Algebra II
Curriculum Framework

Mapping High School Algebra II to:

Mathematics Cognitive Demands
Texas State Standards: Texas Essential Knowledge and Skills, TEKS
Underlying Processes in TEKS assessed in
Texas Assessment of Knowledge and Skills, TAKS
National Council of Teachers of Mathematics, NCTM,
Principles and Standards 2000

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The El Paso Collaborative for Academic Excellence

A Curriculum Framework for High School Algebra II

A group of K-16 classroom teachers and faculty, curriculum specialists, and department chairs met and developed a curriculum framework for high school Algebra II, an important step in developing explicit and comprehensive goals for teachers of Algebra II in the El Paso area. This framework represents the collective work of classroom teachers from K-12 schools and faculty from El Paso Community College and the University of Texas at El Paso. It is meant to assist mathematics teachers in ensuring that the current high school Algebra II course is aligned with the first year college mathematics course that entering college freshmen will take. The expectation is that by using the framework, the number of students having to enroll in remedial mathematics courses will be reduced. Students will benefit because of the collective effort of teachers who will embrace the next stage in this process: implementation with the goal of providing practical revision. With participation from every high school mathematics teacher, curriculum frameworks will become the standard in mathematics coursework for every student in El Paso.

Background

In 1998, the El Paso Collaborative board identified as its top priorities: 1) continuing to focus on mathematics, and 2) aligning mathematics curriculum, K-16. A review of local data on mathematics achievement showed a larger number of students enrolled in and completing college preparatory mathematics courses in high school. It also revealed a continuous increase in student achievement on TAAS. This higher student achievement, however, did not reflect student readiness for college mathematics courses. Further review of the data revealed that large numbers of high school students were placing and enrolling in remedial courses at El Paso Community College and the University of Texas at El Paso. While many factors contribute to the placing of large numbers of students in remedial courses, one known factor is that there was little alignment between what high school teachers expect students to know and be able to do and the expectations of college and university faculty.

To deal with some of these issues, the El Paso Collaborative for Academic Excellence proposed and was funded, by the National Science Foundation and the Pew Charitable Trusts, to support a K-16 Mathematics Alignment Initiative to align mathematics curriculum, instruction, and assessment. A beginning goal of the Initiative was to determine what students need to know and be able to do in a high school mathematics course that would prepare them to enroll in and successfully complete a college level mathematics course. Algebra II was identified as the pivotal course that could provide high school students with preparation for entering and successfully completing a college freshman pre-calculus course without first needing remediation.

Working Group

The Initiative convened a working group of classroom teachers and faculty to write a framework for Algebra II that teachers could utilize as a curriculum guide, no matter what instructional materials they were using for the course. (This work was continued with the development of curriculum frameworks for K-8 Mathematics, Algebra I, Geometry, and Pre-calculus.) The working group included: K-12 classroom teachers from both urban and rural independent school districts; mathematics and science staff developers, mentors with specialization in mathematics from the three major school districts; mathematics instructors from El Paso Community College; and professors representing the Colleges of Education (mathematics), Science (mathematics), and Engineering (computer science) from the University of Texas at El Paso. A complete list of participants in the K-16 Mathematics Working Group is attached.

To prepare for writing the curriculum framework for Algebra II, the group engaged in dialogue and discussion focused on mathematics teaching and learning. Using formatted discussions, the group:

- analyzed and discussed student performance in mathematics using data collected from state-mandated assessments and college placement tests;

- examined textbooks, course requirements, outline format, and state and national placement tools used to assess student knowledge of mathematics;
- reviewed the Texas Essential Knowledge and Skills (TEKS) and the National Council of Teachers of Mathematics (NCTM) Principles and Standards 2000;
- discussed how concepts were connected and developed at different grade levels, and how they led to concepts in higher mathematics;
- discussed international education systems, mathematics teaching and learning, and other issues related to mathematics education in other countries, such as Germany, Japan, Mexico, and Russia;
- identified alternate ways of assessing student learning that provide for standards-based assessment;
- discussed models of teaching mathematics; and,
- reviewed and discussed literature on mathematics education.

After these initial meetings, the group met for several days in summer 2000, fall 2000, spring 2001, and again for several days during summer 2001, to write a curriculum framework for Algebra II. Content for the high school course was placed in text outline form as well as matrix form to map content topics to cognitive demands. Course content was also mapped to textbooks and materials being used in the three major independent school districts, as well as to state (TEKS) and national (NCTM) mathematics standards. A table on standards-based assessment was attached to the matrix as a guide for assessing student learning and understanding of mathematics content. Also included are suggestions on how to determine a student's grade for the course and a timeline for covering the course.

K-16 Leaders Group

A leaders group that included district leaders and central office people from the three major independent school districts, the provost of the University, science and education deans, and mathematics department chairs from both the University and Community College, and lead principals and teachers from the districts, was also convened to dialogue and discuss issues in mathematics education. This group revised the curriculum framework several times, each time providing guidance and feedback as it was being developed.

Needs

What we need now is assistance from high school principals and teachers who will help review, revise, and make practical use of the framework during the current academic year. Ideally, we want the framework reviewed by every high school mathematics teacher, especially by every high school teacher of Algebra I and Algebra II. In order to continue our work in aligning the mathematics curriculum, K-16, we need active participation from every mathematics department in every school in both rural and urban independent school districts.

Call 747-5778 for more information on how you can be involved in reviewing and revising the framework for high school Algebra II.

Lucy Hernandez Michal
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K-16 MATHEMATICS ALIGNMENT WORKING GROUP

Jessie Aguilar	EPCC	Mathematics	Feb. 2000 – Oct. 2000
Liza Aguirre	CLISD	Horizon High School	Oct. 2004 - present
Nancy Arroyo	YISD	Riverside High School	Oct. 2003 - present
Alicia Beltran	SISD	Sanchez Middle School	Oct. 2001 – present
Patricia Benitez	EPISD	Magoffin Middle School	Oct. 2004 - present
Naomi Berglund	EPISD	Mesita Elementary School	Feb. 2000 - April. 2001
Vicky Brown	SISD	Helen Ball Elementary School	Feb. 8 - July 2000
Lupe Bujanda	EPISD	Bowie HS, MSP Staff Dev	Feb. 2000 - present
Lien Diaz	EPISD	Mentor MS, MSP Staff Dev	Oct. 2001 - present
Art Duval, Ph.D.	UTEP	Mathematics	Feb. 2000 - present
Pat Estrada	YISD	Mentor – MS	Feb. 2000 – June 2004
Maritza Fernandez	YISD	Hacienda Heights Elem. School	Oct. 2002 – June 2004
Carol Gardner	EPISD	USP Mentor - Elementary School	Feb. 2000 – June 2003
Ann Gates, Ph.D.	UTEP	Engr. - Computer Science	Feb. 2000 – June 2002
Sandra K. Garza	SISD	Mentor ES**,** SISD Elem Math	Feb. 2000 – present
Joanne Gillis	EPISD	Franklin High School	Feb. 2000 – June 2003
Terrie Giron	YISD	Mentor HS, MSP Staff Dev	Feb. 2000 – present
Martha Gonzales	EPISD	Vilas Elementary School	Oct. 2004 - present
Margie Gutierrez	SISD	Mentor MS	Feb. 2000 – June 2003
Carol Hardee	SISD	Mentor MS	Oct. 2002 - present
Greg Hatch	SISD	MSP Staff Developer	Oct. 2003 - present
Veronica Hernandez	EPISD	Mentor HS, MSP Staff Dev	Feb. 2000 – June 2002
Helmut Knaust, Ph.D.	UTEP	Mathematics	Oct. 2004 - present
Martha Kaudaissy	SISD	Campestre Elementary	Oct. 2001 – present
Blanca Lopez-Martinez	YISD	Mentor ES	Feb. 2000 – June 2003
Tony Murillo	SISD	Socorro Middle School	Oct. 2002 - present
Becky Ontiveros	EPISD	Mentor MS	Feb. 2000 - Aug. 2001
Jaime Ortiz	YISD	Parkland High School	Feb. 2000 - June 2000
Debra Paulson	EPISD	Hornedo MS, EPISD MS Math	Feb. 2000 – present
Joanne Peeples, Ph.D.	EPCC	Mathematics	Oct. 2002 – present
Estella Quinones, Ph.D.	UTEP	Metallurgical & Materials	Oct. 2002 - present
Martin Rede	SISD	Mentor HS, MSP Staff Dev	Feb. 2000 – present
Diane Reed	YISD	J. M. Hanks High School	Feb. 2000 - present
Ullrich Reichenbach	SISD	Montwood High School	Feb. 2001 – Dec. 2002
Fred Rojas	SISD	Americas High School	Oct. 2002 – June 2004
Edna Salas	SISD	Hilley Elementary School	Oct. 2002 - present
James Salazar	YISD	Bel Air HS, MSP Staff Dev	June 2001 – present
Gabriela Schwab	EPCC	Mathematics	Oct. 2002 - present
Marsha Self	EPCC	Mathematics	Feb. 2000 – June 2003
Gus Serrano	YISD	Ranchland Hills Middle School	Feb. 2000 – April 2003
Diane Seufert	EPISD	Carlos Rivera Elementary	April 2001 – present
Mariano Silva	EPISD	Mentor MS	June 2003
Sue Spotts	EPISD	Wiggs Middle School	Oct. 2000 - present
Mourat Tchoshanov, Ph.D., UTEP		Mathematics	Feb. 2000 - present
Rita Tellez	EPISD	Bowie HS, EPISD HS Math	Oct. 2002 – Oct. 2004
Tom Ukstad	SISD	Americas High School	Feb. 2000 - present
Jaime Vasquez	SISD	Hueco Elementary School	Feb. 2000 - May 2000
Donnett Vollmer	EPISD	Magoffin Middle School	Feb. 2000 - May 2000
Xiaomin Wang, Ph.D.	EPCC	Mathematics	Oct. 2004 – April 2005
Matthew Winsor, Ph.D.	UTEP	Mathematics	Oct. 2004 – present
Stella Woo	EPISD	Silva Magnet High School	Oct. 2004 – present
Lucy Hernandez Michal	Director, K-16 Mathematics Alignment Initiative, MSP Director of Mathematics and Science		Jan. 2000 - present

ALGEBRA II COURSE OUTLINE

I. COURSE DESCRIPTION

Algebra II is a course of study of non-linear functions and relations with their applications. The course expands upon mathematical concepts from Algebra I. Students will solve multi-step problems involving equations, inequalities, 3X3 systems, and non-linear functions that include the quadratic, square root, rational, exponential, and logarithmic functions. The course will include a basic introduction to conic sections. Optional topics may include sequences and probability. Connections to other disciplines, technology, and real-world applications will be studied. Algebra 2 will help students experience higher-level mathematics and broaden their potential career choices.

II. PREREQUISITE KNOWLEDGE

A student entering Algebra II should have successfully completed Algebra I and should know and be able to use**:**

A. Real numbers and their operations, quantitative reasoning, patterns, relationships and algebraic thinking, geometry, measurement, basic probability and statistics
B. Problem solving, computation in problem solving contexts, mathematical vocabulary and communication, connections within and outside mathematics and reasoning, multiple representations, applications, and modeling, and use technology whenever appropriate
C. Algebraic concepts of exponents, variables, factoring, linear equations including slope as a constant rate of change, generating linear equations, inequalities, and 2x2 linear systems
D. The foundational concepts of functions, including their applications, inverses, and multiple representations of functions
E. Non-linear functions such as $y = ax^2$, $y = ax^2 + c$, $y = a^x$, and $y = 1/x$ at an introductory level
F. Appropriate technology for the study of algebra
G. Basic operations with polynomial expressions

III. CONTENT

A. In Algebra II, the content focuses on families of functions. They are:
   1. Linear functions (as a brief review), equations, inequalities and systems involving representations of near-linear data and basic linear programming situations
   2. Quadratics (including an introduction of conics)
   3. Square Root functions (studied as inverses of the quadratic functions)
   4. Polynomial functions (introduced briefly with multiplication and division of polynomials by monomials)
   5. Rational functions (including inverse and direct variation models)
   6. Exponential functions (including properties of exponents)
   7. Logarithmic functions (studied as the inverses of exponential functions)
   8. Geometry of functions (attributes of functions and transformations)

B. Each family of functions in Algebra II should be studied in the following framework:
   1. Initiate with an activity showing the need for a function that has not been used as a model before
   2. Lead to basic definitions and other attributes of the function, such as domain, range, intercepts, and asymptotes

3. Include multiple representations of functions such as graphic, numeric, symbolic, verbal, and tabular
4. Use appropriate technology such as spreadsheets, lists, tables, and graphing utilities
5. Extend parent function with parameter changes and transformations
6. Use the function in applications involving solving equations, inequalities, and 3x3 systems of equations, and high-level algorithmic manipulation of equations and inequalities

IV. ASSESSMENT

A. It is suggested that a variety of methods be used to assess student learning. This includes assessments that show student work as well as student explanations of their work. These assessments might include both traditional and alternative methods such as:
1. Performance based tasks
2. Open book (including homework)
3. Technology-based presentations
4. Interviews
5. Observations
6. Portfolios
7. Projects with rubrics (individual and group)
8. Warm-up quizzes
9. Multiple choice
10. Open response
11. Comprehensive, multi-step problems
12. Final Exam – The final exam should be a comprehensive exam standardized by campus with future plans to standardize by district, city, and/or state. Having all students taking a final exam will prepare students for college final exams. The final exam should count approximately 25% of the grade.

B. Recommended Course Grade – Each district has guidelines for course grades and, whenever possible, it is suggested that final course grades for students be guided by the following:
1. Formative assessments 25% (daily tools: warm-ups, quizzes, teacher observations and interviews, group work)
2. Closed book assessments 25% (Open response, multiple choice, quantitative comparisons, SAT, multi-step problems)
3. Open book assessments 25% (homework, projects, presentations, portfolios)
4. Final Comprehensive Exam 25%

V. TIMELINE

A brief overview of basic Algebra I topics, such as linear functions, equations, inequalities, and 2x2 linear systems, may be given at the beginning of the semester (no more than 1 week). It is recommended that the rest of the time should be allotted as follows, and that any further review be given within the following units as needed.

A. Foundations for Functions: Linear Functions, 10%
(include systems of 3x3 linear equations and inequalities)
B. Algebra and Geometry 10%

C. Quadratic Functions and Square Root Functions, 25%
D. Rational Functions, 25%
E. Exponential and Logarithmic Functions, 25%
F. Polynomials, 5%

VI. INFORMATION/RESOURCES

A. FOR STUDENTS
1. Course description
2. Teacher information (conference period, office hours)
3. Work, projects, homework, exams, etc., to be produced by the students including grading policy for each
4. Rubrics for projects/presentations/portfolios
5. Resources – tutoring, lab, Internet web sites specific to the course, computer programs, teacher conference period, other outside support available
6. Weekly calendar
7. Materials: It is recommended that a textbook/calculator package be issued to each student

B. FOR TEACHERS
1. Labs: math and computer
2. Materials: textbooks, calculators with view screens, charts, transparencies, etc.
3. Computer: hardware, software, and multi-media resources
4. Professional Networks: provisions for teacher teaming during conference time, professional development/credits or endorsements to increase salaries, peer coaching
5. References: instructor manuals, journals, Educational Resource Information Clearinghouse, Internet websites
6. CBL- Computer Based Lab and CBR – Computer Based Range
7. Vertical alignment information on K-16 alignment initiatives
8. Suggested course calendar

VII. MATRIX MAPPING ALGEBRA TO COGNITIVE DEMANDS

A. Attached is a matrix that matches cognitive demands to knowledge and skills in Algebra II. The work on cognitive demands has been guided by the work of Andrew Porter, Norman Webb, and John Smithson. The cognitive demands identified by Porter, Webb, and Smithson were used as models and modified by the working group to fit the work in Algebra II. These identify thinking levels that incorporate five (5) levels of cognitive demands. They are listed in order on the matrix from higher order to lower order as you read from left to right. The matrix also maps the textbook and materials being used in each of the major independent school districts, and the state and national mathematics standards.

B. Cognitive Demands for Mathematics

Cognitive demands assist teachers in distinguishing what a student is expected to know and be able to do with mathematics content and what level of thinking a student must be engaged in while learning content. This mapping of topics of cognitive demands describes content knowledge that will not merely be stored, but also understood, represented, organized, connected, and structured in ways that facilitate retrieval and application of knowledge. With knowledge and skills mapped to cognitive demands,

teachers know how to get students to use, represent, and connect pieces of content knowledge in coherent ways that will determine whether students understand knowledge deeply and can use it to solve new problems. The cognitive demands are not linear, nor are they sequential. In many instances they overlap and are not clearly separated. They are to:

1. **Generalize** – make and prove conjectures, prove statements, generate questions
2. **Make Connections** – transfer knowledge, connect two or more concepts to solve non-routine problems
3. **Understand Concepts** – communicate "big ideas", justify and explain solutions to problems, use multiple representations to model mathematical ideas, select the most appropriate representation for given situations
4. **Perform Procedures** – do computations, make observations, measure and compare, solve routine problems
5. **Memorize** – recall facts, definitions, formulas, properties, rules

C. Format and Further Information on Matrix Structure

1. All TEKS are included in the framework
2. Items in the matrix appearing in regular fonts are TEKS and are placed within the appropriate cognitive demand column.
3. Italicized items are used:
    a. to support the teaching and learning of a topic; these do not reference a TEKS;
    b. to paraphrase a TEKS to address the different levels of cognitive demands; these will have a referenced TEKS and are placed under multiple cognitive demands.
4. Strands/topics in matrices overlap and may be integrated.
5. Cognitive demands overlap and are not linear.
6. The framework is not intended to be sequential.
7. Other topics supporting the study of algebra may be included in the matrix.

Algebra II Course Framework Matrix Mapping Knowledge and Skills to Cognitive Demands

Knowledge and Skills	Cognitive Demands				
	Generalize	**Make Connections**	**Understand Concepts**	**Perform Procedures**	**Memorize**
Foundations for Functions 2A.1 The student uses properties and attributes of functions and applies functions to problem situations 2A.2 The student understands the importance of skills required to manipulate symbols to solve problems and uses necessary algebraic skills required to simplify algebraic expressions and solve equations and inequalities in problem situations 2A.3 The student formulates systems of equations and inequalities from problem situations, uses a variety of methods to solve them, and analyzes the solutions in terms of the situations.	Investigate the model for constant rate of change, m = = $\Delta y/\Delta x$, as a linear model, y = mx	2A.1B Collect and organize data, make and interpret scatterplots, fit the graph of a function to the data, interpret results 2A.3A analyze situation and formulate systems of equations in two or more unknowns or inequalities in two unknowns to solve problems Explore transformation of a parent function	2A.1A Identify mathematical domains and ranges of functions and determine reasonable domain and range values for continuous and discrete situations 2A.2B use complex numbers to describe solutions of quadratic equations 2A.3C interpret and determine the reasonableness of solutions to systems of equations or inequalities for given contexts	2A.2A use tools including factoring and properties of exponents to simplify expressions and to transform and solve equations 2A3.B use algebraic methods, graphs, tables , or matrices, to solve systems of equations or inequalities Perform basic matrix operations Form and evaluate the composition of two functions	Know point-slope, general, standard, and slope-intercept forms of equations Know slope of a line m = $\Delta y/\Delta x$ Understand function notation y = f(x) Know matrix notation Know basic matrix operations Understand vocabulary: domain, range, intercepts, matrix, dimension of matrices
	Textbook/materials		**NCTM Standards**		
EPISD **YISD** **SISD**	Glencoe 1.1, problems 32 – 52 2.1, 2.3, 2.4, 2.7, 3.1, 3.2, 3.4 – 3.7, 3.7b Prentice Hall 1.1 – 1.3, 2.1 – 2.5, 3.1, 3.6, 4.1, 4.6 Heath 2.7, (2.1 – 2.4 review briefly) 2.5, 2.6, 1.5, 3.1 – 3.6		Understand patterns, relations, and functions Represent and analyze mathematical situations and structures using algebraic symbols Use mathematical models to represent and understand quantitative relationships Analyze change in various contexts		

Algebra II Course Framework Matrix Mapping Knowledge and Skills to Cognitive Demands

	Cognitive Demands				
Knowledge and Skills	**Generalize**	**Make Connections**	**Understand Concepts**	**Perform Procedures**	**Memorize**
Algebra and geometry **The student:** 2A.4 connects algebraic and geometric representations of functions 2A.5 knows the relationship between the geometric and algebraic descriptions of conic sections	2A.4B extend parent functions with parameters such as s in f(x) = a/z and describe effects of the parameter changes on the graph of parent functions 2A.4C describe and analyze the relationship between a function and its inverse	*Apply symmetry to identify as many points as possible for given points on a conic section* *Explore the relationships between conics* *Determine the equation of the conic section given points on the curve*	2A.5A Describe *and represent* a conic section as the intersection of a plane and a cone 2A.5C-D identify symmetry, of conic sections from their graphs and equations	2A.4A identify and sketch graphs of parent functions, including linear (f(x) = x) quadratic f(x) = x^2), exponential (f(x) = a^x), and logarithmic (f(x) = $\log_a x$) functions, absolute value of x (f(x) = |x|), square root of x (f(x) = $\sqrt{x}$), and reciprocal of x (f(x) = 1/x) 2A.5E use the method of completing the square *to transform the equation of a conic section to standard form* 2A.5B sketch graphs of conic sections to relate simple parameter changes in the equation to corresponding changes in the graph	*Know equations in standard form* *Know attributes of conic sections: domain, range, asymptote, vertices and symmetry*

	Textbooks and Materials	**NCTM Standards**
EPISD **SISD** **YISD**	Glencoe 7.1 – 7.6 (if time permits 7.7) Prentice Hall 10.1 – 10.6 11.1 – 11.6 appropriate parts	Algebra Standard Represent and analyze mathematical situations and structures using algebraic symbols Use mathematical models to represent and understand quantitative relationships Geometry Standard Apply transformations and use symmetry to analyze mathematical situations

Algebra II Course Framework Matrix Mapping Knowledge and Skills to Cognitive Demands

Knowledge and Skills	Cognitive Demands				
	Generalize	**Make Connections**	**Understand Concepts**	**Perform Procedures**	**Memorize**
Quadratic Functions 2A.6 The student understands that quadratic functions can be represented in different ways and translates among their various representations. 2A.7 The student interprets and describes the effects of changes in the parameters of quadratic functions in applied and mathematical situations. 2A.8 The student formulates equations and inequalities based on quadratic functions, uses a variety of methods to solve them, and analyzes the solutions in terms of the situation.	Generalize effects of parameter changes Use technology to extend the concept of a quadratic function	2A.8C compare and translate between algebraic and graphical solutions of quadratic equations 2A.8A analyze situations involving quadratic functions and formulates quadratic equations or inequalities to solve problems 2A.8B *analyze and interpret solutions of quadratic equations using discriminants* Use quadratics to model given data	2A.7A use characteristics of the quadratic parent function to sketch the related graphs and connect between the $y = ax^2 + bx + c$ and the $y = a(x - h)^2 + k$ symbolic representations of the quadratic functions 2A.7B use the parent function to investigate, describe, and predict the effects of changes in a, h, and k on the graphs of $y = a(x - h)^2 + k$ form of a function in applied and purely mathematical situations 2A.6A determine the reasonable domain and range values of quadratic functions, as well as interpret and determine reasonableness of solutions to quadratic equations and inequalities *Model quadratic functions using multiple representations* 2A.6B relate representations of quadratic functions such as algebraic, tabular, graphical, and verbal descriptions	Find the vertex for quadratic functions in $y = a(x-h)^2 + k$ form and $y = ax^2 + bx + c$ form Graph quadratic functions Perform transformations of quadratic functions 2A.6C determine a quadratic function from its roots or graph 2A.8B,D *solve quadratic equations and inequalities using the quadratic formula, graphs, tables, algebraic methods (factoring and completing the square), and graphing technology* Calculate the discriminant of a given quadratic equation Solve quadratic inequalities	notation: $y = x^2$ $y = a(x-h)^2 + k$ $y = ax^2 + bx + c$ vocabulary: Discriminant Vertex Maximum Minimum Symmetry Quadratic formula Basics of complex numbers

	Textbooks & Materials	**NCTM Standards**
EPISD	Glencoe 6.1 – 6.7	Understand patterns, relations, and functions Represent and analyze mathematical situations and structures using algebraic symbols Use mathematical models to represent quantitative relationships Select and use various types of reasoning and methods of proof
YISD	Prentice Hall 5.1 – 5.3, 5.5 – 5.8, Give more time to 5.1 – 5.3	
SISD	Heath 5.1 – 5.7, 6.1 – 6.3, 6.5	

Algebra II Course Framework Matrix Mapping Knowledge and Skills to Cognitive Demands

Knowledge and Skills	Cognitive Demands				
	Generalize	**Make Connections**	**Understand Concepts**	**Perform Procedures**	**Memorize**
Square Root Functions 2A.9 The student formulates equations and inequalities based on square root functions, uses a variety of methods to solve them, and analyzes the solutions in terms of the situation	*Discover that simplified square roots are equivalent using geometry* *Prove that* $\sqrt{a^3} = a\sqrt{a}$ *using a graphical computation of area*	2A.9F analyze situations modeled by square root functions, formulate, equations and inequalities, select a method, and solve problems 2A.9G connect inverses of square roots functions with quadratic functions *Connect and recognize the length of the side of a square as the square root of the area* *Connect physical models to square root functions*	2A.9C determine the reasonable domain and range values of square root functions as well as interpret and determine the reasonableness of solutions to square root equations and inequalities 2A.9A use the parent function to investigate, describe, and predict the effects of parameter changes on the graphs of square root functions and describe limitations on the domains and ranges 2A.9B relate representations of square root functions, such as algebraic tabular, graphical, and verbal descriptions	2A.9A *graph square root functions* 2A.9D determine solutions of square root equations using graphs, tables, and algebraic methods 2A.9E determine solutions of square root inequalities using graphs and tables *Perform transformations on graphs of square root functions* *Simplify square roots*	Notation $y=x^{a/b}$ $y=\sqrt[b]{x^a}$ Properties of square roots $\sqrt{a} * \sqrt{b} = \sqrt{a*b}$ $\frac{\sqrt{a}}{\sqrt{b}} = \sqrt{(a/b)}$ $\sqrt{a} = a^{1/2}$ Vocabulary: Square root, Domain, Range Limits of domain and range for square root functions $y = x^{a/b} = \sqrt[b]{x^a}$ $\sqrt{x} = x^{½}$ or $\sqrt[3]{x} = x^{1/3}$ x^a where a=1

	Textbooks/Materials	**NCTM Standards**
EPISD **SISD** **YISD**	Glencoe 5.5 – 5.10, 8.8, 8.8B (supplement with other materials) Prentice Hall 5.4 (supplement) Heath 2.7, (2.1 – 2.4 review briefly) 2.5, 2.6, 1.5, 3.1 – 3.6	Understand Patterns, Relations and Functions Represent and analyze mathematical situations and structures using algebraic symbols Use mathematical models to represent and understand quantitative relationships

Algebra II Course Framework Matrix Mapping Knowledge and Skills to Cognitive Demands

Knowledge and Skills	Cognitive Demands				
	Generalize	**Make Connections**	**Understand Concepts**	**Perform Procedures**	**Memorize**
Rational Functions 2A.10 The student formulates equations and inequalities based on rational functions, uses a variety of methods to solve them, and analyzes the solutions in terms of the situation.	*Investigate the behavior and attributes of a rational function that make it different from other functions* *Investigate and describe the attributes for* $f(x) = 1/x^n$ *for n= 1, 2, 3…*	2A.10B analyze various representations of rational functions with respect to problem situations 2A.10F analyze a situation modeled by a rational function, formulate an equation or inequality composed of a linear or quadratic function, and solve the problem 2A.10G use functions to model and make predictions in problem situations involving direct and inverse variation *Collect data and fit with a rational function, y = k/(ax+b), by manipulating parameters a, b, and k* *Investigate the relationship between two physical properties, identify and describe the relationship using multiple representations, e.g. velocity and time, or volume and temperature, or volume and pressure of a gas*	2A.10A use quotients of polynomials to describe the graphs of rational functions, predict the effects of parameter changes, describe limitations on the domains and ranges, and examine asymptotic behavior 2A.10C determine the reasonable domain and range values of rational functions a well as interpret and determine the reasonableness of solutions to rational equations and inequalities *Communicate solutions using multiple representations* *Describe short-run and long-run behavior of rational functions* *Use technology to develop concepts*	2A.10D determine solutions of rational equations using graphs, tables and algebraic methods 2A.10E determine solutions of rational inequalities using graphs and tables *Graph and sketch rational functions* *Simplify rational expressions*	*Recognize rational parent function, y=1/x* *Vocabulary domain, range, asymptote, continuous, discontinuous* *inverse variation as y =k/x or xy =k.* *rational function as the quotient of two polynomial functions*
EPISD **SISD** **YISD**	**Textbooks and Materials**		**NCTM Standards**		
	Glencoe 9.1 – 9.5 Prentice Hall 8.1 – 8.6 (supplement with other materials) Heath 10.1 – 10.5		Understand patterns, relations, and functions Represent and analyze mathematical situations and structures using algebraic symbols Use mathematical models to represent and understand quantitative relationships		

Algebra II Course Framework Matrix Mapping Knowledge and Skills to Cognitive Demands

	Cognitive Demands				
Knowledge and Skills	**Generalize**	**Make Connections**	**Understand Concepts**	**Perform Procedures**	**Memorize**
Exponential and logarithmic functions 2A.11 The student formulates equations and inequalities based on exponential and logarithmic functions, uses a variety of methods to solve them, and analyzes the solutions in terns of the situation	*Investigate patterns to make and test conjectures involving exponential models and logarithmic models* *Make and test the conjectures on how the properties of logarithms may be derived*	2A.11A develop definition of logarithms by exploring and describing the relationship between exponential functions and their inverses 2A.11F analyze a situation modeled by an exponential function, formulate and equation or inequality and solve the problem. Analyze inverse relationships between exponential and logarithmic functions Investigate patterns that lead to logarithmic models	2A.11B use the parent functions to investigate, describe, and predict the effects of parameter changes on the graphs of exponential and logarithmic functions, describe limitations on the domains and ranges, and examine asymptotic behavior 2A.11C determine the reasonable domain and range values of exponential and logarithmic functions, as well as interpret and determine the reasonableness of solutions to exponential and logarithmic equations and inequalities *Describe $y = b^x$ as a constant ratio of successive y values for a constant change in x* *Describe the effects of transformations* *Use multiple representations of exponential and logarithmic relationships* *Use patterns to recognize and describe exponential relationships*	2A.11D determine solutions of exponential and logarithmic equations using graphs, tables, and algebraic methods 2A.11E determine solutions of exponential and logarithmic inequalities using graphs and tables *Graph exponential and logarithmic functions* *Use properties of exponents to simplify exponential expressions and solve equations* Convert equations from exponential to logarithmic and vice versa Determine a logarithmic function, or an exponential function for a given data set	Properties of exponents Properties of logarithms Notation $y = b^x$ $y = \log_a x$ $y = c_0 e^{kt}$ Attributes of $y = b^x$ $y = \log_a x$ Vocabulary domain range intercepts asymptotes logarithms Domain, range, intercepts, and asymptotes for $y = \log_a x$

	Textbook & Materials	**NCTM Standards**
EPISD	Glencoe 10.1, 10.6, 10.7 (cover 10.1A after logs)	Understand patterns, relations, and functions Represent and analyze mathematical situations using algebraic symbols
SISD	Prentice Hall 7.1, 7.2, 7.5	Use mathematical models to represent and understand quantitative relationships
YISD	Heath 7.1 – 7.4, 8.1, 8.4, 8.6, 8.7, 7.5	Analyze change in various contexts

Algebra II Course Framework Matrix Mapping Knowledge and Skills to Cognitive Demands

Knowledge and Skills	Cognitive Demands				
	Generalize	**Make Connections**	**Understand Concepts**	**Perform Procedures**	**Memorize**
Polynomials and Polynomial Functions Introduce briefly with: multiplication and division of polynomials by monomials and discussion of roots of polynomials	Compare and contrast the attributes of a given set of graphs of polynomials	Describe the graphs of polynomial functions using the factor theorem and the fundamental theorem of algebra	Interpret connections between higher order polynomials and the number of roots they have Discuss the relationship between x-intercepts and the degree of a polynomial	Use difference tables to find degrees of polynomials Perform basic operations (addition, subtraction, multiplication, division) with polynomials Identify/estimate zeros from graphs and tables Determine polynomials using zeros, graph, and algebraic methods	Know the degree of a polynomial Recognize general form for polynomials $P(x) = a_n x^n + a_{(n-1)} x^{n-1} + \ldots a_1 x + a_o$ $y = a(x-r_1)(x-r_2)\ldots(x-rn)$ Know vocabulary: root, zeros, solutions, intercepts, short run behavior, & long run behavior

	Textbooks & Materials	**NCTM Standards**
EPISD	Glencoe 5.1 – 5.4	Understand patterns, relations and functions
SISD	Prentice Hall 6.1 – 6.5	Represent and analyze mathematical situations and structures using algebraic symbols
YISD	Heath 9.1 – 9.7	Use mathematical models to represent and understand quantitative relationships

Algebra II Course Framework Matrix Mapping Knowledge and Skills to SIMMS

Knowledge and Skills	Unit	Activities	TEKS	NCTM
Linear Functions	*Marvelous Matrices* Level 2, Vol. 1 Making Concessions Level 2, Vol. 2 **Additional or Alternative Modules** *Under the Big Top Level* 1, Vol. 3 (Inequalities and linear Programming) *More or less* Level 4, Vol. 2 (Interpret and solve linear, absolute value, and polynomial inequalities) *What are you Eating* Level 3, Vol. 1 (Linear programming and solving systems of equations)	Activity 2: Addition & subtraction of matrices and multiplying matrices by scalars (Assessment: 2.4, 2.5) Activity 3: Multiplying two matrices (Assessment: 3.1, 3.6) 1 – Representing regions and determining constraints with inequalities, interpreting the meaning of points of a feasible region (Assessment: 1.2, 1.6) 2 – Objective Functions (Max and min values of functions, finding vertices of feasible regions) (Assessment: 2.2, 2.5) 3 – Solve systems of 2x2 equations with matrices (Assessment: 3.2, 3.5) 4 – Solve systems of 3x3 matrices (Assessment: 4.6, 4.7)	(b) Foundations of Functions (1) A (2) A (3) A, B, C	Understand patterns, relations, and functions Represent and analyze mathematical situations and structures using algebraic symbols Use mathematical models to represent and understand quantitative relationships Analyze change in various contexts
Quadratic Functions	*Graphing the Distance* Level 3, Vol. 2 *An Imaginary Journey Through the Real World* Level 6, Vol. 3	3 –Behavior of quadratics under transformations (Assessment: 3.3, 3.7) 4 –Modeling with Quadratic equation, influence of object's acceleration on equation (Assessment: 4.1, 4.5) 1- imaginary solutions to quadratic equations (Assessment: 1.6, 1.7) 3- Exploration 1: Quadratic equations with real and imaginary roots (quadratic formula) (Assessment: 3.1, 3.2)	(c) Algebra and Geometry (1) A, B (d) Quadratic and Square Root functions (1) A, B, C (2) A, B (3) A, B (b) Foundations of Functions (2) B	Understand patterns, relations, and functions Represent and analyze mathematical situations and structures using algebraic symbols Use mathematical models to represent quantitative relationships Select and use various types of reasoning and methods of proof

Algebra II Course Framework Matrix Mapping Knowledge and Skills to SIMMS

Polynomials and Polynomial Functions	*Drafting and Polynomials* Level 4, Vol. 1 (supplement with solving quadratic equations and inequalities)	1 – Identifying the relationships among the zeros, degree, and factors of a polynomial function (2 points linear) (Assessment: 1.2, 1.7) 2 – Extending the concepts of zeros and factors of a polynomial (quadratics) (Assessment: 2.5, 2.6) 3 - Extending the concepts of zeros and factors of a polynomial degrees greater than two (Assessment: 3.2, 3.6) 4 - Behavior of odd and even functions including transformations (Assessment: 4.1, 4.7)	(d) Quadratic and Square Root functions (1) A, B, C (2) A, B (3) C, D (b) Foundations of Functions (1) A	Understand patterns, relations and functions Represent and analyze mathematical situations and structures using algebraic symbols Use mathematical models to represent and understand quantitative relationships
Square Roots and Square Root Functions	*Ostriches are Composed* Level 6, Vol. 2 (Supplement with other material)	1 - Range and domain of square root functions 2 - Composition of square root functions 4 - Examines inverse functions involving square roots, graphically and algebraically	(c) Algebra and Geometry (1) A (d) Quadratic and Square Root Functions (4) A, B, C, F (b) Foundations of Functions (2) C	Understand Patterns, Relations and Functions Represent and analyze mathematical situations and structures using algebraic symbols Use mathematical models to represent and understand quantitative relationships
Rational Functions	*Big Business* Level 4, Vol. 2	1 - Explore rational functions and equivalent functions, extend the concept to graphs of continuous and discontinuous (Assessment: 1.1, 1.4) 2 - Vertical and horizontal asymptotes of rational functions (Assessment: 2.2, 2.3) 3 - Oblique asymptotes of rational functions (Assessment: 3.3, 3.4) 5 - Rational inequalities (Assessment: 5.2, 5.3)	(e) Rational Functions (1), (2), (3), (4), (5)	Understand patterns, relations, and functions Represent and analyze mathematical situations and structures using algebraic symbols Use mathematical models to represent and understand quantitative relationships

Algebra II Course Framework Matrix Mapping Knowledge and Skills to SIMMS

Exponential Functions	*Skeeters* Level 1, Vol. 2 *Atomic Clocks* Level 2, Vol. 2	1 - Develops mathematical model of exponential growth (Assessment: 1.5, 1.6) 3 - Develops exponential equation (Assessment: 3.2, 3.8) 2 - Develops properties of exponents (Assessment: 2.5, 2.10)	(f) Exponential and Logarithmic Functions (1), (2), (3), (4), (5)	Understand patterns, relations, and functions Represent and analyze mathematical situations using algebraic symbols Use mathematical models to represent and understand quantitative relationships Analyze change in various contexts
Logarithmic Functions	*Log Jam* Level 4, Vol. 1	1 - Behavior of logarithmic functions (Assessment: 1.5, 1.6) 2 - Explores the logarithmic scale (Assessment: 2.6, 2.7) 3 - Develops properties of logarithms (Assessment: 3.1, 3.6)	(f) Exponential and Logarithmic Functions (1), (2), (3), (4), (5)	Understand patterns, relations, and functions Represent and analyze mathematical situations using algebraic symbols Use mathematical models to represent and understand quantitative relationships Analyze change in various contexts
Geometry of Functions	*All in the Family* Level 4, Vol. 3	1 - Develops skills for transforming functions (Assessment: 1.1 - 1.4) 2 - Recognize parent functions and use family members to determine transformations (Assessment: 2.3, 2.4) 3 - Find transformed equation to model data sets (Assessment: 3.4, 3.6)	(c) Algebra and Geometry (1) A, B, C (b) Foundations of Functions (1) B	Understand patterns, relations, and functions Represent and analyze mathematical situations using algebraic symbols Use mathematical models to represent and understand quantitative relationships Analyze change in various contexts
Conic Sections	*Transmitting through conics* Level 4 vol.3	1 - Examines a circle and uses distance formula to develop the standard equation of a circle (Assessment: 1.1, 1.6) 2 - Examines an ellipse and develops the standard equation (Assessment: 2.2, 2.6) 3 - Examines a hyperbola and develops the standard equation (Assessment: 3.4, 3.6) 4 - Examines a parabola and develops the standard equation (Assessment: 4.4, 4.6)	(c) Algebra and Geometry (2) A, B, C, D, E	Algebra, Represent and analyze mathematical situations and structures using algebraic symbols, Use mathematical models to represent and understand quantitative relationships, Geometry Standard, Apply transformations, use symmetry to analyze mathematical situations

STANDARDS-BASED ASSESSMENT

Type of Assessment	Purpose of Assessment	How often?	Materials Needed	Descriptors for Acceptable Level of Performance
FORMATIVE ASSESSMENTS 25%				
Student/Teacher Interviews	**To examine the thinking process of students**	**Weekly**	**Paper/recorder**	**Vocabulary, participation**
Observations Discussions	**To measure if a student is able to communicate understanding of a concept**	**As often as possible**	**Checklist**	**Participation**
Warm-up	**Daily review reinforcement**	**Daily**	**Overhead, paper/pencil, calculators**	**Working problem 70% or better**
CLOSED BOOK ASSESSMENTS 25%				
Multiple Choice Exams	**Evaluate skills** Preparation for mandated tests	**Twice a week**	**Scanners** Multiple tests	**80% correct**
Open Response Exams	**Test individual student understanding**	**3 - 4 per grading period**	**Rubrics** Test	**80% correct**
OPEN BOOK ASSESSMENTS 25%				
Performance Based Task	**To measure how close student are in mastering TEKS standards** To measure how well the student transfers and integrates knowledge Measure understanding of concepts	**Every 6 – 12 weeks**	**Tools on a student generated list** Calculator, computer, chart paper, poster board, transparencies, presentation tools, manipulatives, video equipment, multi-media	**Rubric (descriptor) based on TEKS or standard** Include: Content criteria, Process criteria Presentation criteria
Presentation in groups of two, three, or four	**Summative**	**1 per grading period**	**Research material** Access to media center Consumable material	**Knowledge of content** Vocabulary Oral communication
Homework and Openbook exams	**Student finds and uses information in resources to:** Solve problems and explain solutions Explain mathematic concepts Prepare for "closed book" exam	**Midway thru and at the end of a "Big Idea"**	**Textbooks, notes, library, computer resources, calculator, manipulatives**	**Demonstrate knowledge and understanding of the big idea at the "Mastery Level"**
Technology-based presentation	**Extend understanding of concepts**	**2 per semester**	**Computer software, calculators**	**Student/teacher created rubric**
Journaling	**Thinking process, communication**	**Weekly**	**Notebook paper, index cards 5x7**	**Clear writing about topic, turning it in**
Projects	**Extension of concepts** Tests different styles of understanding	**Every 6 weeks**	**Varies with written rubric describing project**	**Rubric Requirements**
FINAL COMPREHENSIVE EXAM 25%				
Comprehensive	**To measure what student knows and is able to do with the knowledge acquired from the entire course**	**1 at the end of the entire course**	**Test**	**80% correct**