DRAFT Proposed Revisions
Texas Essential Knowledge and Skills (TEKS)
Mathematics, High School

Prepared by the State Board of Education (SBOE) TEKS Review Committees

First Draft, July 2011

In 2010-2011 the Commissioner's Mathematics Advisory Group was convened to offer recommendations regarding the next generation of mathematics standards in Texas. *The Commissioner's Draft of the Texas Mathematics Standards* reflects the recommendations of the Commissioner's Mathematics Advisory Group and a panel of national advisors in mathematics. The SBOE-appointed mathematics TEKS review committees used *The Commissioner's Draft of the Texas Mathematics Standards* as a starting point for their recommendations for revisions to the TEKS.

These draft proposed revisions reflect the recommended changes of the committees to the standards in *The Commissioner's Draft of the Texas Mathematics Standards.* Proposed additions are shown in green font with underlines (additions) and proposed deletions are shown in red font with strikethroughs (~~deletions~~).

Comments in the right-hand column provide explanations for the proposed changes. The following notations were used as part of the explanations:

CRS—information added or changed to align with the Texas College and Career Readiness Standards (CCRS)

ER—information added, changed, or deleted based on expert reviewer feedback

MV—multiple viewpoints from within the committee

VA—information added, changed, or deleted to increase vertical alignment

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III.	Select tools such as real objects, manipulatives, paper/pencil, and technology or techniques such as mental math, estimation, and number sense to solve problems.	
IV.	Communicate mathematical ideas, reasoning, and their implications using symbols, diagrams, graphs, and language.	
V.	Create and use representations to organize, record, and communicate mathematical ideas.	
VI.	Explain, display, or justify mathematical ideas and arguments using precise mathematical language in written or oral communications.	

Algebra I Focal Areas
Linear functions, equations and inequalities
Quadratic functions, equations and inequalities
Exponential functions, equations and inequalities
Number and algebraic methods

Algebra I

Introduction

The desire to achieve education excellence is the driving force behind the Texas Essential Knowledge and Skills for mathematics, guided by the Texas College and Career Readiness Standards. By embedding statistics, probability, and financial literacy, while focusing on fluency and deep understandings, Texas will lead the way in mathematics education and prepare all Texas students for the challenges they will face in the 21st century.

The process standards are integrated at every grade level. When possible, students will apply mathematics to problems arising in everyday life, society and the workplace. Students will 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 as well as the reasonableness of the solution. They will select appropriate tools, including real objects, manipulatives, paper and pencil, and technology and techniques, such as mental math, estimation, and number sense to solve problems. Students will effectively communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language. They will use mathematical relationships to generate solutions and make connections and predictions. Students will create and use representations to organize, record, and analyze mathematical relationships to connect and communicate mathematical ideas. They will display, explain, or justify mathematical ideas and arguments using precise mathematical language in written and oral communications.

In Algebra I, students will build on grade 6-8 Mathematics Texas Essential Knowledge and Skills (TEKS), which provide a foundation in linear relationships, number and operations, and proportionality. Students will study linear, quadratic, and exponential functions and their related transformations, equations, and associated solutions. Students will connect functions and their associated solutions in both mathematical and real-world situations. Students will use technology to collect and explore data and analyze statistical relationships. In addition, students will study polynomials of degree one and two, radical expressions, sequences, and laws of exponents. Students will generate and solve linear systems with two equations and two variables and will create new functions through transformations.

Mathematical Process Standards		
Knowledge and Skills Statement. The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:		VA—Process Standards moved to knowledge and skills statements
	Apply mathematics to problems arising in everyday life, society and the workplace.	
	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 as well as the reasonableness of the solution.	

	Select tools, including ~~such as~~ real objects, manipulatives, paper/pencil, ~~and~~ technology, as appropriate and ~~or~~ techniques, including ~~such as~~ mental math, estimation, and number sense, as appropriate to solve problems.	
	Communicate mathematical ideas, reasoning, and their implications using multiple representations including ~~such as~~ symbols, diagrams, graphs, and language as appropriate.	
	Create and use representations to organize, record, and communicate mathematical ideas.	
	Analyze mathematical relationships to connect and communicate mathematical ideas.	
	~~d~~Display, ~~E~~explain, ~~or~~ justify mathematical ideas and arguments using precise mathematical language in written or oral communications.	

Linear Functions, Equations, and Inequalities.		**A1L**
Knowledge and Skills Statement. The student applies the Mathematical Process Standards when using properties of linear functions to generate and represent in multiple ways, with and without technology, linear equations, inequalities, and systems of equations. The student is expected to:		
A1L01	determine the domain and range of a linear function in mathematical problems ~~and real-world problems~~ and determine reasonable domain and range values for real-world situations, both continuous and discrete	We wanted to include real-world situations, so we needed to add "continuous" and "discrete."
A1L02	generate linear equations in two variables for mathematical and real-world problems.	
A1L03	generate linear inequalities in two variables for mathematical and real-world problems.	
A1L04	generate systems of two linear equations for mathematical and real-world problems.	
A1L05	write ~~an equation of a line~~ equations of lines in various forms including $y = mx + b$, $ax + by = c$, and $y - y_1 = m(x - x_1)$.	We pluralized the subject of the sentence.
A1L05.5	determine the slope of a line given the standard form of a line.	We moved this from the strand "Numerical and Algebraic Methods" to the strand "Linear Functions, Equations, and Inequalities" so that the SEs on standard form could be logically connected.
A1L06	write ~~an equation of a line~~ equations of lines that ~~is~~ are parallel, and lines that are ~~or~~ perpendicular, to the x or y axis, ~~including determining~~ and determine whether ~~its slope is~~ their slopes are ~~0~~ zero or undefined.	We pluralized the subject of the sentence and added clarity to the SE.
~~**Coordinate Geometry**~~		

Knowledge and Skills Statement. The student applies the Mathematical Process Standards when using graphs of linear functions and their related transformations to represent in multiple ways, solve, and determine, with and without technology, the solutions to equations, inequalities, and systems of equations. The student is expected to:		
A1L07	determine the effects on the graph of the parent ~~linear~~ function $f(x) = x$ when $f(x)$ is replaced by $a \cdot f(x)$, $f(x) + d$, $f(x - c)$, $f(b \cdot x)$ for specific values of a, b, c and d.	We added clarity and incorporated expert reviewer's comments to add in vocabulary "parent functions." Professional development note: we believe that teachers may need additional professional development on the concept of determining the effect of b and c.
A1L07.1	express slope as a rate of change for a linear function represented ~~with a table, a graph, and an equation~~ tabularly, graphically, and algebraically.	We moved this SE to the strand "Linear Functions, Equations, and Inequalities" to emphasize the connection of slope to other representations besides algebraic.
A1L07.2	calculate the rate of change of a linear function ~~, given as a table, as a graph, or as an equation,~~ represented tabularly, graphically, and algebraically over a specified interval within ~~a~~ mathematical ~~or~~ and real-world problems.	We moved this SE to the strand "Linear Functions, Equations, and Inequalities" to emphasize the connection of slope to other representations besides algebraic.
A1L08	graph ~~a~~ linear functions on the coordinate plane and determine key features including x-intercept, y-intercept, and slope in mathematical and real-world problems.	We pluralized the subject of the sentence.
A1L09	approximate graphically the solutions ~~graphically~~ to ~~a~~ systems of two linear equations with two variables in mathematical and real-world problems.	We made grammatical changes.
A1L10	graph the solution sets ~~to~~ of ~~a~~ linear inequalit~~y~~ies in two variables on the coordinate plane.	"Set" added per expert recommendation. We pluralized the subject of the sentence.
A1L11	graph the solution sets ~~to~~ of ~~a~~ systems of two linear inequalit~~y~~ies in two variables on the coordinate plane.	"Set" added per expert recommendation. We pluralized the subject of the sentence.
~~**Linear Functions and Data**~~		

Knowledge and Skills Statement. The student applies the Mathematical Process Standards to formulate and determine the reasonableness of statistical relationships based on real-world data. The student is expected to:		
A1L12	determine, using technology, the correlation coefficient between two quantitative variables and interpret this quantity as a measure of the strength of the linear association ~~between two quantitative variables~~.	We made grammatical changes.
A1L13	~~differentiate between~~ compare and contrast association and causation in real-world problems.	Notes for professional development: we want teachers to differentiate between association and causation in real-world problems. A strong correlation does not imply a cause and effect relationship.
A1L14	determine, when appropriate, ~~a~~ linear equations that provide~~s~~ a reasonable fit to bivariate data in ~~a~~ scatter plots to approximate solutions to real-world problems and to make predictions.	We pluralized the subject of the sentence.
~~**Solving Linear Equations, Inequalities, and Systems of Equations**~~		
Knowledge and Skills Statement. The student applies the Mathematical Process Standards to solve and determine, with and without technology, the reasonableness of solutions to linear equations, inequalities, and systems of equations. The student is expected to:		
A1L15	solve linear equations for mathematical and real-world problems.	
A1L16	determine the reasonableness, including ~~using~~ the use of appropriate units, of ~~a~~ solutions to ~~a~~ linear equations as applied to mathematical and real-world problems.	We pluralized the subject of the sentence.
A1L17	solve linear inequalities in two variables, including solving inequalities for which the application of the distributive property is necessary and involves variables on both sides of the inequality.	
A1L18	determine the reasonableness, including ~~using~~ the use of appropriate units, of ~~a~~ solution sets to linear inequalities as applied to mathematical and real-world problems.	"Set" added per expert recommendation. We pluralized the subject of the sentence.
A1L19	solve ~~algebraically~~ ,using algebraic methods, systems of two linear equations with two variables for mathematical and real-world problems.	We made grammatical revisions.
A1L20	determine the reasonableness, including ~~using~~ the use of appropriate units, of ~~a~~ solutions to ~~a~~ systems of linear equations as applied to mathematical and real-world problems.	We pluralized the subject of the sentence.

Quadratic Functions~~,~~ and Equations~~, and Inequalities.~~		**A1Q**
Knowledge and Skills Statement. The student applies the Mathematical Process Standards when using properties of quadratic functions to generate and represent in multiple ways, with and without technology, quadratic equations. The student is expected to:		
~~Representation~~		
A1Q01	determine the domain and range of ~~a~~ quadratic functions in mathematical and real-world problems.	We pluralized the subject of the sentence.
~~A1Q02~~	~~apply the Remainder Theorem to a quadratic function. [For a quadratic polynomial q(x) and a number a, the remainder on division of q(x) by x – a is q(a), so q(a) = 0 if and only if (x – a) is a factor of q(x).]~~	In conversations with the Algebra II team, it was decided that this would be covered in
A1Q03	write ~~the~~ equations of ~~a~~ quadratic functions in various ~~standard and vertex~~ forms including $f(x) = ax^2 + bx + c$ and $f(x) = a(x – h)^2 + k$.	We pluralized the subject of the sentence. The change from "standard" and "vertex" to the actual equation form was made per expert reviewer comment, and is consistent with wording in the "Linear Functions, Equations, and Inequalities" strand of this document.
A1Q06.5	Determine quadratic functions when given the ~~roots~~ solutions ~~or~~ and graphs of their related equations.	We moved this from the strand "Numerical and Algebraic Methods" to the strand "Quadratic Functions and Equations" so that the SE could be logically connected to solutions and representations of quadratic equations and functions.
~~Coordinate Geometry~~		
Knowledge and Skills Statement. The student applies the Mathematical Process Standards when using graphs of quadratic functions and their related transformations to represent in multiple ways, solve, and determine, with and without technology, the solutions to equations. The student is expected to:		
A1Q04	determine the effects on the graph of the parent ~~quadratic~~ function $f(x) = x^2$ when $f(x)$ is replaced by $a \cdot f(x)$, $f(x) + d$, $f(x – c)$, $f(b \cdot x)$ for specific values of a, b, c and d.	Professional development note: we believe that teachers may need additional professional development on the concept of determining the effect of b and c. We pluralized the subject of the sentence.

A1Q05	~~relate~~ describe the relationship between the linear factors of ~~a~~ quadratic expressions ~~to~~ and the zeros of ~~the~~ their associated quadratic functions.	We clarified the verb per expert request. We pluralized the subject of the sentence.
A1Q06	graph ~~a~~ quadratic functions on the coordinate plane and determine key features, if possible, including *x*-intercept, *y*-intercept, zeros, maximum value, minimum values, vertex, and axis of symmetry in mathematical and real-world problems.	We pluralized the subject of the sentence.
Knowledge and Skills Statement. The student applies the Mathematical Process Standards to solve and determine, with and without technology, the reasonableness of solutions to quadratic equations. The student formulates and determines the reasonableness of quadratic relationships based on real-world data. The student is expected to:		
~~Solving Equations~~		
A1Q07	solve quadratic equations, having real ~~roots~~ solutions in mathematical and real-world problems, by inspection (~~e.g.,~~ such as $x^2 = a^2$), factoring, taking square roots, completing the square, and applying the quadratic formula.	We changed "roots" to "solutions" to vertically align with Algebra II.
A1Q08	determine the reasonableness, including using the appropriate units, of ~~a~~ solutions to ~~a~~ quadratic equations ~~applied~~ in both mathematical and real-world problems.	We added clarity and pluralized the subject of the sentence.

~~Other~~ Exponential Functions~~,~~ and Equations~~, and Inequalities~~.		**A1E**
Knowledge and Skills Statement. The student applies the Mathematical Process Standards when using properties of exponential functions and their related transformations to formulate, graph, represent in multiple ways, solve, and determine, with and without technology, the reasonableness of solutions to exponential equations. The student formulates and determines the reasonableness of exponential relationships based on real-world data. The student is expected to:		
~~**Representation**~~		
A1E01	determine the domain and range of ~~an~~ exponential functions of the form $f(x) = a \cdot b^x$ in mathematical and real-world problems.	We pluralized the subject of the sentence.
A1E02	determine the meaning of the values of *a* and *b* in ~~an~~ exponential functions of the form $f(x) = a \cdot b^x$ in mathematical and real-world problems.	We pluralized the subject of the sentence. An expert suggested that we include the meaning of the variable *x*. We feel that professional development activities should discuss the meaning of *x* and *f(x)*, and make connections to law of exponents and domain and range.

A1E03	generate ~~an~~ exponential functions in the form $f(x) = a \cdot b^x$ (where b is a rational number) to describe problems arising from mathematical and real-world situations including growth and decay.	We pluralized the subject of the sentence.
A1E04	graph ~~an~~ exponential functions that models ~~s~~ growth ~~or~~ and decay and determine key features including x-intercept, y-intercept, and asymptotes in mathematical and real-world problems.	We pluralized the subject of the sentence and added clarity.
A1E05	identify an exponential function that approximately fits data graphed on a scatter plot to approximate solutions and make predictions for real-world problems.	We wanted to parallel the language used in A1L14.

Number and Algebraic Methods.		**A1A**
Knowledge and Skills Statement: The student applies the Mathematical Process Standards to use algebraic methods to transform and perform operations on polynomial expressions. The student is expected to:		
A1A11	determine the sum~~,~~ and difference~~, and product~~ of polynomials of degree one ~~or~~ and degree two.	We split A1A11 so that sum and difference would be considered separately from product of polynomials, as per expert recommendation.
A1A11.5	determine the ~~sum, difference, and~~ product of polynomials of degree one ~~or~~ and degree two.	
A1A12	determine the quotient of a polynomial of degree ~~of~~ one ~~or~~ and degree two when divided by a polynomial of degree one ~~or~~ and degree two.	We made revisions to add clarity.
A1A13	determine the factors of ~~a~~ polynomials of degree one ~~or~~ and degree two and write the polynomials in factored form.	We made revisions to add clarity.
A1A14	determine the factors, if possible, of simple trinomials (trinomials of the form $ax^2 + bx + c$, where $a = 1$).~~of degree one or two.~~	We made revisions to add clarity.
A1A16	determine if a binomial can be written as the difference of two squares and, if possible, use the structure of a difference of two squares to rewrite it: ~~transform it to illustrate this structure,~~ such as ~~rewriting the expression~~ transform $49x^4 - y^4$ ~~=~~ to $(7x^2)^2 - (y^2)^2$, ~~=~~ and then factor as $(7x^2 + y^2)(7x^2 - y^2)$.	We made revisions to add clarity and to incorporate expert suggestions.
A1A17	transform polynomial expressions with degree ~~of~~ one ~~or~~ and degree two to equivalent forms using the distributive property, such as transform $(4x)(x - 2)$ as $(4x)(x) - (4x)(2)$, and then write as $4x^2 - 8x$, or $4x^2 - 8x$ to $(4x)(x) - (4x)(2)$, and then factor as $(4x)(x - 2)$.	We made revisions to add clarity and to incorporate expert suggestions.
Knowledge and Skills Statement: The student applies the Mathematical Process Standards to use algebraic methods to transform algebraic expressions. The student is expected to:		
A1A01	transform radical expressions involving square roots to solve mathematical and real-world problems.	In professional development, it needs to be clarified what "transform" means.
A1A09	transform algebraic expressions using the laws of integer exponents.	

A1A10	extend ~~previous understandings of~~ the laws of integral exponents to the corresponding laws for rational exponents.	"Students' previous understandings" cannot be presumed or predicted.
Knowledge and Skills Statement: The student applies the Mathematical Process Standards to use algebraic methods to analyze, evaluate, generate, and manipulate relations and functions. The student is expected to:		
A1A02	determine whether ~~a~~ relations represented ~~with words, a table, graph, or symbols~~ verbally, tabularly, graphically, and symbolically define~~s~~ a function.	In professional development, note that "symbolically" includes algebraic, mapping and set notation representations.
A1A06	~~Determine~~ evaluate ~~the value of a linear, quadratic, or exponential~~ functions, expressed in function notation, given ~~an~~ one or more element~~s~~ in ~~its~~ their domains. ~~such as finding f(2) if f(x) = x + 4.~~	We pluralized the subject of the sentence and added clarity; the example is not necessary.
A1A07	identify terms of ~~an~~ arithmetic ~~or~~ and geometric sequences when the sequences ~~is~~ are given in function form ~~or~~ and given in recursive form.	We pluralized the subject of the sentence and added clarity.
A1A08	~~find a formula for the general~~ generate a formula to determine the nth term of ~~an~~ arithmetic ~~or~~ and geometric sequences, given several of ~~its~~ their terms.	We pluralized the subject of the sentence and added verb clarification.
A1A18	solve ~~a literal equation~~ mathematic and scientific formulas, and other literal equations, for a specified variable.	Revision made per comment from expert reviewer.
~~A1A03~~	~~calculate the rate of change of a linear function , given as a table, as a graph, or as an equation, represented tabularly, graphically, or algebraically over a specified interval within a mathematical or real-world problem.~~	We moved this to the strand "Linear Functions, Equations, and Inequalities."
~~A1A04~~	~~express slope as a rate of change for a linear function represented with a table, a graph, and an equation tabularly, graphically, or algebraically.~~	We moved this to the strand "Linear Functions, Equations, and Inequalities."
~~A1A05~~	~~determine the slope of a line given the standard form of a line.~~	We moved this to the strand "Linear Functions, Equations, and Inequalities."
~~A1A15~~	~~determine a quadratic function when given the roots or graph of its related equation.~~	We moved to A1Q02b.

Algebra II

Mathematical Process Standards Algebra II		
I.		VA—Process Standards moved to knowledge and skills statements
II.	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.	
III.		
IV.	Communicate mathematical ideas, reasoning, and their implications using symbols, diagrams, graphs, and language.	
V.		
VI.	Explain, display, or justify mathematical ideas and arguments using precise mathematical language in written or oral communications.	

Algebra II Focal Areas
Attributes of functions and their inverses
Systems of equations and inequalities
Quadratic and square root functions, equations and inequalities
Exponential and logarithmic functions and equations and inequalities
Cubic, cube root, absolute value, and rational functions, equations and inequalities
Number and algebraic methods
Data analysis

Algebra II

Introduction

The desire to achieve educational excellence is the driving force behind the Texas Essential Knowledge and Skills for mathematics guided by the Texas College and Career Readiness Standards. By embedding statistics, probability, finance, and focusing on fluency and deep understandings, Texas will lead the way in mathematics education and prepare all Texas students for the challenges they will face in the 21st century.

The process standards are integrated at every grade level. When possible students will apply mathematics to problems arising in everyday life, society and the workplace. Students will 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. They will select tools such as real objects, manipulatives, paper and pencil, and technology or techniques such as mental math, estimation, reasonableness, and number sense to solve problems. Communication of mathematical ideas, reasoning, and their implications using symbols, diagrams, graphs and language will be emphasized. Students will create and use representations to organize, record, and communicate mathematical ideas. They will explain, display, or justify mathematical ideas and arguments using precise mathematical language in written or oral communications.

In Algebra II students build on the foundations from K-8 and Algebra I. Students broaden their knowledge of quadratic functions, exponential functions and systems of equations. They study logarithmic, square root, cubic, cube root, absolute value, rational functions and their related equations. Students connect functions to their inverses and to their associated equations and solutions in both mathematical and real world situations. In addition, students extend their knowledge of data analysis and numeric and algebraic methods.

Mathematical Process Standards		
Knowledge and Skills Statement. The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:		VA—Process Standards moved to knowledge and skills statements
	Apply mathematics to problems arising in everyday life, society and the workplace.	
	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 as well as the reasonableness of the solution.	
	Select tools, including ~~such as~~ real objects, manipulatives, paper/pencil, ~~and~~ technology, as appropriate and ~~or~~ techniques, including ~~such as~~ mental math, estimation, and number sense, as appropriate to solve problems.	
	Communicate mathematical ideas, reasoning, and their implications using multiple representations including ~~such as~~ symbols, diagrams, graphs, and language as appropriate.	
	Create and use representations to organize, record, and communicate mathematical ideas.	

	Analyze mathematical relationships to connect and communicate mathematical ideas.	
	~~d~~Display, ~~E~~explain, ~~or~~ justify mathematical ideas and arguments using precise mathematical language in written or oral communications.	

Attributes of Functions and their Inverses.		**A2F**
Knowledge and Skills Statement. The student applies mathematical processes to understand that functions have distinct key attributes. The student is expected to:		
A2F01	graph the functions $f(x) = b^x, f(x) = log_b(x), f(x) = \|x\|, f(x) = \sqrt{x}$, $f(x) = \frac{~~a~~\ 1}{~~x~~\ x}$, $f(x) = x^3$, $f(x) = \sqrt[3]{x}$ and when applicable determine the key ~~attributes~~ attributes such as domain, range, intercepts, , symmetries, ~~and~~ asymptotic behavior, and relative ~~maximums and minimums~~ maxima and minima given an interval. For the functions $f(x) = b^x$ and $f(x) = \log_b(x)$, b is 2, 10 or e.	ER, Clarity
Knowledge and Skills Statement. The student applies mathematical processes to understand the relationship between a function and its inverse. The student is expected to:		
A2F04	graph the inverse of a function, if it exists, by reflection across the line $y = x$.	
A2F03	~~explain~~ describe and analyze the relationship between a function and its inverse, if it exists, including the restrictions on domains and ranges. (Include quadratic, square root, logarithmic and exponential functions.)	
A2F02	use ~~determine~~ the composition of two functions, including the necessary restrictions on the domain, to determine if the functions are inverses.	
A2F05	~~graph step and other piecewise-defined functions, including the greatest integer function, and when applicable determine key attributes such as domain, range and symmetry in mathematical and real-world problems.~~	Moved to Pre-Calculus

Systems of Equations and Inequalities.		**A2L**
Knowledge and Skills Statement. The student applies mathematical processes to generate systems of equations and inequalities, to use a variety of methods to solve, and to analyze reasonableness of solutions. The student is expected to:		
A2L01	generate systems of equations for mathematical and real-world problems, including systems consisting of three linear equations in three ~~unknowns~~ variables and systems consisting of two equations, the first linear and the second quadratic.	Consistency
A2L03	represent a system of linear equations using a matrix in mathematical and real-world problems. ~~,and explain why it might be an advantage to replace the system by the matrix~~.	ER

A2L04	solve systems of three linear equations ~~with~~ in three variables ~~algebraically~~ in mathematical and real-world problems using algebraic methods with and without matrices. ~~(Include the use of algebraic methods and matrices.)~~	Clarity
A2L08	solve ~~algebraically~~ systems of two equations in two variables made up of a linear equation and a quadratic equation in mathematical and real-world problems algebraically.	Clarity
A2L05	determine the reasonableness, including using the appropriate units, of solutions to systems of three linear equations in three variables in mathematical and real-world problems.	
A2L09	determine the reasonableness, including using the appropriate units, of solutions to systems of a linear equation and a quadratic equation in two variables in mathematical and real-world problems.	
A2L02	generate systems of at least two linear inequalities in two variables to solve mathematical and real-world problems.	
A2L06	solve systems of two or more linear inequalities ~~with~~ in two variables in mathematical and real-world problems. ~~both algebraically and using matrices~~.	Clarity
A2L07	determine the reasonableness, including using the appropriate units, of solutions in the solution set of ~~to~~ systems of two or more linear inequalities in two variables in mathematical and real-world problems.	Clarity

Quadratic~~,~~ and Square Root~~, Cubic and Cube Root~~ Functions, Equations, and Inequalities.	**A2Q**
Knowledge and Skills Statement. The student applies mathematical processes to understand that quadratic and square root functions and quadratic inequalities can be used to model situations, solve problems, and make predictions. The student is expected to:	
A2Q01	generate a quadratic function from a graph having a given vertex, and generate the quadratic function from a graph that contains the vertex and one other specific point. ~~with graph having a given vertex and axis of symmetry~~, and generate ~~a~~ the quadratic function ~~with~~ from a graph that contains ~~two or more~~ three specified points in the plane.	Clarity – Develop the concept of a family of functions progressing to a specific function.
A2Q07	generate the equation of a parabola using given attributes ~~that may include~~ including vertex, focus, directrix, axis of symmetry, direction of opening and focal width in mathematical and real-world problems.	ER
A2Q06	determine the effect on the graph~~s~~ of $f(x) = \sqrt{x}$~~, $f(x) = x^3$, and $f(x) = \sqrt[3]{x}$~~ when *f(x)* is replaced by *a f(x), f(x) + d, f(bx)*, or *f(~~x+c~~ x-c)* for specific positive and negative values of *a,b,c,* and *d.*	Moved to new strand
A2Q05	~~Rewrite~~ transform a quadratic function $f(x) = ax^2 + bx + c$ ~~in~~ to the form $f(x) = a(x-h)^2 + k$ ~~to reveal~~ to identify the different ~~properties~~ attributes of *f(x)* in mathematical and real-world problems.	Clarity – reveal is too vague, transform and attribute maintains consistency
A2Q02	generate square root functions for mathematical and real-world problems.	

A2Q04	generate quadratic~~,~~ and square root~~, cubic, and cube root~~ equations for real-world problems.	Separated strands
A2Q08	solve quadratic and square root equations that may have real or complex ~~roots~~ solutions in mathematical and real-world problems.	Clarity – roots for function, solutions for equations
A2Q11	determine the reasonableness, including using the appropriate units, of a solution to a square root ~~or cube root~~ equation in mathematical and real-world problems.	Moved to new strand
A2Q03	generate quadratic inequalities for mathematical and real-world problems.	
A2Q09	~~give examples showing how extraneous solutions may arise with quadratic equations in real-world problems.~~	MV; Reasonableness of SE
A2Q10	~~solve cube root equations that have real solutions or complex roots in mathematical and real-world problems.~~	Moved to new strand

Exponential and Logarithmic Functions~~,~~ and **Equations**~~, and Inequalities~~**.**	**A2E**
Knowledge and Skills Statement. The student applies mathematical processes to understand that exponential and logarithmic equations can be used to model situations and solve problems. The student is expected to:	
Exponential and Logarithmic Functions	
A2E02	determine the effect on the graphs of $f(x) = b^x$, and $f(x) = log_b(x)$ when *f(x)* is replaced by *a f(x), f(x) + d, f(bx)*, or *f(~~x+c~~ x-c)* for specific positive and negative values of *a,b,c* and *d*.	Consistency with Common Core switch ALL parameters to k Note conflict with the b's
A2E01	generate exponential and logarithmic equations that model real-world situations.	
~~A2A08~~	transform exponential ~~expressions~~ equations to their corresponding logarithmic ~~expressions~~ equations and logarithmic expressions to their corresponding exponential expressions. in mathematical and real-world problems.	Incorrect terminology
A2E03	solve exponential equations of the form $y = a \cdot b^x$ where *a* is a nonzero real number and b is greater than zero and not equal to 1 and single logarithmic equations that have real ~~roots~~ solutions in mathematical and real-world problems.	Consistency
A2E04	determine the reasonableness, including using the appropriate units, of a solution to an exponential equation in mathematical and real-world problems.	Incorrect terminology
A2E05	determine the reasonableness, including using the appropriate units, of a solution to a logarithmic equation in mathematical and real-world problems.	

~~Quadratic, Square Root,~~ **Cubic**, ~~and~~ **Cube Root**, Absolute Value and Rational **Functions, Equations, and Inequalities.**		**A2Q**
Knowledge and Skills Statement. The student applies mathematical processes to understand that cubic and cube root functions can be used to model situations, solve problems, and make predictions. The student is expected to:		
~~A2Q06~~ A2C02	determine the effect on the graphs of ~~$f(x) = \sqrt{x}$,~~ $f(x) = x^3$, ~~and~~ $f(x) = \sqrt[3]{x}$ when *f(x)* is replaced by *a f(x), f(x) + d, f(bx)*, or *f(~~x+c~~ x-c)* for specific positive and negative values of *a,b,c,* and *d.*	Moved to new strand
~~A2Q04~~ A2C01	generate ~~quadratic, square root,~~ cubic~~,~~ and cube root equations for real-world problems.	Moved to new strand
~~A2Q10~~ A2C04	solve cube root equations that have real solutions ~~or complex roots~~ in mathematical and real-world problems.	ER
~~A2Q11~~ A2C05	determine the reasonableness, including using the appropriate units, of a solution to a ~~square root or~~ cube root equation in mathematical and real-world problems.	Moved to new strand
~~A2Q08~~ A2C03	~~solve quadratic and square root equations that may have real or complex roots solutions in mathematical and real-world problems.~~	Moved to new strand
Knowledge and Skills Statement. The student applies mathematical processes to understand that absolute value equations and inequalities can be used to model situations and solve problems. The student is expected to: **Absolute Value Functions, Equations, and Inequalities**		
~~A2E07~~ A2C07	determine the effect on the graphs of $f(x) = \|x\|$ when *f(x)* is replaced by *a f(x), f(x) + d, f(bx)*, or *f(~~x+c~~ x-c)* for specific positive and negative values of *a,b,c* and *d.*	Consistency
~~A2E06~~ A2C06	generate absolute value linear equations that model mathematical and real-world situations.	
~~A2E08~~ A2C08	solve absolute value linear equations that have real solutions ~~or complex roots~~ in mathematical and real-world problems.	Reasonableness of SE
~~A2E09~~ A2C09	solve absolute value linear inequalities in mathematical and real-world problems.	
Knowledge and Skills Statement. The student applies mathematical processes to understand that rational equations can be used to model situations and solve problems. The student is expected to:		

Rational Functions and Equations		
~~A2E11~~ A2C11	determine the effect on the graphs of $f(x) = \frac{a}{x}\frac{1}{x}$, when *f(x)* is replaced by *a f(x), f(x) + d, f(bx)*, or *f(~~x+c~~ x-c)* for specific positive and negative values of *a,b,c,* and *d.*	ER, Consistency
~~A2E10~~ A2C10	generate rational equations that model mathematical and real-world situations.	
~~A2E12~~ A2C12	solve rational equations that have real solutions ~~or complex roots~~ in mathematical and real-world problems.	Reasonableness of SE
~~A2E13~~ A2C13	determine the reasonableness, including using the appropriate units, of a solution to a rational equation in mathematical and real-world problems.	
~~A2E14~~	~~generate examples showing how extraneous solutions may arise with rational equations in real-world problems.~~	Reasonableness of SE

Number and Algebraic Methods.		A2A
Knowledge and Skills Statement. The student applies mathematical processes to understand the importance of skills to transform and perform operations on expressions. The student is expected to:		
A2A02	apply the properties of matrix addition, matrix subtraction, scalar multiplication of a matrix and matrix multiplication in mathematical and real-world problems.	
A2A01	define complex numbers and use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.	In CCRS and Common Core
A2A04	determine the sum, difference, and product of polynomials. ~~in mathematical and real-world problems~~.	Supporting skill for generating and solving equations.
A2A05	~~determine the quotient of a polynomial divided by a binomial in mathematical and real-world problems, including quotients with remainders.~~ determine the quotient of a polynomial of degree three or four when divided by a polynomial of degree one or two.	VA Algebra I; MV
A2A06	apply the Remainder Theorem ~~to determine the linear factors of~~ to a polynomial function. [For a polynomial q(x) and a number a, the remainder on division of q(x) by x – a is q(a), so q(a) = 0 if and only if x – a is a factor of q(x).]	VA Algebra I

A2A10	determine linear and quadratic factors of a polynomial of degree three or four, including factoring the sum and difference of two cubes, when suitable factorizations are available.	Parallels with A2A05
A2A09	determine the sum, difference, product and quotient of simple rational expressions including determining the restrictions on the domain. ~~in mathematical and real-world problems.~~	Supporting skill for generating and solving equations.
A2A07	transform radical expressions that contain variables to equivalent forms. ~~in mathematical and real-world and problems.~~	Supporting skill for generating and solving equations.
A2A03	transform algebraic expressions using the laws of ~~involving~~ rational exponents.	VA Algebra I
~~A2A08~~	~~transform exponential expressions to their corresponding logarithmic expressions and logarithmic expressions to their corresponding exponential expressions. in mathematical and real-world problems.~~	Moved to new strand

Data.		**A2D**
Knowledge and Skills Statement. The student applies mathematical processes to collect data, to generate distribution, and to interpret results to make conclusions. The student is expected to:		
A2D01	~~when appropriate,~~ use the mean and standard deviation of a data set to fit a normal distribution and use it to ~~approximate normal~~ estimate population percentages using tools such as calculators, spreadsheets and tables.	Doesn't start with a verb; stronger alignment with Common Core
A2D02	~~recognize that there are data sets for which it is not appropriate to model with a normal distribution.~~	Embedded in A2D01
A2D03	understand and determine whether data from a generating process ~~such as simulation~~ are consistent with a specified population model.	Stronger alignment with Common Core with clarity
A2D04	distinguish the purposes and differences among sample surveys, experiments and observation studies and the validity of the generalizations for each type of study. ~~including explaining the role of randomization in each type of study and the scope of inference from each type of study.~~	Reasonableness of SE
A2D05	use data from a sample survey to estimate population mean or population proportion. ~~including developing the margin of error through the use of simulation models for random sampling.~~	Reasonableness of SE
A2D06	use data from a statistical study to describe patterns or departures from patterns such as observed differences between two treatments, and describe if practical significance exists.~~randomized experiment to compare two treatments and use simulation to decide if the observed differences are statistically significant.~~	Stronger alignment with CCRS; Reasonableness of SE
A2D07	determine the strengths and weaknesses of reports based on data. ~~when solving problems in real-world situations.~~	Clarity

Geometry

~~Mathematical Process Standards Geometry~~		
~~I.~~	~~Apply mathematics to problems arising in everyday life, society and the workplace.~~	VA—Process Standards moved to knowledge and skills statements
~~II.~~	~~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.~~	
~~III.~~	~~Select tools such as real objects, manipulatives, paper/pencil, and technology or techniques such as mental math, estimation, and number sense to solve problems.~~	
~~IV.~~	~~Communicate mathematical ideas, reasoning, and their implications using symbols, diagrams, graphs, and language.~~	
~~V.~~	~~Create and use representations to organize, record, and communicate mathematical ideas.~~	
~~VI.~~	~~Explain, display, or justify mathematical ideas and arguments using precise mathematical language in written or oral communications.~~	

Geometry Focal Areas
~~Representations connecting algebra and geometry~~ Coordinate and Transformational Geometry
~~Logical argument, proof, congruence and constructions~~ Logical argument and constructions
Proof and congruence
~~Similarity and Trigonometry~~ Similarity, Proof, and Trigonometry
~~Problem solving with surface area and volume~~ Two- and Three-dimensional figures
~~Basic theorems about circles~~ Circles
Probability

Geometry

Introduction

The College and Career readiness standards are the driving force behind the Texas Essential Knowledge and Skills for mathematics. Maintaining a focus on fluency and deep understandings and by embedding statistics and finance, Texas will lead the way in mathematics education to prepare all Texas students for the challenges they will face in the 21st century.

The process standards are integrated at every grade level. When possible students will apply mathematics to problems arising in everyday life, society and the workplace. Students will 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 problem process. They will select tools such as real objects, manipulatives, paper and pencil, and technology or techniques such as mental math, estimation, reasonableness, and number sense to solve problems. Communication of mathematical ideas, reasoning, and their implications using symbols, diagrams, graphs and language will be emphasized. Students will create and use representations to organize, record, and communicate mathematical ideas. They will explain, display, or justify mathematical ideas and arguments using precise mathematical language in written or oral communications.

In Geometry, students build on the foundations from K-8 and Algebra I. Students will explore concepts covering coordinate and transformational geometry; logical argument and constructions; proof and congruence, similarity, proof, and trigonometry; two- and three-dimensional figures; circles; and probability. In the logical arguments and congruence strand, students are expected to create formal constructions using a straight edge and compass. Though this course is primarily Euclidean geometry, students should complete the course with an understanding that non-Euclidean geometries exist. Within the course, students will begin to focus on more precise terminology and symbolic representations, and the development of proofs. Throughout the standards, to "prove" means a formal proof to be shown in a paragraph, flow chart, or two-column formats. Students will strengthen their mathematical reasoning skills in geometric contexts.

Mathematical Process Standards		
Knowledge and Skills Statement. The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:		VA—Process Standards moved to knowledge and skills statements
	Apply mathematics to problems arising in everyday life, society and the workplace.	

	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 as well as the reasonableness of the solution.	
	Select tools, including ~~such as~~ real objects, manipulatives, paper/pencil, ~~and~~ technology, as appropriate and ~~or~~ techniques, including ~~such as~~ mental math, estimation, and number sense, as appropriate to solve problems.	
	Communicate mathematical ideas, reasoning, and their implications using multiple representations including ~~such as~~ symbols, diagrams, graphs, and language as appropriate.	
	Create and use representations to organize, record, and communicate mathematical ideas.	
	Analyze mathematical relationships to connect and communicate mathematical ideas.	
	~~d~~Display, ~~E~~explain, ~~or~~ justify mathematical ideas and arguments using precise mathematical language in written or oral communications.	
~~Representations:~~ ~~Connecting Algebra and Geometry.~~ Coordinate and Transformational Geometry		**GA**
Knowledge and Skills Statement. The student uses the process skills to understand the connections between algebra and geometry and uses the coordinate plane to verify geometric conjectures. The student is expected to:		
GA01	determine the coordinates of a point that is a given fractional distance from one end of a line segment to the other in the coordinate plane, including finding the midpoint.	
GA02	determine an equation ~~with graph~~ of a line parallel or perpendicular to a given line and that passes through a given point.	ER
GA03	Derive and use formulas involving length, slope, and midpoint to verify ~~prove~~ geometric relationships including congruence of segments and parallelism or perpendicularity of pairs of lines ~~using coordinates and algebraic methods~~.	MV, ER- identified specific techniques to verify geometric relationships
~~GA04~~	~~determine the equation of a parabola given its focus and directrix.~~	This SE is addressed in Algebra II. Per ER, more appropriately placed there.
~~GA05~~	~~solve problems with geometric contexts arising from mathematical and real-world situations that include symbolic representations.~~	ER - This is more of a process standard
Knowledge and Skills Statement. The student uses the process skills to generate and describe rigid transformations (translation, reflection, and rotation) and non-rigid transformations (dilations that preserve similarity and reductions and enlargements that do not preserve similarity). The student is expected to:		

GG07	~~Identify~~ describe and perform transformations of figures in a plane using function notation.~~, taking points in the plane as inputs and giving other points as outputs.~~	Moved from Logical Arguments and Constructions ER – Verb changes MV
GG08	determine the image or pre-image of a given two-dimensional figure under a composition of rigid transformations ~~(translation, reflection, rotation) or~~, a composition of non-rigid transformations, and a composition of both, ~~(dilations that preserve similarity and reductions and enlargements that do not preserve similarity). (Sequences include~~ including rotations and dilations where the center can be any point in the plane.~~)~~	Moved from Logical Argument and Constructions MV
GG09	identify the sequence of Euclidean transformations including rotations and reflections that will carry the image of a given figure onto itself in a given number of steps.	Moved from Logical Argument and Constructions
New SE	Identify and distinguish between reflectional and rotational symmetry in an object.	CRS – B2A

Logical Argument~~, Proof, Congruence~~ and Constructions.		**GG**
Knowledge and Skills Statement. The student uses the process skills with inductive reasoning and a variety of tools to understand geometric relationships. The student is expected to:		
GG01	distinguish between undefined terms, definitions, postulates, conjectures, and theorems ~~using mathematical induction and deductive reasoning.~~	
GG02	Identify and determine the validity of the converse, inverse, and contrapositive of a conditional statement and recognize the connection between a biconditional statement and a true conditional statement with a true converse.	MV, CRS
GG03	verify that a conjecture is false using a counterexample~~s~~.	Grammar
GG04	Investigate patterns and make conjectures about geometric relationships, including angles formed by parallel lines cut by a transversal, criteria required for triangle congruence, special segments of triangles, diagonals of quadrilaterals, interior and exterior angles of polygons, and special segments and angles of circles ~~represent formal geometric constructions~~ choosing from a variety of tools such as compass and straightedge, paper folding and dynamic geometric software. ~~(Constructions include duplicating a line segment; duplicating an angle; constructing an angle bisector; finding the midpoint of a line segment; finding a line parallel or perpendicular to a given line through a point not on the line; and constructing the perpendicular bisector of a line segment.)~~	CRS, Constructions were moved to GG05 ER MV

GG05	~~represent the construction of~~ construct congruent segments, congruent angles, a segment bisector, a angle bisector, perpendicular lines, the perpendicular bisector of a line segment, and a line parallel to a given line through a point not on a line using a compass and a straightedge. ~~an equilateral triangle, a square or a regular hexagon inscribed in a circle choosing from a variety of tools such as compass and straightedge, paper folding and dynamic geometric software.~~	MV Common Core
GG06	~~identify key differences between~~ compare geometric relationships ~~within~~ between Euclidean and spherical geometries~~. (Include~~ including parallel lines and the sum of the angles in a triangle.~~)~~	MV
~~**GG07**~~	~~identify transformations of figures in a plane using function notation, taking points in the plane as inputs and giving other points as outputs.~~	Moved to Coordinate and Transformational Geometry
~~**GG08**~~	~~determine the image or pre-image of a given two-dimensional figure under a composition of rigid transformations (translation, reflection, rotation) or non-rigid transformations (dilations that preserve similarity and reductions and enlargements that do not preserve similarity). (Sequences include rotations and dilations where the center can be any point in the plane.)~~	Moved to Coordinate and Transformational Geometry
~~**GG09**~~	~~identify the sequence of Euclidean transformations including rotations and reflections that will carry the image of a given figure onto itself in a given number of steps.~~	Moved to Coordinate and Transformational Geometry
~~**GG10**~~	~~identify congruent figures and their corresponding sides and angles using the definition of congruence in terms of rigid motions.~~	Moved to Proofs and Congruence
~~**GG11**~~	~~prove whether two triangles are congruent by applying the SAS, ASA, AAS or SSS triangle congruence conditions.~~	Moved to Proofs and Congruence
GG12	Verify the Triangle Inequality theorem and apply the theorem to solve mathematical and real-world problems. ~~use the fact that the sum of the measures of the lengths of any two sides of a triangle is greater than the measure of the length of the third side (Triangle Inequality theorem) in mathematical and real-world problems.~~	ER
~~**GG13**~~	~~prove theorems about the relationships between line segments, lines, and angles that are formed choosing from various formats of proof such as paragraph, flow, two-column, coordinate or transformational, and use these relationships to solve problems. (Theorems include vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; and points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.)~~	Moved to Proofs and Congruence

~~GG14~~	~~prove theorems about the angle relationships in triangles choosing from various formats of proof such as paragraph, flow, two-column, coordinate or transformational, and use these relationships to solve problems. (Theorems include measures of interior angles of a triangle sum to 180°; base angles of an isosceles triangle are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.)~~	Moved to Proofs and Congruence
~~GG15~~	~~prove theorems about parallelograms choosing from various formats of proof such as paragraph, flow, two-column, coordinate or transformational, and use these theorems to solve problems. (Theorems include opposite sides are congruent; opposite angles are congruent; the diagonals of a parallelogram bisect each other; and rectangles are parallelograms with congruent diagonals.)~~	Moved to Proofs and Congruence

~~Logical Argument,~~ Proof~~,~~ and Congruence ~~and Constructions.~~		GG
Knowledge and Skills Statement. The student uses the process skills with deductive reasoning to justify, prove and apply theorems by utilizing a variety of methods (coordinate, transformational, axiomatic) and formats (two-column, paragraph, flow chart). The student is expected to:		
GG10	apply the definition of congruence, in terms of rigid transformations, to identify congruent figures and their corresponding sides and angles ~~using the definition of congruence in terms of rigid motions.~~	Moved from Logical Argument and Constructions ER
GG11	prove ~~whether~~ two triangles are congruent by applying the Side-Angle-Side, Angle-Side-Angle, ~~AAS or~~ and Side-Side-Side ~~triangle~~ congruence conditions.	Moved from Logical Argument and Constructions ER
GG13	prove theorems about angles formed by the intersection of lines and line segments ~~the relationships between line segments, lines, and angles that are formed choosing from various formats of proof such as paragraph, flow, two-column, coordinate or transformational~~, and apply ~~use~~ these relationships to solve problems. ~~(Theorems include vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; and points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.)~~	Moved from Logical Argument and Constructions ER
GG14	prove theorems about the ~~angle~~ relationships in triangles, including the sum of interior angles, base angles of isosceles triangles, midsegments, and medians ~~choosing from various formats of proof such as paragraph, flow, two-column, coordinate or transformational,~~ and apply ~~use~~ these relationships to solve problems. ~~(Theorems include measures of interior angles of a triangle sum to 180°; base angles of an isosceles triangle are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.)~~	Moved from Logical Argument and Constructions ER MV

GG15	prove a quadrilateral is a parallelogram using opposite sides, opposite angles, and diagonals, and apply these relationships to solve problems. ~~Prove theorems about parallelograms choosing from various formats of proofs such as paragraph, flow, two-column, coordinate or transformational, and use these theorems to solve problems.(Theorems include opposite sides are congruent; opposite angles are congruent; the diagonals of a parallelogram bisect each other; and rectangles are parallelograms with congruent diagonals.~~	Moved from Logical Argument and Constructions ER MV

Similarity, Proof, and Trigonometry.		**GS**
Knowledge and Skills Statement. The student uses the process skills in applying similarity to solve problems. The student is expected to:		
GS01	apply the definition of similarity in terms of a dilation to identify similar figures and their ~~similarity transformation to determine whether two figures are similar including identifying~~ proportional sides and the congruent corresponding angles.	MV
GS02	apply the Angle-Angle criterion to verify similar triangles and apply the proportionality of the corresponding sides to solve ~~problems~~ mathematical and real-world ~~and mathematical~~ problems.	ER
Knowledge and Skills Statement. The student uses the process skills with deductive reasoning to justify, prove and apply theorems by utilizing a variety of methods (coordinate, transformational, axiomatic) and formats (two-column, paragraph, flow chart). The student is expected to:		
GS03	prove theorems about similar triangles, including the Triangle Proportionality theorem, ~~choosing from various formats of proof such as paragraph, flow, two-column, coordinate or transformational,~~ and apply ~~use~~ these theorems to solve problems. ~~(Theorems include a line parallel to one side of a triangle divides the other two proportionally and conversely and the Pythagorean theorem proved using triangle similarity.)~~	ER MV
GS04	~~prove the theorem that the length of the altitude drawn to the hypotenuse of a right triangle is the geometric mean between the lengths of the segments on the hypotenuse, choosing from various formats of proof such as paragraph, flow, two-column, coordinate, or transformational, and use this theorem to solve problems.~~ Generalize the relationships that exist when an altitude is drawn to the hypotenuse of a right triangle to solve problems.	ER MV
Knowledge and Skills Statement. The student uses the process skills to understand and apply relationships in right triangles. The student is expected to:		
GS05	determine the lengths of sides and measures of angles in a right triangle by applying the trigonometric ratios sine, cosine and tangent in mathematical and real-world problems.	ER MV
GS06	apply the relationships in special right triangles ($30° - 60° - 90°$ and $45° - 45° - 90°$) and the Pythagorean theorem, including Pythagorean triples, in mathematical and real-world problems.	MV

~~Measurement~~ **Two-dimensional and three-dimensional figures.**		**GM**
Knowledge and Skills Statement. The student uses the process skills to recognize characteristics and dimensional changes of two- and three-dimensional figures. The student is expected to:		
~~GM01~~	~~use appropriate units of measure to solve real-world problems, including conversions between measurement systems.~~	Embedded in standards GM04, GM05, GM06, GM07
GM02	identify the shapes of two-dimensional cross-sections of three-dimensional objects and identify three-dimensional objects generated by rotations of two-dimensional shapes ~~objects~~.	Grammar
GM03	determine how changes in the linear dimensions of a shape affect its perimeter, area, surface area or volume including proportional and non-proportional dimensional change.	Clarify
Knowledge and Skills Statement. The student uses the process skills in the application of formulas to determine measures of two- and three-dimensional figures. The student is expected to:		
GM04	~~determine~~ apply the formula for the area of regular polygons ~~and the area of composite two-dimensional figures~~ in mathematical and real-world problems using appropriate units of measure.	MV, added new standard GM07
GM05	~~determine~~ apply the formulas for the total and lateral surface area ~~(where applicable)~~ of three-dimensional figures, including prisms, pyramids, cones, cylinders, spheres and composite figures, in mathematical and real-world problems using appropriate units of measure. ~~(These figures include prisms, pyramids, cones, cylinders, spheres and composite figures. Dimensions may be labeled with single variables.)~~	MV
GM06	~~determine~~ apply the formulas for the volume of three-dimensional figures, including prisms, pyramids, cones, cylinders, spheres and composite figures, in mathematical and real-world problems using appropriate units of measure. ~~(These figures include prisms, pyramids, cylinders, cones, spheres, and composite figures. Dimensions may be labeled with single variables.)~~	MV
GM07 – new SE	Determine the area of composite two-dimensional figures comprised of a combination of triangles, parallelograms, trapezoids, kites, regular polygons, or sectors of circles in mathematical and real world problems using appropriate units of measure.	Created new standard from GM04

Circles.		**GC**
Knowledge and Skills Statement. The student uses the process skills to understand and apply theorems about circles. The student is expected to:		
GC01	~~prove~~ apply theorems about circles, including relationships among inscribed angles, radii, chords, tangents, and secants ~~lines, and line segments, and use these relationships~~ to solve mathematical and real world problems.	CRS, ER

GC02	apply the proportional relationship between the measure of an arc length of a circle and the circumference of the circle in mathematical and real-world problems~~. This includes~~ including the ratio of the length of an arc intercepted by a central angle and the radius of the circle and the radian measure of an angle.	Grammar
GC03	apply the proportional relationship between the measure of the area of a sector of a circle and the area of the circle in mathematical and real-world problems.	
GC04	determine the equation for the graph of a circle with radius r and center (h, k), $(x-h)^2 + (y-k)^2 = r^2$. ~~and justify the derivation of this equation using the Pythagorean theorem and properties of translations.~~	ER, Present in Pre- Calculus

Probability.		**GD**
Knowledge and Skills Statement. The student uses the process skills to understand probability in real world situations and how to apply independence and dependence of events. The student is expected to:		
GD01	determine probabilities based on area in mathematical and real-world problems. ~~[Obtain the probability measure by taking the measure (area) of a subset and dividing it by the measure (area) of the entire set].~~	Relates to CRS ER, VA
GD02	represent events as subsets of a sample space using the characteristics of the outcomes or as unions, intersections or complements of other events in mathematical and real-world problems.	Relates to CRS
GD03	identify whether two events are independent and ~~give an example of how~~ compute the probability of the two events occurring together. ~~is the product of their probabilities.~~	Relates to CRS
~~GD04~~	~~interpret results in a two-way frequency table of data when the two variables are related.~~	ER, MV,VA – not present in CRS Moved to AQR
~~GD05~~	~~treating a two-way frequency table as a sample space, identify whether two events are independent and determine conditional probabilities.~~	ER, MV,VA – not present in CRS Moved to AQR
GD06	apply conditional probability of A given B and use to determine independence of events A and B in real-world problems.	Relates to CRS, clarity
~~GD07~~	~~use the Addition rule, $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$ in mathematical and real-world problems.~~	ER, MV,VA – not present in CRS Moved to AQR

Mathematical Models with Applications (MMA)

~~Mathematical Process Standards Mathematical Models with Applications (MMA)~~		
I.	~~Apply mathematics to problems arising in everyday life, society and the workplace.~~	VA—Process Standards moved to knowledge and skills statements
II.	~~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.~~	
III.	~~Select tools such as real objects, manipulatives, paper/pencil, and technology or techniques such as mental math, estimation, and number sense to solve problems.~~	
IV.	~~Communicate mathematical ideas, reasoning, and their implications using symbols, diagrams, graphs, and language.~~	
V.	~~Create and use representations to organize, record, and communicate mathematical ideas.~~	
VI.	~~Explain, display, or justify mathematical ideas and arguments using precise mathematical language in written or oral communications.~~	

MMA Focal Areas	
	1 Math Modeling Process Standards
~~Numeric reasoning~~	2 Math Modeling in Personal Finance
~~Expressions, equations and generalized relationships~~	3 Math Modeling in Science and Engineering
~~Geometric reasoning~~	4 Math Modeling in Fine Arts
~~Probabilistic and statistical reasoning~~	5 Math Modeling in Social Sciences

Mathematical Models with Applications

Introduction

General requirements. The provisions of this section shall be implemented beginning the 2013-2014 school year. Students can be awarded one-half to one credit for successful completion of this course. Recommended prerequisite: Algebra I.

The College and Career readiness standards are the driving force behind the Texas Essential Knowledge and Skills for mathematics. By embedding statistics and finance and focusing on fluency and deep understandings, Texas will lead the way in mathematics education and prepare all Texas students for the technological challenges they will face in the 21st century.

The process standards are integrated at every grade level. When possible, students will apply mathematics to problems arising in everyday life, society and the workplace. Students will 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 problem process. They will select tools including ~~real~~ physical objects, manipulatives, paper and pencil, ~~and~~ or technology ~~or~~ and techniques including mental math, estimation, ~~and~~ or number sense to solve problems. Communication of mathematical ideas, reasoning, and their implications using multiple representations including symbols, diagrams, graphs and language will be emphasized. Students will create and use representations to organize, record, and communicate mathematical ideas. Students will analyze mathematical relationships to connect and communicate mathematical ideas. They will explain, display, or justify mathematical ideas and arguments using precise mathematical language in written or oral communications.

Mathematical Models with Applications is designed to build on knowledge and skills from K-8 and Algebra I. This additional math course provides a path for students to succeed in Algebra II and prepares them for various post-secondary choices. Students learn to apply mathematics through experiences in personal finance, science, engineering, fine arts, and social science. Students use algebraic, graphical, and geometric reasoning to recognize patterns and structure, to model information, to solve problems, and to communicate solutions. Students will select from tools such as physical objects, manipulatives, technology (including graphing calculators, data collection devices, and computers), paper/pencil, and from methods such as algebraic techniques, geometric reasoning, patterns, and mental math to solve problems.

In this course students will use a mathematical modeling cycle to analyze problem situations, to understand them better, and to improve decisions. A basic mathematical modeling cycle is summarized below. The student will:

(1) Represent:
- *a) identify the variables in the problem situation and select those that represent essential features,*
- *b) formulate a model by creating and selecting from representations such as geometric, graphical, tabular, algebraic, or statistical that describe the relationships between the variables,*

(2) Compute: analyze and perform operations on these relationships to draw conclusions,
(3) Interpret: interpret the results of the mathematics in terms of the original problem situation,
(4) Revise: confirm the conclusions by comparing them with the problem situation and then revise as necessary,
(5) Report: report on the conclusions and the reasoning behind them.

***Note*: See page 9 for a graphical representation of the above Modeling Cycle for professional development.**		
Mathematical Process Standards		
Knowledge and Skills Statement. The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:		VA—Process Standards moved to knowledge and skills statements
	A. Apply mathematics to problems arising in everyday life, society, and the workplace.	
	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 as well as the reasonableness of the solution.	
	C. Select tools, including real objects, manipulatives, paper/pencil, and technology as appropriate and techniques including mental math, estimation, and number sense as appropriate to solve problems.	
	D. Communicate effectively mathematical ideas, reasoning, and their implications using multiple representations including symbols, diagrams, graphs, and language as appropriate.	
	E. Create and use representations to organize, record, and communicate mathematical ideas.	
	F. Analyze mathematical relationships to connect and communicate mathematical ideas.	
	G. Display, explain, or justify mathematical ideas and arguments using precise mathematical language in written or oral communications.	
~~**Numeric Reasoning.**~~		**MMAN**
~~MMAN01~~	~~compare and analyze various methods for solving a real-life problem.~~	ER deleted based on Expert Reviewer's recommendation to include in process standards
~~MMAN02~~	~~use multiple approaches (algebraic, graphical, and geometric methods) to solve problems from a variety of disciplines.~~	ER deleted based on Expert Reviewer's recommendation to include in process standards
~~MMAN03~~	~~select a method to solve a problem, defend the method, and justify the reasonableness of the results.~~	ER deleted based on Expert Reviewer's recommendation to include in process standards

Mathematical Modeling in Personal Finance ~~**Algebraic Reasoning (Expressions, Equations,**~~	**MMAA**

~~and Generalized Relationships)~~.		
Knowledge and Skills Statement. The student uses graphical and numerical techniques to study patterns and analyze data as it applies to personal finance. The student is expected to:		
MMAA01	use rates, linear functions, and direct variation to solve problems involving personal finance and budgeting, including compensations and deductions.	
MMAA02	solve problems involving personal taxes.	
MMAA03	analyze data to make decisions about banking, including options for online banking, checking accounts, overdraft protection, processing fees, and debit/ATM fees.	Information added for clarification and updated methods of banking
MMAA04	analyze ~~methods of payment available~~ personal credit options in retail purchasing and compare relative advantages and disadvantages of each option.	Clarification of wording
MMAA05	use technology to create amortization models to investigate home financing and compare buying and renting a home.	ER Clarify that students are not required to amortize with paper/pencil
MMAA06	use technology to create amortization models to investigate automobile financing and compare buying and leasing a vehicle.	ER Clarify that students are not required to use amortization tables with paper/pencil
MMAA07	analyze types of savings options involving simple and compound interest and compare relative advantages of these options.	
MMAA08	analyze and compare coverage options and rates in insurance.	
MMAA09	investigate and compare investment options including stocks, bonds, annuities, certificates of deposit, and retirement plans.	Clarifying and updating information

Math Modeling in Science and Engineering		
Knowledge and Skills Statement. The student uses graphical and numerical techniques to study patterns and analyze data as it applies to science and engineering. The student is expected to		
MMAA10	use direct and inverse variation to describe physical laws such as Hook's law, Newton's second law of motion, and Boyle's law~~s~~.	Clarification as to which laws to use – only Newton's law involves direct variation

MMAG01	use ~~geometric~~ exponential models available through technology to model growth and decay in areas such as population, biology, ~~and~~ ecology, and radioactive decay.	Clarification of the model to be used and added one more area of science to be modeled.
	use quadratic functions to model parabolic motion, such as an object dropped, thrown, or kicked.	Standard added to specify the inclusion of quadratic models
MMAG03	use similarity, geometric transformations, symmetry, and perspective drawings to describe mathematical patterns and structure ~~in art and~~ in architecture.	Split this standard between this strand and the Fine Arts to focus on architecture in this strand. Also, added the word "similarity" as this is included when working with transformations
	use scale factors with two-dimensional and three-dimensional objects to demonstrate proportional and non-proportional changes in surface area and volume as applied to fields such as engineering drawing, architecture, and construction	Added standard to support a weak area in geometric thinking. Use within applications in this strand brings more meaning to the mathematics
	Use trigonometric ratios to calculate distances and angle measures as applied in fields such as surveying, navigation, and orienteering	Split from MMAG02: moved the use of ratios to calculate distances to apply to Science and Engineering fields; left trigonometric functions to model periodic motion in art and music in Fine Arts
	use Pythagorean Theorem and special right-triangle relationships to calculate distances.	Added standard to support a weak area in geometric thinking. Use within applications in this strand brings more meaning to the mathematics

Math Modeling in Fine Arts ~~Geometric Reasoning~~.		**MMAG**
Knowledge and Skills Statement. The student uses graphical and numerical techniques to study patterns and analyze data as it applies to fine arts. The student is expected to:		
~~MMAG01~~	~~use geometric models available through technology to model growth and decay in areas such as population, biology, and ecology.~~	Moved to Math Modeling in science and engineering.

MMAG02	use trigonometric functions available through technology to model periodic motion in art and music ~~use trigonometric ratios and functions available through technology to calculate distances and model periodic motion~~.	Moved the use of ratios to calculate distances to apply to Science and Engineering fields; kept trigonometric functions to model periodic motion in art and music in Fine Arts
MMAG03	Use similarity, geometric transformations, symmetry, and perspective drawings to describe mathematical patterns and structure in art and photography ~~and architecture~~.	Split this standard between this strand and the Science and Engineering to focus on art in this strand. Added the word "similarity" as this is included when working with transformations Added photography for more specificity and depth
MMAG04	use geometric transformations, proportions, and periodic motion to describe mathematical patterns and structure in music.	
	use scale factors with two-dimensional and three-dimensional objects to demonstrate proportional and non-proportional changes in surface area and volume as applied to fields such as painting, sculpture, and photography.	Added standard to support a weak area in geometric thinking. Use within applications in this strand brings more meaning to the mathematics

Math Modeling in Social Sciences ~~Probabilistic and Statistical Reasoning.~~		**MMAD**
Knowledge and Skills Statement. The student uses graphical and numerical techniques to study patterns and analyze data as it applies to social science. The student is expected to:		
MMAD01	interpret information from various graphs, including line graphs, bar graphs, circle graphs, histograms, scatterplots, dot plots, stem and leaf plots, and box and whisker plots to draw conclusions from the data.	
MMAD02	analyze numerical data using measures of central tendency, variability, and correlation in order to make inferences.	
MMAD03	analyze graphs from journals, newspapers, and other sources to determine the validity of stated arguments.	

MMAD04	use regression methods available through technology to describe various models for data such as linear, quadratic, and exponential, ~~etc.,~~ select the most appropriate model, and use the model to interpret information.	Deleted the "etc" limit regression to the three functions listed here; Algebra II is adding this same standard and extending to other functions.
MMAD05	formulate a meaningful question, determine the data needed to answer the question, gather the appropriate data, analyze the data, and draw reasonable conclusions.	
MMAD06	communicate methods used, analyses conducted, and conclusions drawn for a data-analysis project through the use of one or more of a written report, a visual display, an oral report, or a multi-media presentation.	Reworded to clarify that a student may use more than one medium for presentation.
MMAD07	determine the appropriateness of a model for making predictions from a given set of data.	
MMAD08	compare theoretical and empirical probability, such as determining if a particular game of chance is fair.	Added the example for clarification
MMAD09	use experiments to determine the reasonableness of a theoretical model such as binomial, geometric, etc.	
	Determine the number of ways an event, such as a sports tournament, may occur using combinations, permutations, and the Fundamental Counting Principle	CRS: this expectation is not addressed in any other of the secondary math student expectations.

The following model is referenced in our introduction and is recommended for use in teacher professional development.

A basic mathematical modeling cycle is summarized below. The student will:

(1)Represent:

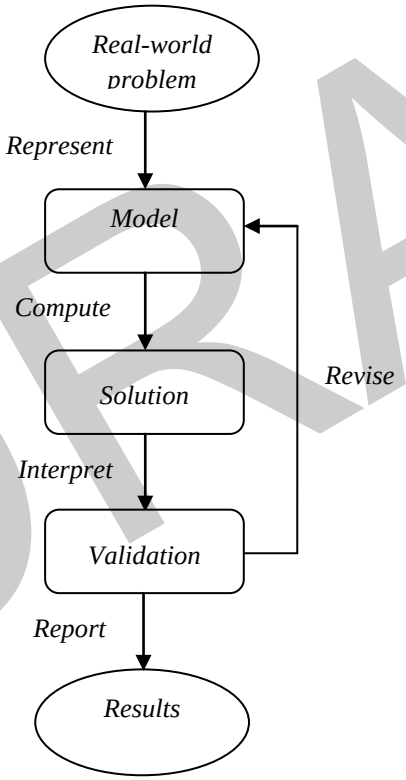
- *a) identify the variables in the problem situation and select those that represent essential features,*
- *b) formulate a model by creating and selecting from representations such as geometric, graphical, tabular, algebraic, or statistical that describe the relationships between the variables,*

(2) Compute: analyze and perform operations on these relationships to draw conclusions,

(3) Interpret: interpret the results of the mathematics in terms of the original problem situation,

(4) Revise: confirm the conclusions by comparing them with the problem situation and then revise as necessary,

(5) Report: report on the conclusions and the reasoning behind them.



Pre-Calculus

	Mathematical Process Standards Precalculus	
I.	Apply mathematics to problems arising in everyday life, society and the workplace.	VA—Process Standards moved to knowledge and skills statements
II.	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.	
III.	Select tools such as real objects, manipulatives, paper/pencil, and technology or techniques such as mental math, estimation, and number sense to solve problems.	
IV.	Communicate mathematical ideas, reasoning, and their implications using symbols, diagrams, graphs, and language.	
V.	Create and use representations to organize, record, and communicate mathematical ideas.	
VI.	Explain, display, or justify mathematical ideas and arguments using precise mathematical language in written or oral communications.	

Pre-Calculus Focal Areas
Functions
Geometric reasoning **Relations and Geometric Reasoning**
Measurement **Number and Measure**
Number and algebraic methods **Algebraic Reasoning**

Pre-Calculus

Introduction

The prerequisites for Pre-Calculus are that students have successfully completed two years of algebra and one year geometry.

The College and Career Readiness Standards are the driving force behind the Texas Essential Knowledge and Skills for mathematics. By embedding statistics and finance and focusing on fluency and deep understandings, Texas will lead the way in mathematics education and prepare all Texas students for the technological challenges they will face in the 21st century.

The process standards are integrated at every grade level. When possible, students will apply mathematics to problems arising in everyday life, society and the workplace. Students will 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 problem process. They will select tools such as real objects, manipulatives, paper and pencil, and technology or techniques such as mental math, estimation, and number sense to solve problems. Communication of mathematical ideas, reasoning, and their implications using symbols, diagrams, graphs and language will be emphasized. Students will create and use representations to organize, record, and communicate mathematical ideas. They will explain, display, or justify mathematical ideas and arguments using precise mathematical language in written or oral communications.

Pre-Calculus is the preparation for calculus. The course takes a functional point of view towards topics and is designed to strengthen and enhance conceptual understanding and mathematical reasoning used when modeling and solving mathematical and real-world problems. Students systematically work with functions and their multiple representations. The study of the topics, concepts, and procedures of precalculus deepens students' understanding of algebra and extends their ability to apply algebra concepts and procedures at higher conceptual levels, as a tool for future study in mathematics. Students investigate and explore mathematical ideas, develop multiple strategies for analyzing complex situations, and use technology such as graphing calculators and mathematical software to build understanding, make connections between representations, and provide support in solving problems.

Mathematical Process Standards		
Knowledge and Skills Statement. The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:		VA—Process Standards moved to knowledge and skills statements
	Apply mathematics to problems arising in everyday life, society and the workplace.	
	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 as well as the reasonableness of the solution.	
	Select tools, including ~~such as~~ real objects, manipulatives, paper/pencil, ~~and~~ technology, as appropriate and ~~or~~ techniques, including ~~such as~~ mental math, estimation, and number sense, as appropriate to solve problems.	
	Communicate mathematical ideas, reasoning, and their implications using multiple representations including ~~such as~~ symbols, diagrams, graphs, and language as appropriate.	
	Create and use representations to organize, record, and communicate mathematical ideas.	

	Analyze mathematical relationships to connect and communicate mathematical ideas.	
	~~d~~Display, ~~E~~explain, ~~or~~ justify mathematical ideas and arguments using precise mathematical language in written or oral communications.	

Functions.		**PF**
Knowledge and Skills Statement. The student uses process standards in mathematics to explore, describe, and analyze the attributes of functions. The student makes connections between multiple representations of functions and algebraically constructs new functions. The student analyzes and uses functions to model real world problems. The student is expected to:		
PF01	use the composition of two functions to model and solve real-world problems.	
PF02	~~give an example~~ demonstrate that function composition is not always commutative.	Clarity of language
PF03	represent a given function as a composite function of two or more functions, ~~For example, $f(x)=\sqrt{x^2+3}$ can be represented as $f(x)=(g\circ h)(x)$ where $g(x)=\sqrt{x}$ and $h(x)=x^2+3$, or f can be represented as $f(x)=(g\circ w\circ v)(x)$ where $g(x)=\sqrt{x}$, $w(x)=x+3$, and $v(x)=x^2$.~~	Instructional example not needed
PF04	describe symmetry of graphs of even and odd functions ~~in mathematical and real-world problems.~~	ER
PF05	determine an inverse function, when it exists, for a given function over its domain or a subset of its domain and represent the inverse ~~graphically and/or algebraically.~~ using multiple representations.	Current verbiage is too limiting
PF06	graph exponential ~~functions~~, ~~and~~ logarithmic ~~functions (including base e), trigonometric functions~~, ~~piece-wise defined functions~~, rational ~~functions~~, polynomial, power, ~~and~~ trigonometric, inverse trigonometric ~~functions~~, and piece-wise defined functions, including step functions.	Base e is implied VA Added Algebra 2 SE A2FO5
PG03	graph functions, including exponential, logarithmic, sine, cosine, rational, polynomial, and power functions ~~logarithmic functions with various bases, including the natural log function,~~ and their transformations including $a \cdot f(x)$, $f(x)+d, f(x-c), f(b \cdot x)$ for specific values of a, b, c, and d, in mathematical and real-world problems.	Combining SE PG03, PG04, PG07, PG16 for continuity of transformations. The real world problems will be addressed in modeling. SE was moved from Geometric Reasoning Focal Area to Function Focal Area to better delineate the focal areas.

PG17	graph ~~inverse trigonometric functions (~~arcsin *x*~~,~~ and arccos *x*~~)~~ ~~with and without technology~~ ~~including explaining why there is a need for restricted domains and ranges in mathematical and real-world problems.~~ and describe the limitations on the domain	SE clarification on the expectation and eliminated the instructional suggestion SE was moved from Geometric Reasoning Focal Area to Function Focal Area to better delineate the focal areas.
PF07	determine and analyze the key features of exponential ~~functions~~, ~~and~~ logarithmic ~~functions~~ ~~(including base e)~~, ~~trigonometric functions~~, ~~piece-wise defined functions,~~ rational ~~functions~~, polynomial, power, ~~and~~ trigonometric, inverse trigonometric ~~functions~~, and piece-wise defined functions including step functions such as domain, range, symmetry, relative maximum, relative minimum, zeros, asymptotes, and intervals over which the function is increasing or decreasing.	Base e is implied VA Added Algebra 2 SE A2FO5
PG04	~~graph power functions (including radical) and their transformations including~~ analyze and describe ~~the concept of~~ end behavior of functions including exponential, logarithmic, rational, polynomial, and power functions using infinity notation to communicate this characteristic in mathematical and real-world problems.	The original SE excluded all functions except power functions. SE was moved from Geometric Reasoning Focal Area to Function Focal Area to better delineate the focal areas.
PG05	~~graph~~ analyze characteristics of rational functions ~~and determine characteristics such as domain,~~ and the behavior of the function around the asymptotes including horizontal, vertical and oblique asymptotes. ~~(horizontal, vertical, slant) and describe the differences between the domains of the rational functions (p(x) s(x)) / (q(x) s(x)) and p(x) / q(x) for p, q and s polynomial functions in mathematical and real-world problems.~~	Focus the SE on particular characteristics of rational functions SE was moved from Geometric Reasoning Focal Area to Function Focal Area to better delineate the focal areas.
PG06	determine various types of discontinuities in the interval $(-\infty, \infty)$ as they relate to ~~rational~~ functions, such as rational and piecewise defined functions, and explore the limitations of the graphing calculator as it relates to the behavior of the function around discontinuities. ~~in mathematical and real-world problems.~~	The original SE was limiting the discussion of discontinuities to rational functions. ER SE was moved from Geometric Reasoning Focal Area to Function Focal Area to better delineate the focal areas.
	describe the left-sided behavior and the right-sided behavior of the graph of a function around discontinuities.	Discussion of discontinuities as alternative to limits concept
	analyze situations modeled by functions including exponential, logarithmic, rational, polynomial, and power functions to solve real-world problems such as problems involving growth and decay and optimization.	SE was created to address the real-world problems for multiple functions that were in PG05, PG07, PA10

PG15	~~determine whether a situation can be modeled by a sinusoidal function, develop a mathematical model to describe the situation, and use the model to solve mathematical and real-world problems.~~ develop and use a sinusoidal function that models a situation in mathematical and real-world problems.	Clarification of expectation SE was moved from Geometric Reasoning Focal Area to Function Focal Area to better delineate the focal areas.
PM02	determine the values of the trigonometric functions at the special angles ~~(30°, 45°, 60°) and the angles, such as the half-angles,~~ and relate~~d to~~ them in mathematical and real-world problems.	Removed the examples SE was moved from Measurement Focal Area to Function Focal Area to better delineate the focal areas.

Relations and Geometric Reasoning ~~**Geometric Reasoning**~~**.**		**PG** More inclusive and descriptive focal area name
Knowledge and Skills Statement. The student uses the process standards in mathematics to model and make connections between algebraic and geometric relations. The student is expected to:		
PG01	graph a set of parametric equations.	Moved SE within Focal Area with common content
PG02	convert parametric equations into rectangular relations and convert rectangular relations into parametric equations. ~~to solve mathematical and real-world problems.~~	As written the standard is too limiting so it is moved to a SE PA15
PA15	use parametric equations to model and solve ~~problems involving motion in~~ mathematical and real-world problems.	Moving the solve from SE PG02 and removing limiting feature SE was moved from Number and Algebraic Methods Focal Area to Relations and Geometric Reasoning Focal Area to better delineate the focal areas.
PG07	~~graph exponential functions and their transformations, including $a \cdot f(x)$, $f(x) + d$, $f(x - c)$, $f(b \cdot x)$ for specific values of a, b, c, and d, to solve problems in mathematical and real-world problems.~~	SE was addressed in PG03
PG08	graph points in the polar coordinate system and convert between ~~the~~ rectangular coordinates and polar coordinate~~s systems in mathematical and real-world problems.~~	ER
PG09	graph polar equations such as cardiods, limaçons, or lemniscates by plotting points and using technology~~. using symmetry, using zeros and maximum values including recognizing special polar graphs.~~	concepts are beyond introduction level of polar
PG13	determine the conic section formed when a plane intersects a double napped cone.	Moved SE within Focal Area for dilineation

PG10	make connections between the locus definition of conic sections and their equations in rectangular coordinates. ~~derive, in rectangular coordinates, the equation of a circle, parabola, ellipse, and hyperbola from their locus definitions.~~	Clarification of expectation
PG11	use the characteristics of an ellipse to write the equation of an ellipse with center (*h*,*k*). ~~and determine the foci and eccentricity in mathematical and real-world problems.~~	Clarification of expectation ER
PG12	use the characteristics of a hyperbola to write the equation of a hyperbola with center (*h*,*k*) ~~and determine the foci, eccentricity and the equations of the asymptotes in mathematical and real-world problems.~~	Clarification of expectation ER
PG16	~~graph the sine and cosine functions and apply one or more transformations to these functions, including $a \cdot f(x)$, $f(x)+d$, $f(x-c)$, $f(b \cdot x)$ for specific values of *a*, *b*, *c* and *d* in mathematical and real-world problems.~~	SE was combined with PG03
PG18	~~estimate the limit of a function at a point, including one-sided limits, using graphs and tables.~~	Duplicates the content of Calculus Replace with discussion of discontinuities
PG19	~~illustrate cases in which a limit of a function fails to exist at a point or as *x* grows without bound, including unequal left-hand and right-hand limits at a point, unbounded behavior, and oscillating behavior.~~	Duplicates the content of Calculus
PG20	~~use knowledge of the limiting process to describe the behavior of a function including end-behavior.~~	Duplicates the content of Calculus
PG21	~~explain, informally, why a limit fails to exist at a point or as *x* grows without bound, including unequal left-hand and right-hand limits at a point, unbounded behavior, and oscillating behavior.~~	Duplicates the content of Calculus
PG22	~~solve problems requiring an understanding of the limiting process in mathematical and real-world problems.~~	Duplicates the content of Calculus

Number and Measure~~ment~~.		**PM** More inclusive and descriptive focal area name
Knowledge and Skills Statement. The student uses process standards in mathematics to apply appropriate techniques, tools, and formulas to calculate measures in mathematical and real world problems. The student is expected to:		
PM01	determine the relationship between the unit circle~~, the wrapping function (W(x)=(cos x, sin x)),~~ and the definition of a periodic function to evaluate trigonometric functions in mathematical and real world problems.	eliminated the instructional suggestion
PM06	~~Identify radian measure of a central angle of a unit circle as the length of the arc subtended by that angle.~~ describe the relationship between degree and radian measure on the unit circle	Clarification of expectation

PM07	represent angles in radians ~~and~~ or degrees based on the concept of rotation and find the measure of reference angles and angles in standard position ~~with a common terminal side in mathematical and real-world problems involving arc length, linear and angular speeds and area of the sector of a circle~~.	Separate SE into two SE's
	represent angles in radians or degrees based on the concept of rotation in mathematical and real-world problems, including linear and angular velocity.	Separate SE PM07
PM03	determine~~, using reference angles,~~ the value of trigonometric ratios of ~~any~~ angles, ~~including~~ and ~~solving~~ solve problems involving trigonometric ratios ~~involving points on the terminal side of an angle~~ in mathematical and real world problems.	Clarification of expectation Moved SE within Focal Area with common content
PM08	use trigonometry ~~to determine directional bearing and harmonic motion~~ in mathematical and real world problems, including directional bearing.	Rephrasing of the SE
PM04	use the Law of Sines in mathematical and real-world problems.	Moved SE within Focal Area with common content
PM05	use the Law of Cosines in mathematical and real-world problems.	Moved SE within Focal Area with common content
PG23	use vectors to model situations involving magnitude and direction.	SE was moved from Geometric Reasoning Focal Area to Number and Measure Focal Area to better delineate the focal areas.
PG24	represent the addition of vectors and the multiplication of a vector by a scalar geometrically and symbolically.	SE was moved from Geometric Reasoning Focal Area to Number and Measure Focal Area to better delineate the focal areas.
PG25	apply vector addition and multiplication of a vector by a scalar in mathematical and real-world problems.	SE was moved from Geometric Reasoning Focal Area to Number and Algebraic Focal Area to better delineate the focal areas.

Algebraic Reasoning ~~Number and Algebraic Methods~~.		**PA**
Knowledge and Skills Statement. The student uses process standards in mathematics to evaluate expressions, describe patterns, formulate models, and solve equations and inequalities using properties, procedures, or algorithms. The student is expected to:		
PA01	represent finite sums and infinite series using sigma notation.	
	expand finite sums and infinite series written in sigma notation	Separate SE PA02 for clarification
PA02	evaluate finite sums and geometric series when possible written in sigma notation. ~~calculate the value, when it exists, of an expression written in sigma notation.~~	ER

PA03	represent arithmetic sequences and geometric sequences ~~and series~~ using ~~recursion~~ recursive formulas. ~~and sigma notation.~~	Clarification of SE and combine series with SE PA05
PA04	calculate the nth term and the nth partial sum of an ~~determine the nth terms and the sum of a finite~~ arithmetic series in mathematical and real-world problems.	Consistent wording with SE PA06
PA05	represent arithmetic series and geometric ~~sequences and~~ series using ~~a recursion formula and~~ sigma notation.	Clarification of SE and combine sequence with SE PA03
PA06	calculate the n^{th} term of a geometric series, the n^{th} partial sum of a geometric series, and sum of ~~a~~ an infinite geometric series when it ~~this sum~~ exists.	ER and clarification of SE
PA11	~~use the Binomial Theorem to write the expression $(a + b)^n$ (n a positive integer) in expanded form.~~ apply the Binomial Theorem for the expansion of $(a+ b)^n$ in powers of a and b for a positive integer n, where a and b are any numbers.	Reworded for specificity Moved SE within Focal Area with common content
PA07	~~determine the trigonometric form of a complex number and relate to polar coordinates.~~	SE is not a prerequisite for Calculus
PA08	~~determine the product and quotient of complex numbers in trigonometric form.~~	SE is not a prerequisite for Calculus
PA09	~~determine powers and all the n^{th} roots of complex numbers.~~	SE is not a prerequisite for Calculus
PA10	use the properties of logarithms to evaluate or transform logarithmic expressions ~~requiring the change of base formula in both mathematical and real-world problems.~~	ER and the change of base statement leads to limitations Moved SE within Focal Area with common content
PA12	~~use Pascal's Relation (triangle) to give a recursive definition of the coefficient $a^p b^{n-p}$ in the expansion of $(a+b)n$.~~	ER
PA13	generate and solve logarithmic equations ~~including those requiring change of base~~ in mathematical and real-world problems.	ER
PA14	generate and solve exponential equations in mathematical and real-world problems.	
PA17	solve polynomial equations with real coefficients by applying a variety of techniques such as factoring, graphical methods or technology ~~including the Fundamental Theorem of Algebra, factoring, Descartes Rule of Signs, and knowing that complex zeros occur in conjugate pairs~~ in mathematical and real-world problems.	ER Added examples for clarification
PA18	solve polynomial ~~and rational~~ inequalities with real coefficients by applying a variety of techniques such as factoring, graphical methods or technology ~~using critical numbers, by testing intervals~~ and write ~~writing~~ the solution set of the polynomial inequality in interval notation in mathematical and real-world problems.	ER and separate SE into two SEs Added examples for clarification

	solve rational inequalities with real coefficients by applying a variety of techniques such as factoring, graphical methods or technology and write the solution set of the rational inequality in interval notation in mathematical and real-world problems.	Separate SE PA18
PG14	use trigonometric identities such as reciprocal, quotient, Pythagorean, cofunctions, even/odd, and sum and difference identities for cosine and sine to simplify trigonometric expressions. ~~in mathematical and real-world problems.~~	ER SE was moved from Geometric Reasoning Focal Area to Algebraic Reasoning Focal Area to better delineate the focal areas.
PA16	generate and solve trigonometric equations in mathematical and real-world problems.	Consistent language with SE PA14 Moved SE within Focal Area with common content

Advanced Quantitative Reasoning (AQR)

~~Mathematical Process Standards Advanced Quantitative Reasoning (AQR)~~		
~~I.~~	~~Apply mathematics to problems arising in everyday life, society and the workplace.~~	VA—Process Standards moved to knowledge and skills statements
~~II.~~	~~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.~~	
~~III.~~	~~Select tools such as real objects, manipulatives, paper/pencil, and technology or techniques such as mental math, estimation, and number sense to solve problems.~~	
~~IV.~~	~~Communicate mathematical ideas, reasoning, and their implications using symbols, diagrams, graphs, and language.~~	
~~V.~~	~~Create and use representations to organize, record, and communicate mathematical ideas.~~	
~~VI.~~	~~Explain, display, or justify mathematical ideas and arguments using precise mathematical language in written or oral communications.~~	

AQR Focal Areas
Expressions, equations and generalized relationships
Geometric reasoning
Probabilistic and statistical reasoning

Advanced Quantitative Reasoning

Introduction

Prerequisites: Geometry and Algebra 2

One-Half to One Credit

The desire to achieve education excellence is the driving force behind the Texas Essential Knowledge and Skills for mathematics, guided by the College and Career Readiness Standards. By embedding statistics, probability, and finance, while focusing on fluency and deep understandings, Texas will lead the way in mathematics education and prepare all Texas students for the challenges they will face in the 21st century.

The process standards are integrated at every grade level. When possible, students will apply mathematics to problems arising in everyday life, society and the workplace. Students will use a problem solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, evaluating the problem-solving process and the reasonableness of the solution. They will select appropriate tools such as real objects, manipulatives, paper and pencil, formulas, theorems, laws, and technology along with techniques such as mental math, estimation, and number sense to solve problems efficiently. Effective communication of mathematical ideas, reasoning, and their implications using multiple representations, such as symbols, diagrams, graphs and language will be emphasized. They will use mathematical relationships to generate solutions and make connections and predictions. Students will analyze mathematical relationships to connect and communicate mathematical ideas. They will display, explain, justify, or prove mathematical ideas and arguments using precise mathematical language in written or oral communications.

In Advanced Quantitative Reasoning, students develop and apply skills necessary for college, careers, and life. Course content consists primarily of applications of high school math concepts to prepare students to become well-educated and highly informed 21st century citizens. The student develops and applies reasoning, planning, and communication to make decisions and solve problems in applied situations involving numerical reasoning, probability, statistical analysis, finance, mathematical selection, and modeling with algebra, geometry, trigonometry, and discrete mathematics.

Mathematical Process Standards		
Knowledge and Skills Statement. The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:		VA—Process Standards moved to knowledge and skills statements
	Apply mathematics to problems arising in everyday life, society and the workplace.	

	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 as well as the reasonableness of the solution.	
	Select tools, including ~~such as~~ real objects, manipulatives, paper/pencil, ~~and~~ technology, as appropriate and ~~or~~ techniques, including ~~such as~~ mental math, estimation, and number sense, as appropriate to solve problems.	
	Communicate mathematical ideas, reasoning, and their implications using multiple representations including ~~such as~~ symbols, diagrams, graphs, and language as appropriate.	
	Create and use representations to organize, record, and communicate mathematical ideas.	
	Analyze mathematical relationships to connect and communicate mathematical ideas.	
	~~d~~Display, ~~E~~explain, ~~or~~ justify mathematical ideas and arguments using precise mathematical language in written or oral communications.	

Numeric Reasoning.		**AQRN**
Knowledge and Skills Statement. The student applies the process standards in mathematics to generate new understandings by extending existing knowledge. The student generates new mathematical understandings through problems involving numerical data that arise in everyday life, society, and the workplace. The student extends existing knowledge and skills to analyze real-world situations. The student is expected to:		
Develop and Apply Skills Used in College and Careers		
AQRN01	~~gather data, conduct investigations, and apply mathematical concepts and models to solve problems in mathematics and other disciplines.~~	This SE is subsumed within the mathematical process standards.
AQRN02	~~demonstrate reasoning skills in developing, explaining, and justifying sound mathematical arguments, and analyze the soundness of mathematical arguments of others.~~	This SE is subsumed within the mathematical process standards.
AQRN03	~~communicate with and about mathematics orally and in writing as part of independent and collaborative work, including making accurate and clear presentations of solutions to problems.~~	This SE is subsumed within the mathematical process standards.
Analyze Numerical Data		
	compare and contrast precision and accuracy in real life situations, such as in measurements and significant figures.	ER

AQRN04	apply~~,~~ and critically compare~~, and contrast~~ within, between, and among published ratios, rates, ratings, averages, weighted averages, and indices as appropriate to make informed decisions.	The deletion and additions were an attempt to clarify the SE. We thought that "critically comparing" included "contrasting." The language "within, between, and among" was to consider singletons and multiple combinations of the contexts.
AQRN05	solve problems involving large quantities that are not easily measured using indirect measurement, such as combinatorics and proportionality.	ER
AQRN06	use arrays to ~~efficiently~~ manage efficiently large collections of data and add, subtract, and multiply matrices to solve applied problems.	Grammar
AQRN07	apply algorithms ~~and~~ to identify errors in recording and transmitting identification numbers.	Technical edit
Use Ranking and Selection		
AQRN08	apply and analyze various ranking algorithms to determine an appropriate method for a given situation, such as determining sports rankings; weighted class ranking; and rankings of top high schools, universities, and best places to live.	ER
AQRN09	analyze various voting and selection processes to ~~determine an appropriate method for a~~ compare results in given situations, such as at-large elections, ballot voting, run offs and plurality versus majority voting.	ER
Use Network Models		
AQRN10	solve problems involving scheduling or routing situations that can be represented by a vertex-edge graph~~, and find~~ by finding critical paths, Euler paths, or minimal spanning trees.	Technical edit
AQRN11	develop and construct~~, analyze, and interpret~~ flow charts using elements such as conditionals, loops, iteration, and recursion, ~~in order~~ to ~~develop~~ analyze and describe problem-solving procedures.	ER: suggested inclusion of conditionals, loops, iteration, and recursion. See comment below for justification of deletions.
	analyze and interpret flow charts in order to explain problem-solving procedures.	We divided the preceding SE into two parts for clarity. We felt that developing and constructing flow charts are separate processes from analyzing and interpreting flow charts.

Algebraic Reasoning (Expressions, Equations, and Generalized Relationships).		AQRA
Knowledge and Skills Statement. The student applies the process standards in mathematics to create and analyze mathematical models of everyday situations to make informed decisions related to earning, investing, spending, and borrowing money by appropriate, proficient, and efficient use of tools including technology. The student uses mathematical relationships to make connections and predictions. The student judges the validity of a prediction and uses mathematical models to represent, analyze, and solve dynamic real-world problems. The student is expected to:		
Model Data		
AQRA01	~~determine whether or not there is a linear relationship in a set of bivariate data by finding and interpreting the correlation coefficient for the data.~~	VA Already addressed in Algebra I and Grade 8 Mathematics.
AQRA02	collect numerical bivariate data~~; use the data~~ to create a scatterplot~~;~~, select a function to model the data, justify the model selection, and use the model to interpret results and to make predictions.	Clarification
	describe the degree to which uncorrelated variables may or may not be related, and analyze situations where correlated variables do or do not indicate a cause and effect relationship.	ER
Model Change and Relationships		
AQRA03	determine or analyze an appropriate growth or decay model for problem situations, including linear, exponential, and logistic functions.	
AQRA04	determine or analyze an appropriate cyclical model for problem situations that can be modeled with ~~trigonometric~~ periodic functions.	ER
AQRA05	determine or analyze an appropriate piecewise model for problem situations.	
AQRA06	solve problems using recursion or iteration as appropriate, ~~including~~ such as those involving population growth or decline, fractals, and compound interest	ER We changed "including" to "such as" to deemphasize exponential applications and give greater emphasis to recursion and iteration.
Model Financial Situations		
AQRA07	determine, represent, and analyze mathematical models for various types of income calculations to determine the best option for a given situation.	

AQRA08	determine, represent, and analyze mathematical models for expenditures, including those involving credit, to determine the best option for a given situation.	
AQRA09	determine, represent, and analyze mathematical models and appropriate representations including formulas and amortization tables for various types of loans and investments to determine the best ~~loan or investment plan~~ option for a given situation such as cell phone plans and buying versus leasing cars.	ER

Geometric Reasoning.		**AQRG**
Knowledge and Skills Statement. The student utilizes the process standards in mathematics to generate new understandings of the use of matrices and logical reasoning by extending existing knowledge of dimensionality, geometric transformations, and conditional statements. The student uses mental math as well as a variety of tools including paper/pencil and technology. The student represents and solves problems involving static and dynamic situations, conducts error analysis, and justifies mathematical arguments using precise mathematical language. The student is expected to:		
Model with Geometric Tools		
AQRG01	create and use two- and three-dimensional representations of authentic situations using geometric models or dynamic geometric environments for computer-aided design and other applications**.**	
AQRG02	~~use vectors to represent and solve applied problems.~~	Reasonableness of SE
AQRG03	use matrices to represent geometric transformations ~~and solve applied problems~~.	Duplication of AQRN06
AQRG04	solve geometric problems ~~involving inaccessible distances~~ using indirect measurements.	ER
Logical Argument and Constructions		
	identify the converse, inverse, and contrapositive of compound conditional statements.	ER
	construct truth tables to determine the validity of mathematical arguments.	ER
	identify missteps or fallacies in logical reasoning.	ER
	develop elementary pseudo-code, such as logical processes on graphing utility or robotics.	ER

Probabilistic and Statistical Reasoning.		**AQRD**
Knowledge and Skills Statement. The student utilizes the process standards in mathematics to generate new understandings of probability and statistics. The student analyzes statistical information and evaluates risk and return to connect mathematical ideas and make informed decisions. The student applies a problem-solving model and statistical methods to design and conduct a study that addresses one or more particular question(s). The student uses multiple representations to communicate effectively the results of student-generated statistical studies and the critical analysis of published statistical studies. The student is expected to:		
Analyze and Evaluate Risk and Return in the Context of Everyday Situations		
	use a two-way frequency table as a sample space to identify whether the two events are independent and interpret results in a two-way frequency table.	Deleted from Geometry and inserted in AQR
	use the Addition rule, $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$ in mathematical and real-world problems.	Deleted from Geometry and inserted in AQR
AQRD01	determine ~~and interpret~~ conditional probabilities and probabilities of compound events by constructing ~~and analyzing~~ representations, including tree diagrams, Venn diagrams, ~~and~~ area models, and formulas, such as Bayes' Theorem, to make decisions in problem situations.	ER We felt determining probabilities was a separate process from interpreting probabilities. We also thought that formulas were important. See comments below for justification of deletions.
	interpret conditional probabilities and probabilities of compound events by analyzing representations, including tree diagrams, Venn diagrams, area models, and formulas, such as Bayes' Theorem.	This new SE contains parts that were deleted from the previous SE.
AQRD02	use probabilities to make and justify decisions about risks in everyday life, such as the lottery, weather forecasts, and motor vehicle safety.	Clarification
AQRD03	calculate expected value to analyze mathematical fairness, payoff, and risk.	
Critique Applications of Statistics		
AQRD04	identify limitations ~~or~~ and lack of information in studies reporting statistical information, especially when studies are reported in condensed form.	To insure that students are exposed to both limitations and lack of information.

AQRD05	interpret and compare ~~the results of polls,~~ statistical results given a margin of error in situations such as polls, quality control, and measurements.	ER
AQRD06	identify uses and misuses of statistical analyses in studies reporting statistics or using statistics to justify particular conclusions, including assertions of a cause and effect relationship rather than an association.	
AQRD07	describe strengths and weaknesses of sampling techniques, data and graphical displays, and interpretations of summary statistics and other results appearing in a study, including reports published in the media.	
Conduct Statistical Analyses		
AQRD08	determine the need for and purpose of a statistical investigation and what type of statistical analysis can be used to answer a specific question or set of questions.	
AQRD09	identify the population of interest for a statistical investigation, select an appropriate sampling technique, and collect data**.**	Clarification
AQRD10	identify the variables to be used in a study.	
AQRD11	determine possible sources of statistical bias in a study and how such bias may affect the ~~ability to generalize~~ validity of the results.	ER
AQRD12	create data displays for given data sets to investigate, compare, and estimate center, shape, spread, and unusual features of the data**.**	
AQRD13	determine possible sources of variability of data, ~~both~~ and identify those that can be controlled and those that cannot be controlled.	Clarification
Communicate Statistical Information		
AQRD14	report results of statistical studies to a particular audience, including selecting an appropriate presentation format, creating graphical data displays, and interpreting results in terms of the question studied.	
AQRD15	justify the design and the conclusion(s) of statistical studies, including the methods used for each**.**	
AQRD16	communicate statistical results in ~~both~~ oral and written formats using appropriate statistical and nontechnical language.	Technical edit

Independent Study in Mathematics

Introduction

Prerequisites: Geometry and Algebra II

One-Half to One Credit

The desire to achieve education excellence is the driving force behind the Texas Essential Knowledge and Skills for mathematics, guided by the College and Career Readiness Standards. By embedding statistics, probability, and finance, while focusing on fluency and deep understandings, Texas will lead the way in mathematics education and prepare all Texas students for the challenges they will face in the 21st century.

The process standards are integrated at every grade level. When possible, students will apply mathematics to problems arising in everyday life, society and the workplace. Students will use a problem solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, evaluating the problem-solving process and the reasonableness of the solution. They will select appropriate tools such as real objects, manipulatives, paper and pencil, formulas, theorems, laws, and technology along with techniques such as mental math, estimation, and number sense to solve problems efficiently. Effective communication of mathematical ideas, reasoning, and their implications using multiple representations, such as symbols, diagrams, graphs and language will be emphasized. They will use mathematical relationships to generate solutions and make connections and predictions. Students will analyze mathematical relationships to connect and communicate mathematical ideas. They will display, explain, justify, or prove mathematical ideas and arguments using precise mathematical language in written or oral communications.

In Independent Study in Mathematics students will extend their mathematical understanding beyond the Algebra II level in a specific area or areas of mathematics, such as theory of equations, number theory, non-Euclidean geometry, linear algebra, advanced survey of mathematics, or history of mathematics.

General Requirements

(A)	~~General requirements. Students can be awarded one-half to one credit for successful completion of Independent Study in Mathematics. Required prerequisites: Algebra II, Geometry.~~ Students may repeat this course with different course content for up to three credits.	Deleted information is provided in the introduction above.
(B)	~~Content requirements. Students will extend their mathematical understanding beyond the Algebra II level in a specific area or areas of mathematics, such as theory of equations, number theory, non-Euclidean geometry, advanced survey of mathematics, or history of mathematics.~~ The requirements for each course must be approved by the local district before the course begins.	Deleted information is provided in the introduction above.
(C)	If this course is being used to satisfy requirements for the Distinguished Achievement Program, student research/products must be presented before a panel of professionals or approved by the student's mentor.	

Mathematical Process Standards		
Knowledge and Skills Statement. The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:		VA—Process Standards moved to knowledge and skills statements
	Apply mathematics to problems arising in everyday life, society and the workplace.	
	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 as well as the reasonableness of the solution.	
	Select tools, including ~~such as~~ real objects, manipulatives, paper/pencil, ~~and~~ technology, as appropriate and ~~or~~ techniques, including ~~such as~~ mental math, estimation, and number sense, as appropriate to solve problems.	
	Communicate mathematical ideas, reasoning, and their implications using multiple representations including ~~such as~~ symbols, diagrams, graphs, and language as appropriate.	
	Create and use representations to organize, record, and communicate mathematical ideas.	
	Analyze mathematical relationships to connect and communicate mathematical ideas.	
	~~d~~Display, ~~E~~explain, ~~or~~ justify mathematical ideas and arguments using precise mathematical language in written or oral communications.	