

Geometry

Curriculum Framework

Mapping High School Geometry 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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El Paso Collaborative for Academic Excellence

A Curriculum Framework for High School Geometry

A group of K-16 classroom teachers and faculty, curriculum specialists, and department chairs met and developed a curriculum framework for high school Geometry, an important step in developing explicit and comprehensive goals for teachers of geometry 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 current high school mathematics courses are 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 large numbers of high school students 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 Precalculus.) 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 Geometry, as with all the others, 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, national, and placement tools used to assess student knowledge of mathematics;
- reviewed the Texas Essential Knowledge and Skills (TEKS) and the National Council of Teachers in 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 bimonthly during academic years and for several days in the summer, to write curriculum frameworks for Algebra II, and continued with K-8 Mathematics, Algebra I, Geometry, and Precalculus. 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, as well as lead principals and teachers from the districts, was also convened to dialogue and discuss issues in mathematics education. This group provided guidance and feedback and contributed revisions to the curriculum frameworks throughout their development.

Needs

What we need now is assistance from high school principals and teachers to 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 geometry. 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 Geometry.

Lucy H. Michal
Director, K-16 Mathematics Alignment Initiative
MSP Director of Mathematics and Science
lmichal@utep.edu

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 – June 2003
Ullrich Reichenbach	SISD	Montwood High School	Feb. 2001 – Dec. 2002
Fred Rojas	SISD	American High School	Oct. 2002 – June 2004
Edna Salas	SISD	Hilley Elementary School	Oct. 2002 – June 2003
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 – June 2004
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

GEOMETRY COURSE OUTLINE

I. COURSE DESCRIPTION

Geometry is the study of measurement of zero, one, two, and three dimensional objects. In studying geometry, students will see and understand how patterns occur in the construction of geometric shapes. Students will use similarity, congruence, transformations, and both formal and informal reasoning to compare and construct given geometric shapes, and shapes found in both art and the world around them. In studying geometry, students will add to their knowledge of mathematical reasoning by formulating, investigating, analyzing, and defending geometric conjectures. This knowledge of geometry will enhance their understanding of algebra and prepare them for higher levels of mathematics. It will also enrich their view and understanding of the vast universe around them.

II. PREREQUISITE KNOWLEDGE

Students entering high school geometry should know and be able to use:

A. Visualization

1. names/definitions of shapes (2D and 3D)
2. properties of shapes
3. basic geometric construction (building blocks)
4. spatial reasoning
5. connect shapes and figures to mathematical situations

B. Analysis

1. relationships between properties (make conjectures about properties)
2. measurement (perimeter, area, volume)
3. categorization using attributes (compare and contrast attributes of 2D and 3D figures, make conjectures about relationships of triangles, quadrilaterals and circles)
4. proportional reasoning
5. Pythagorean theorem

C. Informal Deduction

1. visual proofs
2. introduction to Cartesian coordinate plane
3. transformational geometry

D. Algebra

1. solve linear equations
2. evaluate algebraic expressions
3. Pythagorean theorem

III. CONTENT

After taking high school geometry, students should know, understand, and be able to use:

A. Formal proofs in geometry

1. logical reasoning
2. formal justification
3. proportional reasoning

B. Rigor in geometry

1. axiomatic system
2. construct figures

3. introduction to non-Euclidean geometries (e.g. spherical geometry)
 4. introduction to trigonometry
 5. coordinate geometry
 6. formal use of similarity, transformations, congruence
- C. Application of geometry
1. determine, use, and estimate measurements of 2D and 3D figures
 2. use geometry to make decisions about living and work space
 3. extract geometric information from real life

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. 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

VI. MATRIX MAPPING GEOMETRY TO COGNITIVE DEMANDS

A. Attached is a matrix that matches cognitive demands to knowledge and skills in Geometry. 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 Geometry. 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 and select multiple representations to model mathematical ideas and select the most appropriate for given situations
4. **Perform Procedures** – do computations, make observations, measure and compare, solve routine problems
5. **Memorize** – 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 actual 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 geometry may be included in the matrix.

Geometry Curriculum Framework Mapping Knowledge and Skills to Cognitive Demands

Knowledge and Skills	Cognitive Demands				
	Generalize	Make Connections	Understand Concepts	Perform Procedures	Memorize
<p>Basic Understandings</p> <p>Ga1 Foundation concepts for high school mathematics...</p> <p>Ga2 Geometric thinking and spatial reasoning...</p> <p>Ga3 Geometric figures and their properties...</p> <p>Ga4 The relationship between geometry, other mathematics and other disciplines...</p> <p>Ga5 Tools for geometric thinking...</p> <p>Ga6 Underlying Mathematical Processes</p>	<p><i>Ga1 Expand understanding of K-8 foundation concepts, e.g. generalization of the Pythagorean theorem</i></p> <p><i>Ga2 Express generalizations about space and spatial relationships using geometric thinking and spatial reasoning</i></p> <p><i>Ga5 Use a variety of representations including tools and technology to analyze and prove relationships between transformed geometric figures</i></p> <p><i>Ga6 Use geometry to justify and prove conjectures</i></p>	<p><i>Ga1 Make vertical connections between K-8 concepts & main geometric ideas e.g. connect the concept of ratio with similarity</i></p> <p><i>Ga2 Use geometric figures to connect mathematical concepts & their relationships and use these relationships to solve problems</i></p> <p><i>Ga3 Connect relationships among geometric figures of 0, 1, 2 or 3- dimensions, their size, shape, location, direction, and orientation to algebraic representations of these figures</i></p> <p><i>Ga4 Use geometry to model and represent mathematics and real world situations</i> <i>Ga4 Make connections between geometry and the real and mathematical worlds</i> <i>Ga4 Use geometric ideas, relationships and properties to solve real-world problems</i></p> <p><i>Ga5 Use a variety of representations to solve meaningful problems by representing and transforming figures and analyzing geometric relationships</i></p> <p><i>Ga6 Connect geometry to other domains within mathematics and other disciplines</i></p>	<p><i>Ga1 Build on K-8 mathematics concepts to strengthen the understanding of geometry through other mathematical experiences</i></p> <p><i>Ga2 Use geometric figures, to understand mathematical concepts and to represent mathematical situations</i></p> <p><i>Ga3 Investigate properties of relationships with size, shape, location, direction, and orientation among 0, 1, 2, and 3-dimensional figures to solve problems</i></p> <p><i>Ga4 Recognize that geometry can be used to make connections between geometry and the real and mathematical worlds</i></p> <p><i>Ga5 Use a variety of representations (concrete, pictorial, numerical, symbolic, graphical and verbal), tools, and technology to solve meaningful problems.</i></p> <p><i>Ga6 Use appropriate language to communicate understanding of geometry</i></p>	<p><i>Ga1 Use procedures based on K-8 mathematics to solve routine problems</i></p> <p><i>Ga3 Use properties to determine size, shape, location, and direction and orientation of 0, 1, 2 and 3-dimensional figures</i></p> <p><i>Ga5 Draw and represent 0, 1, 2 and 3- dimensional figures needed to solve problems</i></p> <p><i>Ga5 Perform basic constructions using appropriate tools e.g. ruler, protractor, compass, & technology</i></p> <p><i>Ga6 Use numerical fluency to solve problems in geometry</i> <i>Ga6 Use and manage the language of structure of geometry</i></p>	<p><i>Ga1 Foundation concepts presented in K-8</i></p> <p><i>Ga3 Properties & relationships of 1, 2 and 3 dimensional figures previously investigated</i></p>
Timeline	Textbook and Materials		NCTM Standards		
			<p>Analyze characteristics and properties of 2 and 3-dimensional geometric shapes and develop mathematical arguments about geometric relationships</p> <p>Specify locations and describe spatial relationships using coordinate geometry and other representational systems</p> <p>Apply transformations and use symmetry to analyze mathematical situations</p> <p>Use visualization, spatial reasoning and geometric modeling to solve problems</p>		

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Knowledge and Skills	Cognitive Demands				
	Generalize	Make Connections	Understand Concepts	Perform Procedures	Memorize
<p>Geometric Structure</p> <p>bG.1 The student understands the structure of and relationships within, an axiomatic system.</p> <p>bG.2 The student analyzes geometric relationships in order to make and verify conjectures.</p> <p>bG.3 The student applies logical reasoning to justify and prove mathematical statements.</p> <p>bG.4 The student uses a variety of representations to describe geometric relationships and solve problems.</p>	<p>bG.1C Compare and contrast the structure and implications of Euclidean and non-Euclidean geometries Ga2</p> <p>bG.2A Use constructions to explore attributes of geometric figures and to make conjectures about geometric relationships Ga5</p> <p>bG.2B Make conjectures about angles, lines, polygons, circles, and three –dimensional figures, and determine the validity of conjectures, choosing from a variety of approaches such as coordinate, transformational, or axiomatic Ga5, Ga6</p> <p>bG.3D Use inductive reasoning to formulate a conjecture Ga6</p> <p>bG.3E Use deductive reasoning to prove a statement Ga6</p>	<p>bG.1A Develop an awareness of the structure of a mathematical system, connecting definitions, postulates, logical reasoning, and theorems Ga2</p> <p>bG.3A Determine the validity of a conditional statement, its converse, inverse, and contra positive Ga6</p> <p>bG.3B Construct and justify statements about geometric figures and their properties Ga3</p>	<p>bG.1B Recognize the historical development of geometric systems and know mathematics is developed for a variety of purposes Ga4</p> <p>bG.3C Use logical reasoning to prove statements are true and find counter examples to disprove statements that are false Ga6</p> <p>bG.4 Select an appropriate representation (concrete, pictorial, graphical, verbal or symbolic) to <i>describe geometric relationships and solve problems</i> Ga2, Ga4, Ga5, Ga6</p>	<p><i>Form a conditional statement</i> Ga1, Ga6</p> <p><i>Form the converse of a conditional statement</i> Ga1, Ga6</p>	<p>Mathematical system</p> <p>Geometric system</p> <p>Euclidean geometry</p> <p>Non-Euclidean geometry</p> <p>Axiom</p> <p>Postulate</p> <p>Theorem</p> <p>Converse</p> <p>Conditional statement</p> <p>Ga1</p>
Timeline	Textbook and Materials		NCTM Standards		
			<p>Analyze characteristics and properties of 2 and 3-dimensional geometric shapes and develop mathematical arguments about geometric relationships</p> <p>Specify locations and describe spatial relationships using coordinate geometry and other representational systems</p> <p>Apply transformations and use symmetry to analyze mathematical situations</p> <p>Use visualization, spatial reasoning and geometric modeling to solve problems</p>		

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<p>Geometric Patterns</p> <p>bG.5 The student uses a variety of representations to describe geometric relationships and solve problems</p>	<p>bG.5B Use numeric and geometric patterns to make generalizations, <i>justify, and prove conjectures</i> about geometric properties, including properties of polygons, ratios in similar figures and solids, and angle relationships in polygons and circles Ga2, Ga5, Ga6</p>	<p>bG.5C Use properties of transformations and their compositions to make connections between mathematics and the real world such as tessellations Ga2, Ga3, Ga4, Ga5, Ga6</p> <p>bG.5D Identify and apply patterns from right triangles to solve <i>novel</i> meaningful problems, including special right triangles (45 – 45 – 90 and 30 – 60 – 90) and triangles whose sides are Pythagorean triples. Ga2, Ga3, Ga4, Ga6</p>	<p><i>bG.5D Identify and apply patterns from right triangles to solve problems, including special right triangles (45 – 45 – 90 and 30 – 60 – 90) and triangles whose sides are Pythagorean triples</i> Ga1, Ga2, Ga3, Ga5, Ga6</p> <p>bG.5A Use numeric and geometric patterns to develop algebraic expressions representing geometric properties</p>	<p><i>Gc3 Draw and represent special right triangles (45 - 45 - 90) and (30 – 60 - 90) and triangles whose sides are Pythagorean triples</i> Ga1, Ga3, Ga5</p>	<p>Definitions: Right triangles Pythagorean triples Transformation Compositions of transformations 2-D figure 3-D figure Polygon Solid Tessellation Ratios Circumference Diameter Loci Π Ga 1</p>
Timeline	Textbook and Materials		NCTM Standards		
			<p>Analyze characteristics and properties of 2 and 3-dimensional geometric shapes and develop mathematical arguments about geometric relationships Specify locations and describe spatial relationships using coordinate geometry and other representational systems Apply transformations and use symmetry to analyze mathematical situations Use visualization, spatial reasoning and geometric modeling to solve problems</p>		

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<p>Dimensionality and the Geometry of Location</p> <p>bG.6 The student analyzes the relationship between three-dimensional geometric figures and related two-dimensional representations and uses these representations to solve problems.</p> <p>bG.7 The student understands that coordinate systems provide convenient and efficient ways of representing geometric figures and uses them accordingly.</p>	<p>bG.7C Derive and use formulas involving length, slope, and midpoint <i>Ga2, Ga5</i></p>	<p>G.6C Use orthographic and isometric views of 3-dimensional figures to represent and construct three-dimensional geometric figures and solve problems <i>Ga2, Ga3, Ga5</i></p> <p>bG.7B Use slopes and equations of lines to investigate geometric relationships, including parallel lines, perpendicular lines, and special segments of triangles and other polygons <i>in solving non-routine problems</i> <i>Ga2, Ga3, Ga4, Ga5</i></p>	<p>bG.6A Describe and draw the intersection of a given plane with various three-dimensional geometric figures <i>Ga2, Ga5</i></p> <p>bG.7B Use slope and equations of lines to investigate geometric relationships, including parallel lines, perpendicular lines, and special segments of triangles and other polygons <i>Ga2, Ga3, Ga5</i></p> <p>bG.6B Use nets to represent and construct three-dimensional geometric figures <i>Ga2, Ga3, Ga5</i></p>	<p>bG.7A Use one- and two-dimensional coordinate systems to represent points, lines, rays, line segments and figures <i>Ga1, Ga3, Ga5</i></p> <p><i>bG.7C Use given formulas, to determine distance between two points and slope and midpoint of a line</i> <i>Ga1, Ga6</i></p>	<p><i>Distance Formula</i> <i>Midpoint</i> <i>Pythagorean Theorem</i> <i>Point</i> <i>Line</i> <i>Line segment</i> <i>Figure</i> <i>Parallel lines</i> <i>Perpendicular lines</i> <i>Rectangular coordinate system</i> <i>Ga1</i></p>
Timeline	Textbook and Materials		NCTM Standards		
			<p>Analyze characteristics and properties of 2 and 3-dimensional geometric shapes and develop mathematical arguments about geometric relationships</p> <p>Specify locations and describe spatial relationships using coordinate geometry and other representational systems</p> <p>Apply transformations and use symmetry to analyze mathematical situations</p> <p>Use visualization, spatial reasoning and geometric modeling to solve problems</p>		

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Knowledge and Skills	Cognitive Demands				
	Generalize	Make Connections	Understand Concepts	Perform Procedures	Memorize
<p>Congruence and the Geometry of Size</p> <p>bG.8 The student uses tools to determine measurements of geometric figures and extends measurement concepts to find perimeter, area, and volume in problem situations.</p> <p>bG.9 The student analyzes properties and describes relationships in geometric figures.</p> <p>bG.10 The student applies the concept of congruence to justify properties of figures and solve problems.</p>	<p>bG.9A Formulate and test conjectures about the properties of parallel and perpendicular lines based on explorations and using concrete models Ga2</p> <p>bG.9B Formulate and test conjectures about properties and attributes of polygons and their component parts based on explorations and using concrete models Ga2</p> <p>bG.9C Formulate and test conjectures about the properties and attributes of circles and the lines that intersect them based on explorations and using concrete models Ga2</p> <p>bG.10A Use congruence transformations to make conjectures and justify properties of geometric figures including figures represented on a coordinate plane Ga5, Ga6</p> <p>bG.10B Justify and apply triangle congruence relationships Ga6</p> <p>bG.8C Derive, extend, and use the Pythagorean theorem Ga1, Ga5, Ga6</p>	<p><i>bG.10B Apply triangle congruence relationships to solve problems Ga3, Ga4</i></p> <p>bG.9D Analyze the characteristics of polyhedra and other three dimensional figures and their component parts based on explorations and concrete models Ga2, Ga3, Ga5, Ga6</p> <p><i>bG.8C Apply the Pythagorean theorem to solve problems Ga1, Ga2, Ga4</i></p>	<p><i>bG.8A Explain how to use simple shapes to find the area of composite figures Ga2, Ga3, Ga5</i></p> <p><i>bG.8B Describe how proportional reasoning is used to find areas of sectors and arc lengths of circles Ga1, Ga2, Ga6</i></p>	<p>bG.8A Find areas of regular polygons, circles, and composite figures Ga1, Ga3, Ga5</p> <p>bG.8B Find area of sectors and arc length of circles using proportional reasoning Ga1, Ga3, Ga5</p> <p>bG.8D Find surface area and volume of prisms, pyramids, spheres, cones, cylinders, and composites of these figures in problem situations Ga1, Ga3, Ga5</p> <p><i>bG.8C Use the Pythagorean theorem to solve problems to find missing information from right triangles Ga1, Ga3, Ga5</i></p>	<p>Pythagorean theorem</p> <p>Definitions: Parallel Perpendicular Congruent figures Congruent transformations Reflection of an object Rotation of an object Translation of an object Circumference Diameter Loci II</p> <p>Formulas: area, perimeter, volume, and circumference of 2- dimensional and 3- dimensional figures Ga1, Ga3</p>
Timeline	Textbook and Materials		NCTM Standards		
			<p>Analyze characteristics and properties of 2 and 3-dimensional geometric shapes and develop mathematical arguments about geometric relationships</p> <p>Specify locations and describe spatial relationships using coordinate geometry and other representational systems</p> <p>Apply transformations and use symmetry to analyze mathematical situations</p> <p>Use visualization, spatial reasoning and geometric modeling to solve problems</p>		

Geometry Curriculum Framework Mapping Knowledge and Skills to Cognitive Demands

Knowledge and Skills	Cognitive Demands				
	Generalize	Make Connections	Understand Concepts	Perform Procedures	Memorize
<p>Similarity and the Geometry of Shape</p> <p>bG.11 The student applies the concepts of similarity to justify properties of figures and solve problems</p>	<p>bG.11A Use and extend similarity properties and transformations to explore and justify conjectures about geometric figures Ga2, Ga5</p> <p><i>bG.11B Make conjectures from patterns of similar figures Ga2, Ga5</i></p> <p>bG.11C Justify triangle similarity relationships, such as right triangle ratios, trigonometric ratios, and Pythagorean triples using a variety of methods Ga1, Ga5, Ga6</p>	<p>bG.11C Apply triangle similarity relationships, such as right triangle ratios, trigonometric ratios, and Pythagorean triples to solve problems using a variety of methods Ga1, Ga2, Ga3, Ga4, Ga6</p>	<p>bG.11C Develop triangle similarity relationships, such as right triangle ratios, trigonometric ratios, and Pythagorean triples to solve problems using a variety of methods Ga2, Ga3, Ga6</p> <p>bG.11D Describe the effect on perimeter, area, and volume when one of more dimensions of a figure are changed and apply this idea in solving problems Ga2, Ga3, Ga5</p>	<p>bG.11B Use ratios to solve problems involving similar figures Ga1, Ga3, Ga5</p>	<p>Pythagorean triples Ratio Right triangle ratios</p> <p>Similarity Transformation Trigonometric ratios Ga1</p>
Timeline	Textbook and Materials		NCTM Standards		
			<p>Use visualization, spatial reasoning, and geometric modeling to solve problems</p> <p>Specify locations and describe spatial relationships using coordinate geometry and other representational systems</p> <p>Apply transformations and use symmetry to analyze mathematical situations</p> <p>Use visualization, spatial reasoning, and geometric modeling to solve problems</p>		

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 2, 3, or 4	Summative	1 per grading period	Research material Access to media center Consumable material	Knowledge of content Vocabulary Oral communication
Homework and “Open book” 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, 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	Measures what student knows and is able to do with knowledge acquired from entire course	1 at the end of the entire course	Test	80% correct

