Mathematics TEKS
SUPPORTING INFORMATION

GEOMETRY

TEA
Texas Education Agency

TEKS	Supporting Information
(a) General requirements. Students shall be awarded one credit for successful completion of this course. Prerequisite: Algebra I.	The TEKS include descriptions of prerequisite coursework. Algebra I is a required prerequisite.
(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.	A well-balanced mathematics curriculum includes the Texas College and Career Readiness Standards. A focus on mathematical fluency and solid understanding allows for rich exploration of the key ideas of Geometry.
(b) Introduction. (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.	This paragraph occurs second in the TEKS, preceding the content descriptions. This highlights the emphasis of student use of the mathematical process standards to acquire and demonstrate mathematical understanding. The concepts of generalization and abstraction in the text from G(1)(B) included in the introductory paragraphs from elementary TEKS may be considered subsumed in this language. Computer programs may be included under technology in the text from G(1)(C). This introductory paragraph states, “Students will use mathematical relationships to generate solutions and make connections and predictions,” instead of the text from G(1)(E).
(b) Introduction. (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.	Specifics about Geometry mathematics content are summarized in this paragraph. This summary follows the paragraph about the mathematical process standards. This supports the notion that the TEKS should be learned in a way that integrates the mathematical process standards in an effort to develop fluency. The paragraph also connects the key concepts found in Geometry to prior content and the Texas College and Career Readiness Standards.

(b) Introduction. (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.	A general statement about Geometry and the use of these TEKS is provided.
(b) Introduction. (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.	The State Board of Education approved the retention of some "such as" statements within the TEKS where needed for clarification of content. The phrases "including" and "such as" should not be considered as limiting factors for the student expectations (SEs) in which they reside.

Additional Resources are available online including

- Vertical Alignment Charts
- Texas Mathematics Resource Page
- Texas College and Career Readiness Standards

TEKS: Mathematical Process Standards.	Supporting Information
G(1)(A) **Mathematical process standards.** The student uses mathematical processes to acquire and demonstrate mathematical understanding. **The student is expected to apply mathematics to problems arising in everyday life, society, and the workplace.**	This SE emphasizes application. The opportunities for application have been consolidated into three areas: everyday life, society, and the workplace. This SE, when paired with a content SE, allows for increased relevance through connections within and outside mathematics. *Example*: When paired with G(1)(G) and G(6)(E), the student may be asked to explain why checking for square (i.e. checking to see if the diagonals of a rectangular building frame are equal) is sufficient to ensure that all of the angles of a rectangular frame are in fact 90°.
G(1)(B) **Mathematical process standards.** The student uses mathematical processes to acquire and demonstrate mathematical understanding. **The student is expected to 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.**	This process standard applies the same problem-solving model and is included in the TEKS for kindergarten through grade 12. This is the traditional problem-solving process used in mathematics and science. Students may be expected to use this process in a grade appropriate manner when solving problems that can be considered difficult relative to mathematical maturity.
G(1)(C) **Mathematical process standards.** The student uses mathematical processes to acquire and demonstrate mathematical understanding. **The student is expected to 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.**	The phrase "as appropriate" indicates that students are assessing which tools and techniques to apply rather than trying only one or all of those listed. *Example:* When paired with G(5)(C), the student is expected to choose the appropriate tool(s) to construct the perpendicular bisector.
G(1)(D) **Mathematical process standards.** The student uses mathematical processes to acquire and demonstrate mathematical understanding. **The student is expected to communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate.**	Students may be expected to address three areas: mathematical ideas, reasoning, and implications of these ideas and reasoning. Communication can be through the use of symbols, diagrams, graphs, or language. The phrase "as appropriate" implies that students may be expected to assess which communication tool to apply rather than trying only one or all of those listed. The use of multiple representations includes translating and making connections among the representations. *Example*: When paired with G(3)(A), the student may be expected to communicate the process of transforming a shape on a coordinate plane using symbols, diagrams, graphs, and language as appropriate.
G(1)(E) **Mathematical process standards.** The student uses mathematical processes to acquire and demonstrate mathematical understanding. **The student is expected to create and use representations to organize, record, and communicate mathematical ideas.**	The expectation is that students use representations for three purposes: to organize, record, and communicate mathematical ideas. Representations include verbal, graphical, tabular, and algebraic representations. As students create and use representations, the students will evaluate the effectiveness of the representations to ensure that those representations are communicating mathematical ideas with clarity. *Example*: When paired with G(13)(D), students may be expected to create a graph or a table in order to organize the data, determine the experimental probability of a conditional event, and communicate their results.
G(1)(F) **Mathematical process standards.** The student uses mathematical processes to acquire and demonstrate mathematical understanding. **The student is expected to analyze mathematical relationships to connect and communicate mathematical ideas.**	Students may be expected to analyze relationships and form connections with mathematical ideas. Students may form conjectures about mathematical representations based on patterns or sets of examples and non-examples. Forming connections with mathematical ideas extends past conjecturing to include verification through a deductive process. *Example*: When paired with G(5)(A), students may be expected to look for and analyze the relationship between the diagonals of a given type of quadrilateral.
G(1)(G) **Mathematical process standards.** The student uses mathematical processes to acquire and demonstrate mathematical understanding. **The student is expected to display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication.**	The expectation is that students speak and write with precise mathematical language to explain and justify the work. This includes justifying a solution. *Example*: When paired with G(4)(C), the student may be expected to explain in precise mathematical language why a given counterexample demonstrates that a conjecture is false.

TEKS: Coordinate and Transformational Geometry.	Supporting Information
G(2)(A) **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 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.**	Students may be expected to measure fractional distances other than 1/2 or 1 using one- and two-dimensional coordinate systems. This SE includes determining the coordinates of the point given a fractional distance from one of the two endpoints of the line segment finding the coordinates of the midpoint. This SE includes determining fractional distances through similar figures and proportional reasoning. Though fractional distances beyond the midpoint can be calculated algebraically, students may not yet have experience with a system of equations containing two quadratic equations.
G(2)(B) **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 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.**	Students may be expected to verify geometric relationships including congruent segments and parallel and perpendicular lines. In grade 8, students are expected to use the Pythagorean Theorem to determine the distance between two points on a coordinate plane [8(7)(D)]. This SE extends 8(7)(D) to the applications of deriving the distance formula. In Algebra I, students are expected to write the equation of a line that contains a given point and is parallel or perpendicular to a given line [A(2)(B), (E), and (F)]. *Example*: When paired with G(1)(F), the expectation is that students determine equations of a line perpendicular to a given line in order to explore concepts such as the height of triangles on a coordinate plane.
G(2)(C) **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 determine an equation of a line parallel or perpendicular to a given line that passes through a given point.**	In Algebra I, students are expected to write the equation of a line that contains a given point and is parallel or perpendicular to a given line [A(2)(B), (E), and (F)]. *Example*: When paired with G(1)(F), the expectation is that students determine equations of a line perpendicular to a given line in order to explore concepts such as the height of triangles on a coordinate plane.

TEKS: Coordinate and Transformational Geometry.	Supporting Information
G(3)(A) **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 describe and perform transformations of figures in a plane using coordinate notation.**	This SE extends past rotations in grade 8 and explicitly states coordinate notation [8(3)(A); 8(10)(A), (B), and (C)]. Students may be expected to be able to "describe" and "perform" transformations.
G(3)(B) **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 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.**	In grade 8, students graph and algebraically represent single transformations. *Example*: Students are expected to describe a translation and a reflection algebraically such as $(x, y) \rightarrow (x + 3, -y - 2)$. Dilations are included with the center of dilation other than origin. In grade 8, students are expected to dilate with the origin as the center. In Geometry, rotations may or may not be about the origin. Also in grade 8, students are expected to differentiate between transformations that preserve congruence and those that do not. Rigid and non-rigid transformations are explicitly included in this SE. This SE includes graphing and describing a composition of transformations. *Example*: When paired with G(1)(A), tessellations could be included.
G(3)(C) **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 identify the sequence of transformations that will carry a given pre-image onto an image on and off the coordinate plane.**	Students may be expected to identify the sequence of transformations performed for a given preimage and image. These transformations may or may not be represented on a coordinate plane.
G(3)(D) **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 identify and distinguish between reflectional and rotational symmetry in a plane figure.**	This SE includes symmetry in a plane figure and transformations. *Example*: When paired with G(1)(A), students may be expected to determine the type of transformations needed to make a tessellation.

TEKS: Logical Argument and Constructions.	Supporting Information
G(4)(A) **Logical argument and constructions.** The student uses the process skills with deductive reasoning to understand geometric relationships. **The student is expected to distinguish between undefined terms, definitions, postulates, conjectures, and theorems.**	The undefined terms include those mentioned in Euclid's *Elements*: point, line, and plane. Logical reasoning is implicit within G(1)(B), (D), (E), (F), and (G). *Example*: When paired with G(1)(D), students may be expected to use multiple representations of undefined terms to distinguish their attributes.
G(4)(B) **Logical argument and constructions.** The student uses the process skills with deductive reasoning to understand geometric relationships. **The student is expected to 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.**	The skill of connecting a biconditional statement and a true conditional statement with a true converse is included.
G(4)(C) **Logical argument and constructions.** The student uses the process skills with deductive reasoning to understand geometric relationships. **The student is expected to verify that a conjecture is false using a counterexample.**	When paired with G(1)(D), (F), or (G), students may be expected to use logical reasoning to verify the truthfulness of a conjecture. Students may be expected to use a counterexample to verify that a conjecture is false.
G(4)(D) **Logical argument and constructions.** The student uses the process skills with deductive reasoning to understand geometric relationships. **The student is expected to compare geometric relationships between Euclidean and spherical geometries, including parallel lines and the sum of the angles in a triangle.**	Specificity includes the clarification of changing "non-Euclidean geometries" to "spherical geometries." Specificity includes "parallel lines and the sum of the angles in a triangle" when comparing relationships between Euclidean and spherical geometries.

TEKS: Logical Argument and Constructions.	Supporting Information
G(5)(A) **Logical argument and constructions**. The student uses constructions to validate conjectures about geometric figures. **The student is expected to 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.**	"Patterns" include numeric and geometric properties. "Relationships" may or may not include algebraic expressions representing properties. Students may be expected to investigate geometric relationships. Specificity regarding the use of constructions to investigate patterns and make conjectures is included. When paired with G(1)(D), (F), and (G), students may be expected to determine the validity of their conjectures.
G(5)(B) **Logical argument and constructions**. The student uses constructions to validate conjectures about geometric figures. **The student is expected to 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.**	The use of constructions including those made by compass and straightedge is explicit in this SE. The figures a student is expected to construct have been included.
G(5)(C) **Logical argument and constructions**. The student uses constructions to validate conjectures about geometric figures. **The student is expected to use the constructions of congruent segments, congruent angles, angle bisectors, and perpendicular bisectors to make conjectures about geometric relationships.**	This SE includes specificity regarding the geometric figures about which students may be expected to make conjectures. A student may be expected to identify constructions when making conjectures about geometric relationships. *Example*: When paired with G(1)(F), students may be expected to use constructions to explore and validate conjectures about the attributes of geometric figures.
G(5)(D) **Logical argument and constructions**. The student uses constructions to validate conjectures about geometric figures. **The student is expected to verify the Triangle Inequality theorem using constructions and apply the theorem to solve problems.**	This SE makes the verification of the Triangle Inequality Theorem using constructions explicit. The foundation for the Triangle Inequality Theorem begins in grade 6, where students verify that a given set of lengths could form a triangle [6(8)(A)].

TEKS: Proof and Congruence.	Supporting Information
G(6)(A) **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 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.**	This SE includes angles formed by the "intersection of lines and line segments." This SE also provides specificity as to which theorems need to be verified. Throughout the standards, to "prove" means to provide formal proof to be shown in a paragraph, flow chart, or two-column format.
G(6)(B) **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 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.**	This SE specifies that students are expected to prove that two triangles are congruent. Specificity includes the "congruence conditions" that are to be used to prove two triangles are congruent.
G(6)(C) **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 apply the definition of congruence, in terms of rigid transformations, to identify congruent figures and their corresponding sides and angles.**	This SE unites some of the concepts found in G(3)(B) and G(6)(B). This SE is related to G(6)(B) in the same manner as G(7)(A) and (B), respectively.
G(6)(D) **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 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.**	This SE includes the proof of the Pythagorean Theorem. Throughout the standards, to "prove" means to provide formal proof, which could be shown in a paragraph, flow chart, or two-column format. This SE asks students to "verify theorems about the relationships." This SE focuses on the relationships in triangles and the application of those relationships to solve problems. In grade 8, students are expected to use models and diagrams to explain the Pythagorean Theorem, but they are not expected to prove it. The students are also expected to use the Pythagorean Theorem and its converse to solve problems [8(6)(C), 8(7)(C), and (D)]. Methods for proving may include coordinate, transformational, axiomatic, and formats such as two-column, paragraph, or flow chart.
G(6)(E) **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 prove a quadrilateral is a parallelogram, rectangle, square, or rhombus using opposite sides, opposite angles, or diagonals and apply these relationships-to solve problems.**	Methods for proving may include coordinate, transformational, axiomatic, and formats such as two-column, paragraph, or flow chart. Throughout the standards, to "prove" means formal proof to be shown in a paragraph, flow chart, or two-column format.

TEKS: Similarity, Proof, and Trigonometry.	Supporting Information
G(7)(A) **Similarity, proof, and trigonometry.** The student uses the process skills in applying similarity to solve problems. **The student is expected to apply the definition of similarity in terms of a dilation to identify similar figures and their proportional sides and the congruent corresponding angles.**	Students begin solving problems involving similar figures in grades 7 and 8 [7(5)(A); 8(3)(A), (B); and 8(4)(A)]. This SE is more general than G(7)(B), focusing on the definition of similarity and dilation. The Angle-Angle criterion and proportionality of sides has been reserved for G(7)(B), whereas the similarity theorems have been reserved for G(8)(A).
G(7)(B) **Similarity, proof, and trigonometry.** The student uses the process skills in applying similarity to solve problems. **The student is expected to apply the Angle-Angle criterion to verify similar triangles and apply the proportionality of the corresponding sides to solve problems.**	Students begin solving problems involving similar figures in grades 7 and 8 [7(5)(A); 8(3)(A), (B); and 8(4)(A)]. This SE is more specific than G(7)(A) with which it shares a similar relationship to the pair of SE's G(6)(B) and (C) under the "Proof and congruence" strand. This SE focuses upon application. Proof of the similarity theorems have been reserved for G(8)(A).

TEKS: Similarity, Proof, and Trigonometry.	Supporting Information
G(8)(A) **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 prove theorems about similar triangles, including the Triangle Proportionality theorem, and apply these theorems to solve problems.**	Students begin solving problems involving similar figures in grades 7 and 8 [7(5)(A); 8(3)(A), (B); and 8(4)(A)]. This SE focuses upon proof unlike G(7)(B), which focuses on applications, and G(7)(A), which focuses upon the definition.
G(8)(B) **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 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.**	Students begin solving problems involving similar figures in grades 7 and 8 [7(5)(A); 8(3)(A), (B); and 8(4)(A)].

TEKS: Similarity, Proof, and Trigonometry.	Supporting Information
G(9)(A) **Similarity, proof, and trigonometry.** The student uses the process skills to understand and apply relationships in right triangles. **The student is expected to 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.**	This SE makes explicit the application of special right triangle relationships, Pythagorean Theorem, and Pythagorean triples to solve problems involving right triangles. In grade 8, students are expected to use the Pythagorean Theorem and its converse to solve problems. Students may be expected to solve problems requiring the use of two or more right triangle relationships.
G(9)(B) **Similarity, proof, and trigonometry.** The student uses the process skills to understand and apply relationships in right triangles. **The student is expected to apply the relationships in special right triangles 30°-60°-90° and 45°-45°-90° and the Pythagorean theorem, including Pythagorean triples, to solve problems.**	This SE makes explicit the application of special right triangle relationships, Pythagorean Theorem, and Pythagorean triples to solve problems involving right triangles. In grade 8, students are expected to use the Pythagorean Theorem and its converse to solve problems [8(6)(C), 8(7)(C), and (D)]. Students may be expected to solve problems requiring the use of two or more right triangle. Students may be expected to solve problems requiring the use of two or more right triangle relationships.

	This SE focuses on applying relationships to solve problems involving special right triangles. *Example*: When paired with G(1)(F), the expectation is that students analyze the relationships in special right triangles and Pythagorean triples.

TEKS: Two-dimensional and three-dimensional figures.	Supporting Information
G(10)(A) **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 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.**	This SE specifies the identification of two-dimensional cross sections for specific geometric figures. Students may be expected to identify 3-D objects generated by rotations of 2-D shapes.
G(10)(B) **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 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.**	This SE is an extension of G(11)(D) and includes proportional and non-proportional dimensional change. Students are expected only to model the effects of dimensional changes on the perimeter and area in grade 8 [8(10)(D)]. This grade 8 standard is restricted to proportional dimension change of two-dimensional shapes. This SE is not limited to two-dimensional shapes.

TEKS: Two-dimensional and three-dimensional figures.	Supporting Information
G(11)(A) **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 apply the formula for the area of regular polygons to solve problems using appropriate units of measure.**	This SE focuses on solving problems that include determining the area of regular polygons.
G(11)(B) **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 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.**	Students determine the composite area of figures composed of rectangles, squares, parallelograms, trapezoids, triangles, semicircles, and quarter circles in grade 7 [7(9)(C)]. This SE extends 7(9)(C) to include kites, regular polygons, and sectors as parts of composite figures.
G(11)(C) **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 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.**	In grade 7, students determine the surface area of pyramids and prisms using nets [7(9)(C) and (D)]. In grade 8, students are expected to connect previous knowledge of surface area and nets to the surface area formulas [8(7)(B)]. This SE extends 8(7)(B) to include cones, pyramids, spheres, and composite figures. Students may be expected to use appropriate units of measure.
G(11)(D) **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 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.**	In grade 7, students are expected to solve problems involving the volume of pyramids and prisms (rectangular and triangular) [7(9)(A)]. In grade 8, students are expected to solve problems involving the volume of cylinders, cones, and spheres using the formula $V = bh$ [8(6)(A) and 8(7)(A)]. This SE extends the grade 7 SEs involving composite figures into the third dimension [7(9)(C) and (D)]. Students are expected to use appropriate units of measure.

TEKS: Circles.	Supporting Information
G(12)(A) **Circles.** The student uses the process skills to understand geometric relationships and apply theorems and equations about circles. **The student is expected to apply theorems about circles, including relationships among angles, radii, chords, tangents, and secants, to solve non-contextual problems.**	Students are expected to apply theorems that include angles, radii, chords, tangents, and secants.
G(12)(B) **Circles.** The student uses the process skills to understand geometric relationships and apply theorems and equations about circles. **The student is expected to apply the proportional relationship between the measure of an arc length of a circle and the circumference of the circle to solve problems.**	Proportional reasoning represents a "capstone" skill for grades 6-8 mathematics. This SE applies proportional reasoning to determine arc length. The focus is on solving problems using the proportional relationships and an arc length.
G(12)(C) **Circles.** The student uses the process skills to understand geometric relationships and apply theorems and equations about circles. **The student is expected to 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.**	Proportional reasoning represents a "capstone" skill for grades 6-8 mathematics. This SE applies proportional reasoning to determine the area of a sector. The focus is on solving problems using the proportional relationships and the area of a sector.
G(12)(D) **Circles.** The student uses the process skills to understand geometric relationships and apply theorems and equations about circles. **The student is expected to 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.**	When paired with G(1)(D) and (F), students may be expected to make connections between familiar angles such as 90°, 180°, 270°, and 360° and their corresponding radian measures for a circle with radius 1.
G(12)(E) **Circles.** The student uses the process skills to understand geometric relationships and apply theorems and equations about circles. **The student is expected to 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), $(x - h)^2 + (y - k)^2 = r^2$.**	This SE extends previous work with the Pythagorean Theorem. This SE extends the Pythagorean Theorem to the equation of a circle. This is the only discussion of the equation of a circle. The discussion of the equation of a parabola is included in Algebra I [A(6)(B), A(7)(A) and (C)] and Algebra II [2A(4)(B) and (D)]. In Precalculus, students are introduced to the equations of an ellipse and hyperbola, as well as parametric representations of all conic shapes [P(3)(H) and (I)] and the relationship of the equations to each other in rectangular coordinates [P(3)(G)].

TEKS: Probability.	Supporting Information
G(13)(A) **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 develop strategies to use permutations and combinations to solve contextual problems.**	Students may be, but are not necessarily, expected to use formulas to calculate permutations and combinations. Students may be given data as an organized list or diagram.
G(13)(B) **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 determine probabilities based on area to solve contextual problems.**	In grade 7, students determine probabilities. This SE extends this concept to include probabilities based on area [7(6)(C), (D), (E), (H), and (I)]. This concept may be used to help students with the notion of the normal curve and other probabilistic distributions in Statistics [S(5)(C)].
G(13)(C) **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 identify whether two events are independent and compute the probability of the two events occurring together with or without replacement.**	This SE builds on grade 7 probability standards [7(6)(C), (D), (E), and (I)]. Academic vocabulary includes compound events, independent events, and dependent events.
G(13)(D) **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 apply conditional probability in contextual problems.**	Students may be expected to connect the concept of conditional probability to dependent events and to determine the conditional probability of a compound event in a problem situation.
G(13)(E) **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 apply independence in contextual problems.**	Students may be expected to determine the probability of independent events in problem situations.