Texas Mathematics

Algebraic Reasoning

Adopted 2015

Mathematical process standards

1. The student uses mathematical processes to acquire and demonstrate mathematical understanding. AR.9-12.1

(A) apply mathematics to problems arising in everyday life, society, and the workplace AR.9-12.1.A

(B) use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution AR.9-12.1.B

(C) select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems AR.9-12.1.C

(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate AR.9-12.1.D

(E) create and use representations to organize, record, and communicate mathematical ideas AR.9-12.1.E

(F) analyze mathematical relationships to connect and communicate mathematical ideas AR.9-12.1.F

(G) display, explain, or justify mathematical ideas and arguments using precise mathematical language in written or oral communication AR.9-12.1.G

Patterns and structure

2. The student applies mathematical processes to connect finite differences or common ratios to attributes of functions AR.9-12.2

(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 AR.9-12.2.A

(B) classify a function as linear, quadratic, cubic, and exponential when a function is represented tabularly using finite differences or common ratios as appropriate AR.9-12.2.B

(C) determine the function that models a given table of related values using finite differences and its restricted domain and range AR.9-12.2.C

(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.9-12.2.D

(3) The student applies mathematical processes to understand the connections among representations of functions and combinations of functions, including the constant function, $f(x) = x$, $f(x) = x^2$, $f(x) = \sqrt{x}$, $f(x) = 1/x$, $f(x) = x^3$, $f(x) = \sqrt[3]{x}$, $f(x) = bx$, $f(x) = |x|$, and $f(x) = \log_b(x)$ where b is 10 or e; functions and their inverses; and key attributes of these functions AR.9-12.3

(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 AR.9-12.3.A

(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 AR.9-12.3.B

(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.9-12.3.C

(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 $h(x) = f(x) + g(x)$ AR.9-12.3.D

(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 final purchase price, h(x) of an item with price x dollars representing a 20% discount, $f(x) = 0.8x$ followed by a 6% sales tax, $g(x) = 1.06x$ AR.9-12.3.E

(F) compare and contrast a function and possible functions that can be used to build it tabularly, graphically, and symbolically such as a quadratic function that results from multiplying two linear functions AR.9-12.3.F

Number and algebraic methods

4. The student applies mathematical processes to simplify and perform operations on functions represented in a variety of ways, including real-world situations AR.9-12.4

(A) 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 AR.9-12.4.A

(B) compare and contrast the results when adding two linear functions and multiplying two linear functions that are represented tabularly, graphically, and symbolically AR.9-12.4.B

(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 AR.9-12.4.C

(D) determine the linear factors of a polynomial function of degree two and of degree three when represented symbolically and tabularly and graphically where appropriate AR.9-12.4.D

(5) The student applies mathematical processes to represent, simplify, and perform operations on matrices and to solve systems of equations using matrices AR.9-12.5

(A) add and subtract matrices AR.9-12.5.A

(B) multiply matrices AR.9-12.5.B

(C) multiply matrices by a scalar AR.9-12.5.C

(D) represent and solve systems of two linear equations arising from mathematical and real-world situations using matrices AR.9-12.5.D

(E) represent and solve systems of three linear equations arising from mathematical and real-world situations using matrices and technology AR.9-12.5.E

(6) The student applies mathematical processes to estimate and determine solutions to equations resulting from functions and real-world applications with fluency AR.9-12.6

(A) estimate a reasonable input value that results in a given output value for a given function, including quadratic, rational, and exponential functions AR.9-12.6.A

(B) solve equations arising from questions asked about functions that model real-world applications, including linear and quadratic functions, tabularly, graphically, and symbolically AR.9-12.6.B

(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 AR.9-12.6.C

Modeling from data

7. **The student applies mathematical processes to analyze and model data based on real-world situations with corresponding functions** AR.9-12.7

(A) **represent domain and range of a function using interval notation, inequalities, and set (builder) notation** AR.9-12.7.A

(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** AR.9-12.7.B

(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** AR.9-12.7.C

(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** AR.9-12.7.D

(E) **determine if a given linear function is a reasonable model for a set of data arising from a real-world situation** AR.9-12.7.E