ALGEBRA 1 SPRINGBOARD

HISD Curriculum: Unit 2.1 Planning Guide

Unit Planning Guide User Information

Unit 2.1 Solving Equations Using Proportional Reasoning and Algebraic Properties, Part 2 Lesson Set: Solving Equations	4 90-minute lessons	or	8 45-minute lessons

HISD Objectives / TEKS

Ⓡ ALGI.1D

Represent relationships among quantities by using and building concrete models, completing tables, constructing graphs or diagrams, writing verbal descriptions, and writing equations or inequalities.

Ⓢ ALGI.3A

Use manipulatives, drawings, verbal descriptions, and symbols to represent unknowns and variables in real-world situations.

Ⓡ ALGI.4A

Find specific function values; add, subtract, multiply, or divide to simplify polynomial expressions; transform and solve equations including factoring as necessary in problem situations which are expressed in verbal, algebraic, or pictorial (algebra tiles) representations.

Ⓢ ALGI.4B

Demonstrate pictorially and algebraically the commutative, associative, and distributive properties to simplify algebraic expressions.

AR Ⓢ ALGI.7A

Analyze situations involving linear functions in forms of a graph, table, equation, or verbal description in order to formulate a linear equation or inequality to solve a problem.

Ⓡ ALGI.7B

Investigate methods for solving linear equations and inequalities using concrete models, graphs, and the properties of equality, select a method, and solve the equations.

PS ALGI(8.14A)

Identify and apply mathematics to everyday experiences, to activities in and outside of school, with other disciplines, and with other mathematical topics.

PS ALGI(8.14D)

Select tools such as real objects, manipulatives, paper/pencil, and technology or techniques such as mental math, estimation, and number sense to solve problems.

PS ALGI(8.15B)

Evaluate the effectiveness of different representations to communicate ideas.

PS ALGI(8.16B)

Validate conclusions using mathematical properties and relationships.

◈ English Language Proficiency Standards	College and Career Readiness Standards
• ELPS C.1a Use prior knowledge and experiences to understand meanings in English. • ELPS C.1g Demonstrate an increasing ability to distinguish between formal and informal English and an increasing knowledge of when to use each one commensurate with grade-level learning expectations. • ELPS C.4d Use prereading supports such as graphic organizers, illustrations, and pretaught topic-related vocabulary and other prereading activities to enhance comprehension of written text.	• CCRS 2.C1 Recognize and use algebraic field properties, concepts, procedures, and algorithms to solve equations, inequalities, and systems of linear equations. • CCRS 2.D1 Interpret multiple representations of equations and relationships. • CCRS 2.D2 Translate among multiple representations of equations and relationships. • CCRS 10.A2 Connect mathematics to the study of other disciplines.

Essential Understandings / Guiding Questions

- Algebraic properties are used to translate verbal expressions to algebraic equations.
  1. Why is the distributive property useful in solving equations?
  2. How are properties used to translate and solve equations?

Essential Understandings / Guiding Questions
• Algebraic equations and expressions model real-world relationships. **1.** Why are equations and expressions useful? **2.** How are like terms combined when there are variables on both sides of the equation? • Proportional relationships can be derived from similarity relationships. **1.** How are proportional relationships derived from similarity relationships? **2.** How are proportions used to represent a problem situation?

Instructional Considerations	**Instructional Strategies / Activities**
Prerequisites and/or **Background Knowledge for Students** In middle school, students studied plotting and identifying inequalities on a number line. In both middle school and in Unit 1 of Algebra I, students solved and interpreted one-step equations. In Unit 1 of Algebra I, students used patterns to generate rules and find solutions for those rules. Students also reviewed all field properties, and made connections to concrete and pictorial representations. In Algebra I Unit 1.2, students solved direct proportions that involved neither two-step equations nor the distributive property. In Algebra I Unit 1.2, students used algebra tiles to create concrete representations of algebraic operations. **Background Knowledge for Teacher** Critical Content • Use the distributive property in multiple representations; • Solve multi-step equations with variables on both sides; • Solve proportions using the distributive property; and • Solve inequalities. Objective ALGI.7A concentrates on translating verbal descriptions and geometric relationships to algebraic equations. Objective ALGI.3A emphasizes the concrete modeling of solving equations with manipulatives and writing equations from real-world activities. Include proportional relationships involving binomials and distributive property. Approach proportionality with more emphasis on common denominators instead of "cross product." **Instructional Accommodations for Diverse Learners** ◈ Situations involving multiple solutions may confuse students who are used to expecting single solutions. However, in Algebra II, students will encounter inequalities and other situations that involve multiple solutions. Therefore, it is critical in Algebra I that they experience an in-depth exploration of inequalities. C.4f	✵ KWL Forming a Magic Square provides an **engagement** game for translating algebraic expressions into algebraic equations. Access student prior knowledge with all vocabulary and symbols they may know to translate from a verbal expression to algebraic expression. (See Resources) When teaching distributive property, students should use tiles or counters to demonstrate multiplication. Challenge them to show multiplication with one digit, two digits, and then eventually with variable expressions. Draw parallels to order of operations (doing parentheses first, then multiplication) versus distributive property (multiplying, then addition/subtraction in parenthesis). Explain this through actual integer values such as 2(3+4), then extend to variable expressions such as $2(x + 4)$. This demonstration through **explorations** assists students to answer guiding questions, "Why is the distributive property used?" and "How are properties used to translate and solve equations?" **Instructional Accommodations for Diverse Learners** ◈ Students should use tiles or cups and counters to demonstrate the process of solving multi-step equations. Using page 1 and page 4 of Cups and Counters, students may explore how to solve equations with variables on both sides. Page 1 will provide a template for paralleling the concrete example of cup and counters to the algebraic steps to solving an equation. Page 4 of the activity gives instructions to the teacher as to variations that students may do such as adding the opposite sign versus reversing the operation. Using algebra tiles also gives the same concrete visualization as cups and counters. (See Resources) C.1g, C.4d ✵ Two-Column Notes Have students create a chart with a topic for changing a concrete/pictorial representation to an algebraic representation. On one side, students translate each step with the manipulatives into pictures; on the other side, students translate each pictorial step into symbolic representations. Allow students to summarize concrete examples to algebraic properties of equations at the bottom of the two-column notes. Students should generate concepts that they are translating into pictures.

Instructional Considerations	Instructional Strategies / Activities
While considering the "Instructional Strategies" column, note the verbs that align with the 5E Lesson Model: **Engage**, **Explore**, **Explain**, **Elaborate**, and **Evaluate**. These cues indicate appropriate strategies, level of rigor, and level of questioning to use during instruction.	**Nonlinguistic Representations** Think-Pair-Share Students should use graphing calculators to solve equations in multiple ways. Allow students to debate which method, solving by graphing or by using tables, better suits a particular goal of a problem. To elaborate, students should write out their justifications for choosing one method over another. **Generating and Testing Hypotheses** Similar Figures is a Gizmo!, an online simulation available at ExploreLearning.com. It allows students to manipulate two similar figures and vary the scale factor to see what changes are possible under similarity. Have students make predictions and then test their predictions by manipulating the figures. Students should write about their findings and share their discoveries with the class. (See Resources) **Cooperative Learning** Revisit Triangular Similarities to prepare students for work with proportionality. Allow students work in pairs and assign one problem to each pair. Give students chart paper to demonstrate their work. (Clean book covers with blank backs work well for this task and your bookroom probably has more than enough.) Have each pair state the property they used to solve their proportion. **Evaluate** whether students can draw conclusions about similar figures or understand the basis of scale factors in proportionality. (See Resources) C.3e Students will solve proportions with only one variable as well as more difficult proportion that will require using distributive property and properties of equations. Discuss with students the similarities and differences in dealing with both levels of difficulty. Relate proportionality to real-world applications such as similarities in geometric shapes.

Assessment Connections

- Prose – as an exit ticket, have students write a short paragraph that details the steps for solving a multi-step linear equation.
- Formative Assessment 2.1 – evaluates students on correct answers in a multiple choice item and their ability to analyze incorrect answer as well.
- SpringBoard Course 3 – Embedded Assessment #1: Education Pays

Resources

Clarifying Activities:	Textbook Resources:	SpringBoard Activities:
• Forming a Magic Square • Cups and Counters • Triangular Similarities	• McDougal-Littell, *Algebra 1*: 2.5 Apply the Distributive Property, pp. 96 – 101 3.3 Solve Multi-Step Equations, pp. 148 – 153 3.6 Solve Proportions with Cross-Products, pp.168 – 175	• *SpringBoard Mathematics with Meaning: Middle School 3* 2.4 Modeling and Solving Multi-Step Equations 3.2 Functions

Unit Planning Guide User Information

Unit 2.1 Solving Equations Using Proportional Reasoning and Algebraic Properties **Lesson Set: Solving Equations and Inequalities**	2 90-minute lessons	or	4 45-minute lessons

HISD Objectives / TEKS

Ⓐ Ⓢ ALGI.7A

Analyze situations involving linear functions in forms of a graph, table, equation, or verbal description in order to formulate a linear equation or inequality to solve a problem.

Ⓡ ALGI.7B

Investigate methods for solving linear equations and inequalities using concrete models, graphs, and the properties of equality, select a method, and solve the equations.

◈ English Language Proficiency Standards	College and Career Readiness Standards
• ELPS C.2e Use visual, contextual, and linguistic support to enhance and confirm understanding of increasingly complex and elaborated spoken language.	• CCRS 2.C1 Recognize and use algebraic field properties, concepts, procedures, and algorithms to solve equations, inequalities, and systems of linear equations. • CCRS 2.C2 Explain the difference between the solution set of an equation and the solution set of an inequality. • CCRS 2.D2 Translate among multiple representations of equations and relationships.

Essential Understandings / Guiding Questions

Algebraic equations and inequalities model real-world relationships.

1. Why are equations and inequalities useful?
2. How are symbols of inequalities read?
3. How are inequalities solved and graphed?
4. How are equations different from inequalities?
5. Why do absolute value equations and inequalities have multiple solutions?

Instructional Considerations

Prerequisites and/or **Background Knowledge for Students**
In middle school, students studied inequalities in relation to ordering numbers, but not formally in solving equations. Some references have been made to plotting and identifying inequalities on a number line.

Background Knowledge for Teacher
Critical Content
- Solve absolute value equations;
- Solve inequalities ; and
- Solve absolute value inequalities.

Build on the formal definition of absolute value to lead students to solving both answers of the equation and inequalities. Reinforce that an absolute value is the distance from zero on a number line and that distance may be on the negative side of zero or the positive.

In Objective ALGI.7A, include verbal descriptions to translate to absolute value equations.

Instructional Strategies / Activities

Summarizing and Note Taking
Build parallel concepts in students' knowledge of solving equations to solving absolute value equations. Have students brainstorm what they know about absolute values. Explain and demonstrate using a number line that an absolute value is the distance from zero on a number line and that distance may be on the negative side of zero or the positive.

◈ Students **engage** in an introduction of inequalities with Which is Bigger – see Resources. This activity will reinforce what students know about inequalities and the use of "less than" and "greater than." C.2e

Instructional Considerations	Instructional Strategies / Activities
When graphing on a number line, the students must show mastery by communicating "why" they are to shade in one direction or the other, not just doing so because the inequality is pointing in a particular direction. Students must also demonstrate an understanding of when to use a shaded or non-shaded circle (open circle or closed circle).	**Identifying Similarities and Differences** Two-Column Notes Parallel the process of solving equations to the process of solving inequalities. Have students work in pairs to **explore** and to examine the similarities and differences between the two processes. Use a two-column table so students can compare solving equations and inequalities. For instance, in equations and inequalities, solving is the reversal of order of operations, such as subtracting a quantity from both sides of the equation or inequality. Have the students summarize what they did differently and similarly in the process. Completing the Process allows students to continue their **exploration** of graphing inequalities on a number line. Extend from students' knowledge of discrete and continuous graphs. Ask students when values are included (closed circle) and when they are the omitted (open circle). Students may complete Inequalities in the Pet Shop individually or in groups as an assessment activity. (See Resources) Continue to **elaborate** by making parallels to the process of solving absolute value inequalities to solving "regular" inequalities. Have students work in pairs on the clarifying activity Absolute Value Inequalities – see Resources. Extend students' knowledge and make comparisons when **exploring** multiple or infinite solutions exhibited by the conjunctions and disjunctions of the solution set. **Explain**, discuss, and relate these concepts on the number line as an intersection or a union of two sets.

Assessment Connections

- Formative Assessment 2.2 – students represent the equation-solving process in various ways.
- SpringBoard Algebra 1 – Embedded Assessment #3: A Healthy Pool

Resources

Clarifying Activities:	Textbook Resources:	SpringBoard Activities:
• Which is Bigger • Completing the Process • Inequalities in the Pet Shop • Absolute Value Inequalities	• McDougal-Littell, *Algebra 1*: 6.5 Solving Absolute Value Equations pp. 392 – 397 6.1 Solving Inequalities Using Addition and Subtraction, pp. 356 – 358 6.2 Solving Inequalities Using Multiplication and Division, pp. 363 – 365 6.3 Solve Multi-step Inequalities, pp. 369 – 371 • 6.6 Solve Absolute Value Inequalities, pp. 398 – 400	• *SpringBoard Mathematics with Meaning: Algebra 1* 1.6 Solving Inequalities 1.7 Absolute Value