Whether a point on the boundary of the graph of the solutions to a system of inequalities is a solution or not.

S2 Using patterns to help write equations.

S3 Finding solutions to equations by reasoning about a situation or by using algebra.

S4 Graphing equations in two variables.

S5 Creating equivalent expressions.

S6 Rearranging equations to pin down a certain quantity.

S7 Writing equations in two or more variables.

S8 Solving an equation for a particular variable.

S9 Graphing linear equations in the form ax + by= c and interpret points on the graph in context.

S10 Finding the slope and vertical intercept of a line with equation ax + by = c.

S11 Transforming an equation from ax + by = c into the equivalent form y = mx + b.

S12 Using tables and graphs to solve systems of equations.

S13 Using substitution or elimination to solve a system of equations.

S14 Determining whether a system of equations will have 0, 1, or infinitely many solutions.

S15 Writing inequalities to represent constraints in situations.

S16 Writing and solving one-variable inequalities and interpreting the solutions in terms of the situation.

S17 Graphing the solution to an inequality in one-variable.

S18 Finding the solution to an inequality in two variables.

S19 Writing, interpreting, and graphing solutions to inequalities and systems of inequalities in two variables.

S20 Writing the equation for a line in point-slope form