

TEKS Clarification Document

Mathematics– Algebra 2

2011 – 2012



ALGEBRA 2

§111.31. Implementation of Texas Essential Knowledge and Skills for Mathematics, Grades 9-12.

Source: The provisions of this §111.31 adopted to be effective September 1, 1996, 21 TexReg 7371; amended to be effective August 1, 2006, 30 TexReg 4479

§111.33. Algebra II.

(a) Basic understandings.

(1) Foundation concepts for high school mathematics. As presented in Grades K-8, the basic understandings of number, operation, and quantitative reasoning; patterns, relationships, and algebraic thinking; geometry; measurement; and probability and statistics are essential foundations for all work in high school mathematics. Students continue to build on this foundation as they expand their understanding through other mathematical experiences.

(2) Algebraic thinking and symbolic reasoning. Symbolic reasoning plays a critical role in algebra; symbols provide powerful ways to represent mathematical situations and to express generalizations. Students study algebraic concepts and the relationships among them to better understand the structure of algebra.

(3) Functions, equations, and their relationship. The study of functions, equations, and their relationship is central to all of mathematics. Students perceive functions and equations as means for analyzing and understanding a broad variety of relationships and as a useful tool for expressing generalizations.

(4) Relationship between algebra and geometry. Equations and functions are algebraic tools that can be used to represent geometric curves and figures; similarly, geometric figures can illustrate algebraic relationships. Students perceive the connections between algebra and geometry and use the tools of one to help solve problems in the other.

(5) Tools for algebraic thinking. Techniques for working with functions and equations are essential in understanding underlying relationships. Students use a variety of representations (concrete, pictorial, numerical, symbolic, graphical, and verbal), tools, and technology (including, but not limited to, calculators with graphing capabilities, data collection devices, and computers) to model mathematical situations to solve meaningful problems.

(6) Underlying mathematical processes. Many processes underlie all content areas in mathematics. As they do mathematics, students continually use problem-solving, language and communication, and reasoning (justification and proof) to make connections within and outside mathematics. Students also use multiple representations, technology, applications and modeling, and numerical fluency in problem-solving contexts.

Bold, italic black: Knowledge and Skills Statement (TEKS); Bold black: Student Expectation (TEKS)

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ALGEBRA 2

<p>2A.1</p>	<p><i>Foundations for functions. The student uses properties and attributes of functions and applies functions to problem situations. The student is expected to:</i></p>
<p>2A.1A</p>	<p>Identify the mathematical domains and ranges of functions and determine reasonable domain and range values for continuous and discrete situations.</p> <p><i>Readiness Standard</i></p> <p>Use, Apply, Identify, Determine</p> <p>REASONABLE MATHEMATICAL DOMAINS AND RANGES</p> <p>Including, but not limited to:</p> <ul style="list-style-type: none"> • Comparison of discrete and continuous domain • Representations of domain and range with and without technology <ul style="list-style-type: none"> • Tables • Graphs • Verbal descriptions • Algebraic generalizations (including equation and function notation) • Connections among the representations • Notation of domain and range including set builder notation <ul style="list-style-type: none"> • Lists of domain and range in sets (including $f(x)$ for y) • Verbal <ul style="list-style-type: none"> • Ex: Domain is all real numbers; domain is all real numbers greater than five. • Ex: Range is all real numbers less than zero; range is all real numbers. • Symbolic <ul style="list-style-type: none"> • Ex: domain (e.g., $\{x \mid x > 0\}$; $\{x \mid -3 < x < 4\}$; $\{x \mid x \in \mathbb{R}\}$; \emptyset) • Ex: range (e.g., $\{y \mid y \leq 0\}$; $\{y \mid -7 < y \leq 4\}$; $\{f(x) \mid -5 < f(x) \leq 2\}$; $\{y \mid y \in \mathbb{R}\}$; \emptyset) • Determination of scales for graphs and windows on graphing calculators using domain and range • Contextual domain and range of real-world problem situation • Specific range values at given domain values from various representations (e.g., tables, graphs, or algebraic generalizations)

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ALGEBRA 2

	<ul style="list-style-type: none"> • Specific domain values at given range values from various representations (e.g., tables, graphs, or algebraic generalizations) • Domain and range of the problem situation versus the domain and range of the mathematical function <p>Note:</p> <ul style="list-style-type: none"> • In Algebra 1, students determine domain and range using various representations of functions. <p>TxCCRS Note:</p> <p>VII. Functions B1 – Understand and analyze features of a function.</p>
<p>2A.1B</p>	<p>Collect and organize data, make and interpret scatterplots, fit the graph of a function to the data, interpret the results, and proceed to model, predict, and make decisions and critical judgments.</p> <p><i>Readiness Standard</i></p> <p>Collect, Organize</p> <p>DATA</p> <p>Including, but not limited to:</p> <ul style="list-style-type: none"> • Data sets and real-world problem situations • Data collection and analysis with and without the use of technology (e.g., CBR/CBL, graphing calculators, and computers) <ul style="list-style-type: none"> • Ex: measurement activities, experiments, simulations, Internet, etc. • Representations of data with and without technology <ul style="list-style-type: none"> • Tables • Graphs including scatterplots • Verbal descriptions • Algebraic generalizations (including equation and function notation) <p>Use, Make, Interpret, Fit, Model, Apply</p> <p>SCATTERPLOTS AND REPRESENTATIVE FUNCTIONS FOR DATA</p> <p>Including, but not limited to:</p>

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- Data sets and real-world problem situations
- General trends in data
- Data collection and analysis with and without the use of technology (e.g., CBR/CBL, graphing calculators, and computers)
 - Ex: measurement activities, experiments, simulations, Internet, etc.
- Representations of data with and without technology
 - Tables
 - Graphs, including scatterplots
 - Verbal descriptions
 - Algebraic generalizations (including equation and function notation)
- Parent functions as representations of scatterplots of data with and without technology
 - Linear
 - Quadratic
 - Square root
 - Rational
 - Exponential
 - Logarithmic
 - Absolute value
- Linear or non-linear scatterplots using graphing technology
 - Positive linear correlation
 - Negative linear correlation
 - No linear correlation

Model, Predict, Make

DECISIONS AND CRITICAL JUDGEMENTS IN PROBLEM SITUATIONS

Including, but not limited to:

- Data sets and real-world problem situations

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- General trends in the data with and without technology
- Data collection and analysis with and without the use of technology (e.g., CBR/CBL, graphing calculators, and computers)
 - Ex: measurement activities, experiments, simulations, Internet, etc.
- Representations of data with and without technology
 - Tables
 - Graphs including scatterplots
 - Verbal descriptions
 - Algebraic generalizations (including equation and function notation)
- Parent functions as representations of scatterplots of data with and without technology
 - Linear
 - Quadratic
 - Square root
 - Rational
 - Exponential
 - Logarithmic
 - Absolute value
- Linear or non-linear scatterplots using graphing technology
 - Positive linear correlation
 - Negative linear correlation
 - No linear correlation
- Predictions and critical judgments in terms of the scatterplots and representative functions

Note:

- In Algebra 1, students collect and analyze data using various representations, which are then used to make predictions and critical judgments.

TxCCRS Note:

- II. Algebraic Reasoning D1 – Interpret multiple representations of equations and relationships.
- II. Algebraic Reasoning D2 – Translate among multiple representations of equations and relationships.
- III. Geometric Reasoning C2 – Make connections between geometry, statistics, and probability.

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	<p>IV. Measurement Reasoning D1 – Compute and use measures of center and spread to describe data. VI. Statistical Reasoning A1 – Plan a study. VI. Statistical Reasoning B1 – Determine types of data. VI. Statistical Reasoning B2 – Select and apply appropriate visual representations of data. VI. Statistical Reasoning B4 – Describe patterns and departure from patterns in a set of data. VI. Statistical Reasoning C1 – Make predictions and draw inferences using summary statistics. VI. Statistical Reasoning C2 – Analyze data sets using graphs and summary statistics. VI. Statistical Reasoning C3 – Analyze relationships between paired data using spreadsheets, graphing calculators, or statistical software. VII. Functions A2 – Recognize and distinguish between different types of functions. VII. Functions B2 – Algebraically construct and analyze new functions. VII. Functions C1 – Apply known function models. VII. Functions C2 – Develop a function to model a situation. VIII. Problem Solving and Reasoning B2 – Use various types of reasoning. 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. X. Connections A1 – Connect and use multiple strands of mathematics in situations and problems.</p>
<p>2A.2</p>	<p><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></p>
<p>2A.2A</p>	<p>Use tools including factoring and properties of exponents to simplify expressions and to transform and solve equations.</p> <p><i>Supporting Standard</i></p> <p>Use</p> <p>MATHEMATICAL TOOLS</p> <p>Including, but not limited to:</p> <ul style="list-style-type: none"> • Factoring <ul style="list-style-type: none"> • Greatest common factor • Difference of squares • Sum and difference of cubes

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ALGEBRA 2

- Trinomials
- Algebraic properties of equations and inequalities
 - Ex: commutative, associative, distributive, identities, inverses, etc.
- Properties of exponents
 - Zero power
 - Negative exponents
 - Multiplication law of exponents
 - Division law of exponents
 - Power law of exponents
 - Rational exponents

Manipulate, Simplify

EXPRESSIONS

Including, but not limited to:

- Mathematical expressions
 - Evaluation of expressions when given values for variables
 - Simplification of expressions using properties of algebra
 - Polynomial expressions
 - Characteristics of polynomials
 - Classifications of polynomials
 - Operations with polynomials
 - Factoring
 - Algebraic generalization of a data set or problem situation
 - Problem situations involving simplifying polynomials and operations with polynomials
- Functional expressions
 - Equation notation

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ALGEBRA 2

- Ex: If $(2, y)$ is a solution to the equation, find y if $2x - 3y = 7$.
- Ex: Given the equation $y = 2x + 3$, where y is dependent on x , what are the dependent values if $x \in \{-4, 0, 2, 12\}$?
- Function notation
 - Ex: If $(f(x) = 2x - 1)$, find $f(2)$.
 - Ex: If $(f(x) = 2x - 1)$ and $f(x) = 5$, find x .
- Function values using technology (e.g., the table or trace features on the graphing calculator)
- Tools (e.g., exponent rules, factoring, algebraic properties)

Manipulate, Transform, Solve

EQUATIONS AND INEQUALITIES

Including, but not limited to:

- Distinction between expressions and equations and the difference between simplifying and solving (TxCCRS)
- Types of equations and inequalities
 - Linear
 - Quadratic
 - Square root
 - Rational
 - Exponential
 - Logarithmic
- Tools (e.g., factoring, algebraic properties, and rules of exponents)
- Transformation of equations and inequalities using properties of equality and/or properties of inequalities

Note:

- In Algebra 1, students simplify expressions, apply rules of exponents, and solve linear and quadratic equations.

TxCCRS Note:

- II. Algebraic Reasoning A1 – Explain and differentiate between expressions and equations using words such as “solve,” “evaluate,” and “simplify.”
- 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).

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	<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>2A.2B</p>	<p>Use complex numbers to describe the solutions of quadratic equations.</p> <p><i>Supporting Standard</i></p> <p>Use, Describe</p> <p>COMPLEX NUMBERS AS SOLUTIONS TO QUADRATIC EQUATIONS</p> <p>Including, but not limited to:</p> <ul style="list-style-type: none"> • Complex number system <ul style="list-style-type: none"> • Definitions and characteristics of real and imaginary parts • Complex numbers on the graphing calculator • Methods of determining complex solutions <ul style="list-style-type: none"> • Graph of function (indicative of complex solution, does not cross x-axis) • Algebraic manipulation • Quadratic formula <p>Note:</p> <ul style="list-style-type: none"> • In Algebra 1, students solve quadratic equations for real solutions only. <p>TxCCRS Note:</p> <p>I. Numeric Reasoning A2 – Define and give examples of complex numbers.</p>
<p>2A.3</p>	<p><i>Foundations for functions. The student formulates systems of equations and inequalities from problem situations, uses a variety of methods to solve them, and analyzes the solutions in terms of the situations. The student is expected to:</i></p>
<p>2A.3A</p>	<p>Analyze situations and formulate systems of equations in two or more unknowns or inequalities in two unknowns to solve problems.</p> <p><i>Readiness Standard</i></p> <p>Formulate, Use, Solve, Analyze</p>

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