Amarillo ISD— Algebraic Reasoning Standards

Amarillo Independent School District follows the Texas Essential Knowledge and Skills (TEKS). All of AISD curriculum and documents and resources are aligned to the TEKS.

The State of Texas State Board of Education has defined the focal points for Algebraic Reasoning in mathematics in the third paragraph of the introduction to the Texas Essential Knowledge and Skills.

In Algebraic Reasoning, students will build on the knowledge and skills for mathematics in Kindergarten-Grade 8 and Algebra I, continue with the development of mathematical reasoning related to algebraic understandings and processes, and deepen a foundation for studies in subsequent mathematics courses. Students will broaden their knowledge of functions and relationships, including linear, quadratic, square root, rational, cubic, cube root, exponential, absolute value, and logarithmic functions. Students will study these functions through analysis and application that includes explorations of patterns and structure, number and algebraic methods, and modeling from data using tools that build to workforce and college readiness such as probes, measurement tools, and software tools, including spreadsheets.

Unit 1 – Using Patterns to Determine Functions
Unit 2 – Functions and Their Inverses
Unit 3 – Combining Functions in Real-World Applications
Unit 4 – Factoring Polynomials
Unit 5 – Quotients of Polynomials
Unit 6 – Matrices
Unit 7 – Solving Equations; Predicting Reasonable Solutions
Unit 8 – Determining Functions from Real-World Situations
Unit 9 – TSI Review/Semester Review
### First Semester

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<tr>
<th>Unit 1 – Using Patterns to Determine Functions</th>
<th>4 Weeks</th>
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| **AR.2 Patterns and structure.** The student applies mathematical processes to connect finite differences or common ratios to attributes of functions. The student is expected to: | **(A)** determine the patterns that identify the relationship between a function and its common ratio or related finite differences as appropriate, including linear, quadratic, cubic, and exponential functions;  
**(B)** classify a function as linear, quadratic, cubic, and exponential when a function is represented tabularly using finite differences or common ratios as appropriate;  
**(C)** determine the function that models a given table of related values using finite differences and its restricted domain and range; and  
**(D)** determine a function that models real-world data and mathematical contexts using finite differences such as the age of a tree and its circumference, figurative numbers, average velocity, and average acceleration. |
| **AR.3 Patterns and structure.** The student applies mathematical processes to understand the connections among representations of functions and combinations of functions, including the constant function, \( f(x) = x \), \( f(x) = x^2 \), \( f(x) = \sqrt{x} \), \( f(x) = 1/x \), \( f(x) = x^3 \), \( f(x) = 3\sqrt{x} \), \( f(x) = bx \), \( f(x) = |x| \), and \( f(x) = \log_b(x) \) where \( b \) is 10 or \( e \); functions and their inverses; and key attributes of these functions. The student is expected to: | **(A)** compare and contrast the key attributes, including domain, range, maxima, minima, and intercepts, of a set of functions such as a set comprised of a linear, a quadratic, and an exponential function or a set comprised of an absolute value, a quadratic, and a square root function tabularly, graphically, and symbolically;  
**(B)** compare and contrast the key attributes of a function and its inverse when it exists, including domain, range, maxima, minima, and intercepts, tabularly, graphically, and symbolically;  
**(C)** verify that two functions are inverses of each other tabularly and graphically such as situations involving compound interest and interest rate, velocity and braking distance, and Fahrenheit-Celsius conversions; |
| **AR.7 Modeling from data.** The student applies mathematical processes to analyze and model data based on real-world situations with corresponding functions. The student is expected to: | **(A)** represent domain and range of a function using interval notation, inequalities, and set (builder) notation;  
**(B)** compare and contrast between the mathematical and reasonable domain and range of functions modeling real-world situations, including linear, quadratic, exponential, and rational functions;  
**(C)** determine the accuracy of a prediction from a function that models a set of data compared to the actual data using comparisons between average rates of change and |
finite differences such as gathering data from an emptying tank and comparing the average rate of change of the volume or the second differences in the volume to key attributes of the given model; (D) determine an appropriate function model, including linear, quadratic, and exponential functions, for a set of data arising from real-world situations using finite differences and average rates of change; and

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<th>Unit 2 – Functions and Their Inverses</th>
<th>3 Weeks</th>
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<td><strong>AR.3 Patterns and structure.</strong> The student applies mathematical processes to understand the connections among representations of functions and combinations of functions, including the constant function, ( f(x) = x, f(x) = x^2, f(x) = \sqrt{x}, f(x) = \frac{1}{x}, f(x) = x^3, f(x) = \sqrt[3]{x} ), and ( f(x) = \log_b(x) ) where ( b ) is 10 or ( e ); functions and their inverses; and key attributes of these functions. The student is expected to:</td>
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<td>(A) compare and contrast the key attributes, including domain, range, maxima, minima, and intercepts, of a set of functions such as a set comprised of a linear, a quadratic, and an exponential function or a set comprised of an absolute value, a quadratic, and a square root function tabularly, graphically, and symbolically;</td>
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<td>(B) compare and contrast the key attributes of a function and its inverse when it exists, including domain, range, maxima, minima, and intercepts, tabularly, graphically, and symbolically;</td>
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<td>(C) verify that two functions are inverses of each other tabularly and graphically such as situations involving compound interest and interest rate, velocity and braking distance, and Fahrenheit-Celsius conversions;</td>
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<td><strong>AR.7 Modeling from data.</strong> The student applies mathematical processes to analyze and model data based on real-world situations with corresponding functions. The student is expected to:</td>
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<td>(A) represent domain and range of a function using interval notation, inequalities, and set (builder) notation;</td>
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<td>(B) compare and contrast between the mathematical and reasonable domain and range of functions modeling real-world situations, including linear, quadratic, exponential, and rational functions;</td>
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<th>Unit 3 – Combining Functions in Real-World Applications</th>
<th>2 Weeks</th>
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<td><strong>AR.3 Patterns and structure.</strong> The student applies mathematical processes to understand the connections among representations of functions and combinations of functions, including the constant function, ( f(x) = x, f(x) = x^2, f(x) = \sqrt{x}, f(x) = \frac{1}{x}, f(x) = x^3, f(x) = \sqrt[3]{x} ), and ( f(x) = \log_b(x) ) where ( b ) is 10 or ( e ); functions and their inverses; and key attributes of these functions. The student is expected to:</td>
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<td>(D) represent a resulting function tabularly, graphically, and symbolically when functions are combined or separated using arithmetic operations such as combining a 20% discount and a 6% sales tax on a sale to determine ( h(x) ), the total sale, ( f(x) = 0.8x, g(x) = 0.06(0.8x) ), and ( h(x) = f(x) + g(x) );</td>
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| (E) model a situation using function notation when the output of one function is the input of a second function such as determining a function \( h(x) = g(f(x)) = 1.06(0.8x) \) for the
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<tr>
<th><strong>AR.4 Number and algebraic methods.</strong> The student applies mathematical processes to simplify and perform operations on functions represented in a variety of ways, including real-world situations. The student is expected to:</th>
<th><strong>(C)</strong> determine the quotient of a polynomial function of degree three and of degree four when divided by a polynomial function of degree one and of degree two when represented tabularly and symbolically; and <strong>(D)</strong> determine the linear factors of a polynomial function of degree two and of degree three when represented symbolically and tabularly and graphically where appropriate.</th>
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<tr>
<td><strong>Unit 4 – Factoring Polynomials</strong></td>
<td><strong>8 Weeks</strong></td>
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<td><strong>AR.4 Number and algebraic methods.</strong> The student applies mathematical processes to simplify and perform operations on functions represented in a variety of ways, including real-world situations. The student is expected to:</td>
<td>(C) connect tabular representations to symbolic representations when adding, subtracting, and multiplying polynomial functions arising from mathematical and real-world situations such as applications involving surface area and volume; (B) compare and contrast the results when adding two linear functions and multiplying two linear functions that are represented tabularly, graphically, and symbolically;</td>
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<tr>
<td><strong>Unit 5 – Quotients of Polynomials</strong></td>
<td><strong>2 Weeks</strong></td>
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<td><strong>AR.4 Number and algebraic methods.</strong> The student applies mathematical processes to simplify and perform operations on functions represented in a variety of ways, including real-world situations. The student is expected to:</td>
<td>(C) determine the quotient of a polynomial function of degree three and of degree four when divided by a polynomial function of degree one and of degree two when represented tabularly and symbolically; and</td>
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### Unit 6 – Matrices

**AR.5 Number and algebraic methods.** The student applies mathematical processes to represent, simplify, and perform operations on matrices and to solve systems of equations using matrices. The student is expected to:

- (A) add and subtract matrices;
- (B) multiply matrices;
- (C) multiply matrices by a scalar;
- (D) represent and solve systems of two linear equations arising from mathematical and real-world situations using matrices; and
- (E) represent and solve systems of three linear equations arising from mathematical and real-world situations using matrices and technology.

### Unit 7 – Solving Equations; Predicting Reasonable Solutions

**AR.6 Number and algebraic methods.** The student applies mathematical processes to estimate and determine solutions to equations resulting from functions and real-world applications with fluency. The student is expected to:

- (A) estimate a reasonable input value that results in a given output value for a given function, including quadratic, rational, and exponential functions;
- (B) solve equations arising from questions asked about functions that model real-world applications, including linear and quadratic functions, tabularly, graphically, and symbolically; and
- (C) approximate solutions to equations arising from questions asked about exponential, logarithmic, square root, and cubic functions that model real-world applications tabularly and graphically.

### Unit 8 – Determining Functions from Real-World Situations

**AR.7 Modeling from data.** The student applies mathematical processes to analyze and model data based on real-world situations with corresponding functions. The student is expected to:

- (C) determine the accuracy of a prediction from a function that models a set of data compared to the actual data using comparisons between average rates of change and finite differences such as gathering data from an emptying tank and comparing the average rate of change of the volume or the second differences in the volume to key attributes of the given model;
- (D) determine an appropriate function model, including linear, quadratic, and exponential functions, for a set of data arising from real-world situations using finite differences and average rates of change; and
- (E) determine if a given linear function is a reasonable model for a set of data arising from a
To ensure that every student has an opportunity to learn, understand and demonstrate the Texas Essential Knowledge and Skills, Amarillo Independent has adopted the following protocols for teachers, curriculum and others to use in reference to Curriculum, Instruction and Assessment.

### Curriculum
1) Prioritize essential learning based on AISD written curriculum and adhere to the scope and sequence.
2) Develop deep understandings of the AISD written curriculum with an emphasis on the essential learning outcomes.
3) Create relevant learning environments in every classroom using the AISD written curriculum.
4) Analyze vertical and horizontal alignment to ensure grade level curriculum is being taught.

### Instruction
1) Common lessons are developed based on strategically selected grade level TEKS and include learning opportunities for students that:
   - are at the expected level of thinking and rigor
   - utilize research based instructional strategies
   - are actively engaging
   - have real world applications
2) Collaboratively align instruction to assessment.
3) Individual student instructional needs are considered and addressed in the lessons.
4) Strategic re-teaching when students do not understand.
5) Common lessons are analyzed and strengthened through a continuous improvement process such as the Professional Teaching Model, Lesson Study or other method for collaborative study and sharing.

### Assessment
1) Collaboratively align all assessment to the AISD written curriculum and reflect appropriate rigor.
2) Collaboratively engage in purposeful dialogue about assessment tied to clearly defined essential learning outcomes.
3) Continuously improve and adjust instruction based on common assessment results and student work.
4) Provide feedback to the annual curriculum feedback and revision process.