

INSTRUCTIONAL FOCUS DOCUMENT

HS/Algebra 1



UNIT: 02 **TITLE: Algebraic Expressions and Equations**

SUGGESTED DURATION: 8 days



State Resources:

Mathematics TEKS Toolkit: Clarifying Activity/Lesson/Assessment
<http://www.utdanacenter.org/mathtoolkit/instruction/alg1.php>

TEXTTEAMS: Algebra 1: 2000 and Beyond: II – Linear Functions; 3. Linear Equations and Inequalities, 3.1 Solving Linear Equations, Act. 1 (Concrete Models), Act. 2 (Using Concrete Models)

RATIONALE:

This unit bundles student expectations that focus on simplifying expressions using properties of algebra, solving equations, and representing solution methods. Students extend the methods used to solve equations in middle school to include functional analysis of graphs and tables using technology.

Prior to this unit, in Grades 7 and 8, students solved equations using concrete models and algebraic manipulation. During this unit, students review these methods and also solve equations by analyzing tables and graphs of functions. The properties of algebra are used to simplify algebraic expressions. Students explain and differentiate between expressions and equations. After this unit, students will apply multiple methods for solving equations and inequalities. Students will also apply properties of algebra to simplify and perform operations with polynomials. These skills are necessary not only in Algebra 1, but in subsequent courses in mathematics.

Focusing on methods for solving linear equations including models, tables, graphs, and the properties of equality is emphasized in the *Texas College and Career Readiness Standards* (TxCCRS): I. Numeric Reasoning B1, C1; II. Algebraic Reasoning A1, B1, C1, C2, D1, D2; VI. Statistical Reasoning B2; VII. Functions A1, B1, B2, C2; IX. Communication and Representation A1, A3, B1, B2, C1; and STAAR Readiness Standards: A.1D, A.4A, and A.7B. Using symbols to represent variables, applying algebraic properties, formulating equations in problem situations, and justifying the reasonableness of solutions are addressed in the STAAR Supporting Standards: A.3A, A.4B, A.7A, and A.7C.

According to the National Council of Teachers of Mathematics (NCTM), *Principles and Standards for School Mathematics* (2000), students should develop an understanding of the algebraic properties that govern manipulation of symbols in expressions, equations, and inequalities. According to *Navigating through Algebra in Grades 9 – 12*:

High school students continue to develop fluency with mathematical symbols and become proficient in operating on algebraic expressions in solving problems. Their facility with representation expands to include equations, inequalities, systems of equations, graphs, matrices, and functions, and they recognize and describe the advantages and disadvantages of various representations for a particular situation. Such facility with symbols and alternative representations enables them to analyze a mathematical situation, choose an appropriate model, select an appropriate solution method, and evaluate the plausibility of their solutions.” (NCTM, 2002, p. 3)

National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics*. Reston, VA: National Council of Teachers of Mathematics, Inc.
National Council of Teachers of Mathematics. (2002). *Navigating through algebra in grades 9 – 12*. Reston, VA: National Council of Teachers of Mathematics, Inc.
Texas Education Agency. (2009). *Texas college and career readiness standards*. Austin, TX: Author.



MISCONCEPTIONS/UNDERDEVELOPED CONCEPTS:

- Some students may think that in the graph or table method of solving the equation, the y -value is the answer instead of the x -value.
- Some students may think that the negative is distributed only to the first term of the expression in parentheses.

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- Some students may think that a constant term can be combined with a variable term (e.g., $2x + 5 = 7x$).

PERFORMANCE INDICATORS	CONCEPTS	KEY UNDERSTANDINGS FOR LEARNERS
<p>Analyze a problem situation that can be represented algebraically by a one- or two-step equation such as the following:</p> <ul style="list-style-type: none"> • At the local HUB's grocery store, the cost of a carton of tamales, c, depends on the number of tamales, t. The cost of the packaging is \$0.25 and each tamale is \$0.50. If a carton contained one dozen tamales, what would be the cost? If the cost of a carton of tamales is \$15.25, how many tamales are in the carton? <p>Create a graphic organizer for the problem situation that includes formulating a representative equation, selecting two different solution methods (concrete model, table, graph, or algebraic method), solving the equation by each method, and interpreting the reasonableness of the solution in terms of the problem situation. (A.3A; A.4A; A.7A, A.7B, A.7C)</p> <p>ELPS 1C; 3D; 5B</p>	<p>Foundation for Functions – Generalizations; Symbols and Variables; Transforming and Solving Equations</p> <p>Linear Functions – Equations</p>	<p>One- and two-step equations can be written to represent problem situations algebraically and solved using a variety of methods. The reasonableness of the solution can be justified in terms of the problem situation.</p>
<p>Use the properties of algebra to simplify algebraic expressions in problem situations such as the following:</p> <ul style="list-style-type: none"> • Find expressions to represent the area and perimeter of a rectangle whose length is represented by $3x + 1$ and whose width is represented by $5x - 6$. <p>Create a display of the problem that includes a diagram of the problem situation, appropriate representative expressions, simplified algebraic expressions, and a summary of the process used to simplify the expressions. (A.4A, A.4B)</p> <p>ELPS 1E; 3J; 5G</p>	<p>Foundation for Functions – Manipulation of Symbols; Simplification of Expressions</p>	<p>The properties of algebra can be used to simplify algebraic expressions in problem situations.</p>

KEY ACADEMIC VOCABULARY SUPPORTING CONCEPTUAL DEVELOPMENT

- **Algebraic expression** – generalization that is a combination of variables, numbers (constants and coefficients), and operations

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KEY ACADEMIC VOCABULARY SUPPORTING CONCEPTUAL DEVELOPMENT
<ul style="list-style-type: none"> • Equation – a mathematical sentence composed of algebraic expressions set equal to each • Evaluating an algebraic expression – simplifying an algebraic expression after replacing variables with assigned numeric values • Simplifying an algebraic expression – determining the most compact or efficient form of an expression by combining like terms and constants without changing the value of the expression • Solving an equation – process of finding the value of a variable that makes the equation true

TEKS#	TEKS	SPECIFICITY
A.1	<p><i>Foundations for functions. The student understands that a function represents a dependence of one quantity on another and can be described in a variety of ways. The student is expected to:</i></p>	
A.1D	<p>Represent relationships among quantities using concrete models, tables, graphs, diagrams, verbal descriptions, equations, and inequalities.</p> <p><i>Readiness Standard</i></p>	<p>Represent</p> <p>RELATIONSHIPS AMONG QUANTITIES</p> <p>Including, but not limited to:</p> <ul style="list-style-type: none"> • Sets of related data • Representations of relationships with and without technology <ul style="list-style-type: none"> • Models <ul style="list-style-type: none"> • Concrete • Pictorial models (e.g., mappings) • Tables • Graphs • Verbal descriptions • Algebraic generalizations <ul style="list-style-type: none"> • Equations <ul style="list-style-type: none"> • $y = 2x + 3$ • Connections between representations of relationships with and without technology • Analysis of data for predictions and conclusions (TxCCRS) <p>Note:</p> <ul style="list-style-type: none"> • In middle school, students generate different representations of data from other representations. (TEKS 8.4A) <p>TxCCRS Note:</p> <p>II. Algebraic Reasoning D1 – Interpret multiple representations of equations and relationships.</p> <p>II. Algebraic Reasoning D2 – Translate among multiple representations of equations and relationships.</p> <p>VI. Statistical Reasoning B2 – Select and apply appropriate visual representations of data.</p> <p>VII. Functions A1 – Recognize whether a relation is a function.</p>

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TEKS# SE#	TEKS	SPECIFICITY
		<p>VII. Functions B1 – Understand and analyze features of a function. VII. Functions B2 – Algebraically construct and analyze new functions. VII. Functions C2 – Develop a function to model a situation. IX. Communication and Representation B1 – Model and interpret mathematical ideas and concepts using multiple representations. IX. Communication and Representation B2 – Summarize and interpret mathematical information provided orally, visually, or in written form within the given context. IX. Communication and Representation C1– Communicate mathematical ideas, reasoning, and their implications using symbols, diagrams, graphs, and words.</p>
A.3	<i>Foundations for functions. The student understands how algebra can be used to express generalizations and recognizes and uses the power of symbols to represent situations. The student is expected to:</i>	
A.3A	<p>Use symbols to represent unknowns and variables.</p> <p style="color: green;"><i>Supporting Standard</i></p>	<p>Use</p> <p>SYMBOLS</p> <p>Including, but not limited to:</p> <ul style="list-style-type: none"> • Representation of an unknown quantity in a problem situation • Representations problem situations with and without technology <ul style="list-style-type: none"> • Models <ul style="list-style-type: none"> • Pictorial models (e.g., diagrams of the problem situation) • Verbal descriptions • Algebraic generalizations • Verbal expressions translated to algebraic expressions using symbols • Problem situation as an expression, equation, or inequality <p>Express, Represent</p> <p>UNKNOWN AND VARIABLES</p> <p>Including, but not limited to:</p> <ul style="list-style-type: none"> • Representation of an unknown quantity in a problem situation • Representations problem situations with and without technology <ul style="list-style-type: none"> • Models <ul style="list-style-type: none"> • Pictorial models (e.g., diagrams of the problem situation) • Verbal descriptions • Algebraic generalizations • Verbal expressions translated to algebraic expressions using symbols • Problem situation as an expression, equation, or inequality <p>Note:</p> <ul style="list-style-type: none"> • In middle school, students use symbols to represent arithmetic sequences.

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TEKS# SE#	TEKS	SPECIFICITY
		TxCCRS Note: VII. Functions B2 – Algebraically construct and analyze new functions. VII. Functions C2 – Develop a function to model a situation. IX. Communication and Representation A1 – Use mathematical symbols, terminology, and notation to represent given and unknown information in a problem. IX. Communication and Representation A3 – Use mathematics as a language for reasoning, problem solving, making connections, and generalizing.
A.4	<i>Foundations for functions. The student understands the importance of the skills required to manipulate symbols in order to solve problems and uses the necessary algebraic skills required to simplify algebraic expressions and solve equations and inequalities in problem situations. The student is expected to:</i>	
A.4A	Find specific function values, simplify polynomial expressions, transform and solve equations, and factor as necessary in problem situations. <i>Readiness Standard</i>	Find FUNCTION VALUES Including, but not limited to: <ul style="list-style-type: none"> • Evaluation of mathematical expressions • Simplification of numeric expressions by order of operations • Evaluation of algebraic expressions when given specific values for variables • Evaluation of functions • Equation notation <ul style="list-style-type: none"> • Ex: If $(2, y)$ is a solution to the equation, find y if $2x - 3y = 7$. Manipulate, Factor, Simplify, Use POLYNOMIAL EXPRESSIONS Including, but not limited to: <ul style="list-style-type: none"> • Concrete models of polynomials • Characteristics of polynomials • Operations with polynomials (addition, subtraction, multiplication) • Algebraic generalization of a data set or problem situation • Problem situations involving simplifying polynomials and operations with polynomials Manipulate, Solve, Transform EQUATIONS Including, but not limited to: <ul style="list-style-type: none"> • Distinction between expressions and equations and the difference between simplifying and solving (TxCCRS) • Types of equations <ul style="list-style-type: none"> • Linear

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TEKS# SE#	TEKS	SPECIFICITY
		<ul style="list-style-type: none"> • Transformation of equations using properties of equality <p>Note:</p> <ul style="list-style-type: none"> • In middle school, students solve equations in one variable using concrete models, pictorial models, and algebraic symbols. <p>TxCCRS Note:</p> <p>I. Numeric Reasoning B1 – Perform computations with real and complex numbers. (Algebra 1 only requires the students to compute with real numbers.)</p> <p>II. Algebraic Reasoning A1 – Explain and differentiate between expressions and equations using words such as “solve”, “evaluate”, and “simplify”.</p> <p>II. Algebraic Reasoning B1 – Recognize and use algebraic (field) properties, concepts, procedures, and algorithms to combine, transform, and evaluate expressions (e.g., polynomials, radicals, rational expressions).</p> <p>II. Algebraic Reasoning C1 – Recognize and use algebraic (field) properties, concepts, procedures, and algorithms to solve equations, inequalities, and systems of linear equations.</p>
A.4B	<p>Use the commutative, associative, and distributive properties to simplify algebraic expressions.</p> <p><i>Supporting Standard</i></p>	<p>Manipulate, Use</p> <p>ALGEBRAIC PROPERTIES</p> <p>Including, but not limited to:</p> <ul style="list-style-type: none"> • Commutative, associative, and distributive properties • Simplification of algebraic expressions • Transformations to solve equations • Problem situations including those involving perimeter, area, and composite figures <p>Simplify</p> <p>ALGEBRAIC EXPRESSIONS</p> <p>Including, but not limited to:</p> <ul style="list-style-type: none"> • Commutative, associative, and distributive properties • Transformations to solve equations • Problem situations including those involving perimeter, area, and composite figures <p>Note:</p> <ul style="list-style-type: none"> • This does not mean identifying properties by name only. <p>TxCCRS Note:</p> <p>II. Algebraic Reasoning A1 – Explain and differentiate between expressions and equations using words such as “solve”, “evaluate”, and “simplify”.</p> <p>II. Algebraic Reasoning B1 – Recognize and use algebraic (field) properties, concepts, procedures, and algorithms to combine, transform, and evaluate expressions (e.g., polynomials, radicals, rational expressions).</p>

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		II. Algebraic Reasoning C1 – Recognize and use algebraic (field) properties, concepts, procedures, and algorithms to solve equations, inequalities, and systems of linear equations.
A.7	<i>Linear functions. The student formulates equations and inequalities based on linear functions, uses a variety of methods to solve them, and analyzes the solutions in terms of the situation. The student is expected to:</i>	
A.7A	<p>Analyze situations involving linear functions and formulate linear equations or inequalities to solve problems.</p> <p><i>Supporting Standard</i></p>	<p>Use, Analyze, Formulate, Solve</p> <p>EQUATIONS FOR PROBLEM SITUATIONS</p> <p>Including, but not limited to:</p> <ul style="list-style-type: none"> • Linear equations representing data collections and problem situations • Representations of data sets and problem situations <ul style="list-style-type: none"> • Tables • Graphs • Verbal descriptions • Algebraic generalizations • Connections between the representations and the representative linear equation <p>Note:</p> <ul style="list-style-type: none"> • In middle school, students solve equations using concrete models, pictorial models, and algebraic symbols. <p>TxCCRS Note:</p> <p>VII. Functions C2 – Develop a function to model a situation. IX. Communication and Representation B2 – Summarize and interpret mathematical information provided orally, visually, or in written form within the given context.</p>
A.7B	<p>Investigate methods for solving linear equations and inequalities using concrete models, graphs, and the properties of equality, select a method, and solve the equations and inequalities.</p> <p><i>Readiness Standard</i></p>	<p>Use, Investigate, Select</p> <p>METHODS FOR SOLVING EQUATIONS</p> <p>Including, but not limited to:</p> <ul style="list-style-type: none"> • Concrete models (e.g., algebra tiles, etc.) • Graphs with and without technology • Tables with and without technology • Transformations using the properties of equality • Relationships and connections between the methods of solution • Distinction between expressions and equations and the difference between simplifying and solving (TxCCRS) <p>Solve</p> <p>EQUATIONS</p>

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		<p>Including, but not limited to:</p> <ul style="list-style-type: none"> • Equations that represent a problem situation or data collection • Missing coordinate of a solution point to a function <ul style="list-style-type: none"> • Ex: If $(x, -4)$ is a solution to the equation $5y - 4x = -8$, what is the value of x? • Appropriate methods for solving particular linear equations <ul style="list-style-type: none"> • Concrete models (e.g., algebra tiles, etc.) • Graphs with and without technology • Tables with and without technology • Transformations using the properties of equality • Relationships and connections between the methods of solution <ul style="list-style-type: none"> • Equations <ul style="list-style-type: none"> • One-dimensional <ul style="list-style-type: none"> • Ex: $x = 2$ and a point on a number line • Two-dimensional <ul style="list-style-type: none"> • Ex: $y = 2x + 3$ or $f(x) = 2x + 3$ and a solid line on a coordinate plane • Ex: $y = 2$ and a horizontal solid line on a coordinate plane • Ex: $x = 2$ and a vertical solid line on a coordinate plane • Distinction between expressions and equations and the difference between simplifying and solving (TxCCRS) <p>Note:</p> <ul style="list-style-type: none"> • In middle school, students solve equations using concrete models, pictorial models, and algebraic symbols. <p>TxCCRS Note:</p> <p>II. Algebraic Reasoning A1 – Explain and differentiate between expressions and equations using words such as “solve”, “evaluate”, and “simplify”.</p> <p>II. Algebraic Reasoning C1 – Recognize and use algebraic (field) properties, concepts, procedures, and algorithms to solve equations, inequalities, and systems of linear equations.</p> <p>II. Algebraic Reasoning C2 – Explain the difference between the solution set of an equation and the solution set of an inequality.</p> <p>IX. Communication and Representation B1 – Model and interpret mathematical ideas and concepts using multiple representations.</p>
A.7C	<p>Interpret and determine the reasonableness of solutions to linear equations and inequalities.</p> <p><i>Supporting Standard</i></p>	<p>Analyze, Interpret, Determine</p> <p>REASONABLENESS OF SOLUTIONS TO EQUATIONS</p> <p>Including, but not limited to:</p> <ul style="list-style-type: none"> • Justification of solutions to equations with and without technology <ul style="list-style-type: none"> • Verbal • Graphical

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		<ul style="list-style-type: none"> • Algebraic by substitution of solutions into original function • Justification of reasonableness of solution in terms of the problem situation or data collection <p>Note:</p> <ul style="list-style-type: none"> • In middle school, students solve equations using concrete models, pictorial models, and algebraic symbols. <p>TxCCRS Note: I. Numeric Reasoning C1 – Use estimation to check for errors and reasonableness of solutions.</p>

<p>The English Language Proficiency Standards (ELPS), as required by 19 Texas Administrative Code, Chapter 74, Subchapter A, §74.4, outline English language proficiency level descriptors and student expectations for English language learners (ELLs). School districts are required to implement ELPS as an integral part of each subject in the required curriculum.</p> <p>– School districts shall provide instruction in the knowledge and skills of the foundation and enrichment curriculum in a manner that is linguistically accommodated commensurate with the student’s levels of English language proficiency to ensure that the student learns the knowledge and skills in the required curriculum.</p> <p>– School districts shall provide content-based instruction including the cross-curricular second language acquisition essential knowledge and skills in subsection (c) of the ELPS in a manner that is linguistically accommodated to help the student acquire English language proficiency.</p> <p>http://ritter.tea.state.tx.us/rules/tac/chapter074/ch074a.html#74.4</p>	
ELPS#	Subsection C: Cross-curricular second language acquisition essential knowledge and skills.
C(1)	<i>Cross-curricular second language acquisition/learning strategies. The ELL uses language learning strategies to develop an awareness of his or her own learning processes in all content areas. In order for the ELL to meet grade-level learning expectations across the foundation and enrichment curriculum, all instruction delivered in English must be linguistically accommodated (communicated, sequenced, and scaffolded) commensurate with the student’s level of English language proficiency. The student is expected to:</i>
1C	Use strategic learning techniques such as concept mapping, drawing, memorizing, comparing, contrasting, and reviewing to acquire basic and grade-level vocabulary.
1E	Internalize new basic and academic language by using and reusing it in meaningful ways in speaking and writing activities that build concept and language attainment.
C(3)	<i>Cross-curricular second language acquisition/speaking. The ELL speaks in a variety of modes for a variety of purposes with an awareness of different language registers (formal/informal) using vocabulary with increasing fluency and accuracy in language arts and all content areas. ELLs may be at the beginning, intermediate, advanced, or advanced high stage of English language acquisition in speaking. In order for the ELL to meet grade-level learning expectations across the foundation and enrichment curriculum, all instruction delivered in English must be linguistically accommodated (communicated, sequenced, and scaffolded) commensurate with the student’s level of English language proficiency. The student is expected to:</i>
3D	Speak using grade-level content area vocabulary in context to internalize new English words and build academic language proficiency.
3J	Respond orally to information presented in a wide variety of print, electronic, audio, and visual media to build and reinforce concept and language attainment.
C(5)	<i>Cross-curricular second language acquisition/writing. The ELL writes in a variety of forms with increasing accuracy to effectively address a specific purpose and audience in all content areas. ELLs may be at the beginning, intermediate, advanced, or advanced high stage of English language acquisition in writing. In order for the ELL to meet</i>

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	<i>grade-level learning expectations across foundation and enrichment curriculum, all instruction delivered in English must be linguistically accommodated (communicated, sequenced, and scaffolded) commensurate with the student's level of English language proficiency. For Kindergarten and Grade 1, certain of these student expectations do not apply until the student has reached the stage of generating original written text using a standard writing system. The student is expected to:</i>
5B	Write using newly acquired basic vocabulary and content-based grade-level vocabulary.
5G	Narrate, describe, and explain with increasing specificity and detail to fulfill content area writing needs as more English is acquired.

SAMPLE