Geometry & Honors Geometry

It is the fundamental philosophy of the Temple Christian School Math Department that the observable complexity and order demonstrated in nature is the result of God's creative power and design rather than "cosmic happenstance." It would indeed seem to us that Galileo Galilei was correct when he said that mathematics is the language "with which God has written the universe." In light of this, the department's desire is to teach mathematics with a spiritual emphasis in accordance with the Apostle Paul's assertion in Romans 1 that God's eternal power and divine nature are clearly seen in nature.

In light of the department philosophy and given the size of our school, we have instituted a college preparatory curriculum that has two tiers in concert with a Christian world-view. It is designed so that students may aggressively pursue mathematics, or may simply prepare for the entry-level college algebra curriculum. As a result, the TCS Math Department hopes that critical thinking and exploration will run throughout our curriculum and coursework, increasing in emphasis as students rise higher in the degree of difficulty of the work attempted.

Course Description

This course is designed the students that have completed an Algebra 1 course. The course is designed to rigorously cover the items in the TEKS mandated by the Texas Education Agency, and is aimed at providing students with a solid foundation in math. At the conclusion of this course, students should be prepared for follow-on coursework in Algebra II.

Specific objectives for this course include basic geometric figures, measurement, deductive reasoning, proof, application of parallel and perpendicular line relationships, determining if figures are congruent/similar, performing transformations on a coordinate plane, an introduction to trigonometry, properties of circles, polygon characteristics, determining the area of polygons, and exploration of solids (volume and surface area).

Scope & Sequence for Fall 2017

Geometry Basics: Students will be taught the basics of inductive reasoning and pattern description. Fundamentals such as measurement and naming/identification of lines, rays, segments, points and planes will be taught. Students will be introduced to utilization of the straightedge and protractor.
TEKS §111.41 (c): 1A-G, 2A-B, 4A (Reference Chapter 1, planned time is 12 days)

Reasoning and Proof: Students will study the history and methods for proof in the mathematical sense. Students will utilize deductive reasoning and draw conclusions from conditional and bi-conditional statements. Students will prove statements related to algebra, segments and angles.
TEKS §111.41 (c): 1A-g, 4B-D, 5A, 13 A, C-E (Reference Chapter 2, planned time is 14 days)

Relationships of Lines: Students will study the possible relationships between lines in a plane. Students will develop proofs to show lines are parallel or perpendicular. Students will apply this knowledge to lines on the coordinate plane.
TEKS §111.41 (c): 1A-G, 2C, 4D, 5A-C, 6A (Reference Chapter 3, planned time is 14 days)

Congruence in Triangles: Students will be introduced to congruence and apply it specifically to triangles. Students will use a variety of methods to determine triangles are congruent and study the applications of congruence.
TEKS §111.41 (c): 1A-G, 6B-d, 7B (Reference Chapter 4, planned time is 14 days)

Properties of Triangles: Students will learn about bisectors, medians, altitudes and mid-segments of triangles. Students will learn to construct these and solve real world problems related to them. Inequality relationships in triangles will be explored.
TEKS §111.41 (c): 1A-G, 5D, 7A, 8A-B (Reference Chapters 5, planned time is 12 days)

Similarity: Students will study ratios and proportions in order to solve problems related to similar figures. Students will model real world problems using a variety of methods and develop proofs to show figures are similar. In addition dilations will be explored and the relationship between the pre-image and image will be described and utilized to find unknowns.
TEKS §111.41 (c): 1A-G, 7A, 8A-B (Reference Chapters 6, planned time is 13 days)

Scope & Sequence for Spring 2018

Introduction to Trigonometry: Students will derive and extend the Pythagorean Theorem and study the properties of selected special triangles. In addition students will learn the basics of trigonometry (sine, cosine and tangent) with an emphasis on practical application. A brief exploration of physics will be made by utilizing vectors to describe motion.
TEKS §111.41 (c): 1A-G, 9A-B (Reference Chapter 7, planned time is 13 days)

Polygons: Students will about polygons and explore the various properties of selected quadrilaterals. Students will model and solve problems related to length and area.
TEKS §111.41 (c): 1A-G, 6E, 10A-B, 11A-B (Reference Chapter 8, planned time is 14 days)

Transformations: Students will study rigid transformations and describe the effects of transformations on figures. Congruence relationships will be explored as will compositions.
TEKS §111.41 (c): 1A-G, 3A-D (Reference Chapter 9, planned time is 12 days)

Circles: Students will learn the terminology related to circles and be able to draw circles of various radius and diameter. Segment and line relationships will be described and the properties related to them will be explored. Students will study central angles, inscribed angles and other angles related to circles. The equation of a circle will be derived and students will study circles in relation to the coordinate plane.
TEKS §111.41 (c): 1A-G, 12A-E, 13B (Reference Chapter 10, planned time is 14 days)

Area in Polygons and Circles: Students will develop a formula for finding the area of any regular polygon, find circumference of circles and area of circles. The relationship between perimeter and area in similar figures will be further developed and a ratio for describing the relationship will be utilized to solve problems. Arc length and sector area will be found using proportions and real world applications will be discussed.
TEKS §111.41 (c): 1A-G, 11A-B (Reference Chapter 11, planned time is 14 days)

Solids: Students will explore 3 dimensional figures, utilize the correct terminology, explore the history of solids and find surface are/volume. The relationship between 2 dimensions and 3 will be explored via plane intersecting solids, and nets.
TEKS §111.41 (c): 1A-G, 11C-D (Reference Chapter 12, planned time is 14 days)

Of note: 'planned time' as indicated for each chapter may be adjusted based on specific class learning pace, as well as school-related activities; there is sufficient flexibility in the scope/sequence to adjust for schedule impacts.

Methodology

There will be two major methods emphasized in our coursework; all students will be (1) encouraged to take advantage of the inherent strengths generated by mathematics done without a calculator and (2) will be taught to use modern technology as an exploratory tool to enhance the learning process.

Textbook

This document is linked to the Geometry textbook in current use (Geometry, Holt McDougal Larson, ISBN 0547315317) to complete a well-rounded high school mathematics study mandated by the state of Texas.

Evaluation

Assessment will include recall, understanding, and skill level for each class, and will occur in three primary ways. Students will undergo chapter assessments/tests (approximately every 3 weeks) and a semester cumulative assessment (Semester Exam). Students will also undertake assessments over the course of each chapter to include quizzes and homework assignments. Not all homework will be used in the grading process, but enough will be used to confirm and validate a student's demonstrated progress. In addition, a bi-weekly participation grade will be awarded to each student. As the name implies, it is based on in-class work (answering questions, problem solving on the 'white board', and adherence to classroom policies/procedures). In assessing student work, mathematics department instructors will encourage student development of the ability to articulate what they know about the subject being studied in both written and oral form.

Texas Essential Knowledge & Skills

§111.41. Geometry, Adopted 2012 (One Credit)

(a) General requirements. Students shall be awarded one credit for successful completion of this course. Prerequisite: Algebra I.

(b) Introduction.

(1) The desire to achieve educational 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 solid understanding, Texas will lead the way in mathematics education and prepare all Texas students for the challenges they will face in the 21st century.

(2) The process standards describe ways in which students are expected to engage in the content. The placement of the process standards at the beginning of the knowledge and skills listed for each grade and course is intentional. The process standards weave the other knowledge and skills together so that students may be successful problem solvers and use mathematics efficiently and effectively in daily life. The process standards are integrated at every grade level and course. 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 and the reasonableness of the solution. Students will select appropriate tools such as 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 such as symbols, diagrams, graphs, and language. Students will use mathematical relationships to generate solutions and make connections and predictions. Students will analyze mathematical relationships to connect and communicate mathematical ideas. Students will display, explain, or justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

(3) In Geometry, students will build on the knowledge and skills for mathematics in Kindergarten-Grade 8 and Algebra I to strengthen their mathematical reasoning skills in geometric contexts. Within the course, students will begin to focus on more precise terminology, symbolic representations, and the development of proofs. 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. Students will connect previous knowledge from Algebra I to Geometry through the coordinate and transformational geometry strand. In the logical arguments and constructions 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. In proof and congruence, students will use deductive reasoning to justify, prove and apply theorems about geometric figures. Throughout the standards, the term "prove" means a formal proof to be shown in a paragraph, a flow chart, or two-column formats. Proportionality is the unifying component of the similarity, proof, and trigonometry strand. Students will use their proportional reasoning skills to prove and apply theorems and solve problems in this strand. The two- and three-dimensional figure strand focuses on the application of formulas in multi-step situations since students have developed background knowledge in two- and three-dimensional figures. Using patterns to identify geometric properties, students will apply theorems about circles to determine relationships between special segments and angles in circles. Due to the emphasis of probability and statistics in the college and career readiness standards, standards dealing with probability have been added to the geometry curriculum to ensure students have proper exposure to these topics before pursuing their post-secondary education.

(4) These standards are meant to provide clarity and specificity in regards to the content covered in the high school geometry course. These standards are not meant to limit the methodologies used to convey this knowledge to students. Though the standards are written in a particular order, they are not necessarily meant to be taught in the given order. In the standards, the phrase "to solve problems" includes both contextual and non-contextual problems unless specifically stated.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) Mathematical process standards. The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:

(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 and the reasonableness of the solution;

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

(D) communicate 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; and

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

(2) Coordinate and transformational geometry. The student uses the process skills to understand the connections between algebra and geometry and uses the one- and two-dimensional coordinate systems to verify geometric conjectures. The student is expected to:

(A) determine the coordinates of a point that is a given fractional distance less than one from one end of a line segment to the other in one- and two-dimensional coordinate systems, including finding the midpoint;

(B) derive and use the distance, slope, and midpoint formulas to verify geometric relationships, including congruence of segments and parallelism or perpendicularity of pairs of lines; and

(C) determine an equation of a line parallel or perpendicular to a given line that passes through a given point.

(3) Coordinate and transformational geometry. 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:

(A) describe and perform transformations of figures in a plane using coordinate notation;

(B) determine the image or pre-image of a given two-dimensional figure under a composition of rigid transformations, a composition of non-rigid transformations, and a composition of both, including dilations where the center can be any point in the plane;

(C) identify the sequence of transformations that will carry a given pre-image onto an image on and off the coordinate plane; and

(D) identify and distinguish between reflectional and rotational symmetry in a plane figure.

(4) Logical argument and constructions. The student uses the process skills with deductive reasoning to understand geometric relationships. The student is expected to:

(A) distinguish between undefined terms, definitions, postulates, conjectures, and theorems;

(B) 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;

(C) verify that a conjecture is false using a counterexample; and

(D) compare geometric relationships between Euclidean and spherical geometries, including parallel lines and the sum of the angles in a triangle.

(5) Logical argument and constructions. The student uses constructions to validate conjectures about geometric figures. The student is expected to:

(A) investigate patterns to 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 choosing from a variety of tools;

(B) construct congruent segments, congruent angles, a segment bisector, an 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;

(C) use the constructions of congruent segments, congruent angles, angle bisectors, and perpendicular bisectors to make conjectures about geometric relationships; and

(D) verify the Triangle Inequality theorem using constructions and apply the theorem to solve problems.

(6) Proof and congruence. The student uses the process skills with deductive reasoning to prove and apply theorems by using a variety of methods such as coordinate, transformational, and axiomatic and formats such as two-column, paragraph, and flow chart. The student is expected to:

(A) verify theorems about angles formed by the intersection of lines and line segments, including vertical angles, and angles formed by parallel lines cut by a transversal and prove equidistance between the

endpoints of a segment and points on its perpendicular bisector and apply these relationships to solve problems;

(B) prove two triangles are congruent by applying the Side-Angle-Side, Angle-Side-Angle, Side-Side-Side, Angle-Angle-Side, and Hypotenuse-Leg congruence conditions;

(C) apply the definition of congruence, in terms of rigid transformations, to identify congruent figures and their corresponding sides and angles;

(D) verify theorems about the relationships in triangles, including proof of the Pythagorean Theorem, the sum of interior angles, base angles of isosceles triangles, midsegments, and medians, and apply these relationships to solve problems; and

(E) prove a quadrilateral is a parallelogram, rectangle, square, or rhombus using opposite sides, opposite angles, or diagonals and apply these relationships-to solve problems.

(7) Similarity, proof, and trigonometry. The student uses the process skills in applying similarity to solve problems. The student is expected to:

(A) apply the definition of similarity in terms of a dilation to identify similar figures and their proportional sides and the congruent corresponding angles; and

(B) apply the Angle-Angle criterion to verify similar triangles and apply the proportionality of the corresponding sides to solve problems.

(8) Similarity, proof, and trigonometry. The student uses the process skills with deductive reasoning to prove and apply theorems by using a variety of methods such as coordinate, transformational, and axiomatic and formats such as two-column, paragraph, and flow chart. The student is expected to:

(A) prove theorems about similar triangles, including the Triangle Proportionality theorem, and apply these theorems to solve problems; and

(B) identify and apply the relationships that exist when an altitude is drawn to the hypotenuse of a right triangle, including the geometric mean, to solve problems.

(9) Similarity, proof, and trigonometry. The student uses the process skills to understand and apply relationships in right triangles. The student is expected to:

(A) determine the lengths of sides and measures of angles in a right triangle by applying the trigonometric ratios sine, cosine, and tangent to solve problems; and

(B) apply the relationships in special right triangles 30°-60°-90° and 45°-45°-90° and the Pythagorean theorem, including Pythagorean triples, to solve problems.

(10) Two-dimensional and three-dimensional figures. The student uses the process skills to recognize characteristics and dimensional changes of two- and three-dimensional figures. The student is expected to:

(A) identify the shapes of two-dimensional cross-sections of prisms, pyramids, cylinders, cones, and spheres and identify three-dimensional objects generated by rotations of two-dimensional shapes; and

(B) determine and describe how changes in the linear dimensions of a shape affect its perimeter, area, surface area, or volume, including proportional and non-proportional dimensional change.

(11) Two-dimensional and three-dimensional figures. 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:

(A) apply the formula for the area of regular polygons to solve problems using appropriate units of measure;

(B) determine the area of composite two-dimensional figures comprised of a combination of triangles, parallelograms, trapezoids, kites, regular polygons, or sectors of circles to solve problems using appropriate units of measure;

(C) apply the formulas for the total and lateral surface area of three-dimensional figures, including prisms, pyramids, cones, cylinders, spheres, and composite figures, to solve problems using appropriate units of measure; and

(D) apply the formulas for the volume of three-dimensional figures, including prisms, pyramids, cones, cylinders, spheres, and composite figures, to solve problems using appropriate units of measure.

(12) Circles. The student uses the process skills to understand geometric relationships and apply theorems and equations about circles. The student is expected to:

(A) apply theorems about circles, including relationships among angles, radii, chords, tangents, and secants, to solve non-contextual problems;

(B) apply the proportional relationship between the measure of an arc length of a circle and the circumference of the circle to solve problems;

(C) apply the proportional relationship between the measure of the area of a sector of a circle and the area of the circle to solve problems;

(D) describe radian measure of an angle as the ratio of the length of an arc intercepted by a central angle and the radius of the circle; and

(E) show that the equation of a circle with center at the origin and radius r is $x^2 + y^2 = r^2$ and determine the equation for the graph of a circle with radius r and center (h, k), $(x - h)^2 + (y - k)^2 = r^2$.

(13) Probability. 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:

(A) develop strategies to use permutations and combinations to solve contextual problems;

(B) determine probabilities based on area to solve contextual problems;

(C) identify whether two events are independent and compute the probability of the two events occurring together with or without replacement;

(D) apply conditional probability in contextual problems; and

(E) apply independence in contextual problems.

Source: The provisions of this §111.41 adopted to be effective September 10, 2012, 37 TexReg 7109.