Geometry (IMRA)

Subject: Mathematics
Grade: 10
Expectations: 49
Breakouts: 176

(a) 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. Studentll g p(t)-2.3 (.)-1.od(.)asand language. Students will use mathematical relationships to generate 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.

(b) Knowledge and Skills Statements

(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;

(i) apply mathematics to problems arising in everyday life

(ii) apply mathematics to problems arising in society

(iii) apply mathematics to problems arising in 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;

(i) 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

(ii) use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the 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;

(i) select tools, including real objects as appropriate, to solve problems

(ii) select tools, including manipulatives as appropriate, to solve problems

(iii) select tools, including paper and pencil as appropriate, to solve problems

(iv) select tools, including technology as appropriate, to solve problems

(v) select techniques, including mental math as appropriate, to solve problems

(vi) select techniques including estimation as appropriate, to solve problems

(vii) select techniques, including 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;

(i) communicate mathematical ideas using multiple representations, including symbols as appropriate

(ii) communicate mathematical ideas using multiple representations, including diagrams as appropriate

(iii) communicate mathematical ideas using multiple representations, including graphs as appropriate

(iv)

(viii) communicate mathematical reasoning using multiple representations, including language as appropriate

(ix) communicate [mathematical ideas'] implications using multiple representations, including symbols as appropriate

(x) communicate [mathematical ideas'] implications using multiple representations, including diagrams as appropriate

(xi) communicate [mathematical ideas'] implications using multiple representations, including graphs as appropriate

(xii) communicate [mathematical ideas'] implications using multiple representations, including language as appropriate

(xiii) communicate [mathematical reasoning's] implications using multiple representations, including symbols as appropriate

(xiv) communicate [mathematical reasoning's] implications using multiple representations, including diagrams as appropriate

(xv) communicate [mathematical reasoning's] implications using multiple representations, including graphs as appropriate

(xvi) communicate [mathematical reasoning's] implications using multiple representations, including language as appropriate

(E) create and use representations to organize, record, and communicate mathematical ideas;

(i) create representations to organize mathematical ideas

(ii) create representations to record mathematical ideas

(iii) create representations to communicate mathematical ideas

(iv) use representations to organize mathematical ideas

(v) use representations to record mathematical ideas

(vi) use representations to communicate mathematical ideas

(F) analyze mathematical relationships to connect and communicate mathematical ideas; and

(i) analyze mathematical relationships to connect mathematical ideas

(ii) analyze mathematical relationships to communicate mathematical ideas

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

(i) display mathematical ideas using precise mathematical language in written or oral communication

(ii) display mathematical arguments using precise mathematical language in written or oral communication

(iii)

(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;

(i) 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-dimensional coordinate systems, including finding the midpoint

(ii) 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 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

(i) derive the distance formula

(ii) use the distance formula to verify geometric relationships, including congruence of segments

(iii) use the distance formula to verify geometric relationships, including parallelism or perpendicularity of pairs of lines

(iv) derive the slope formula

(v) use the slope formula to verify geometric relationships, including parallelism or perpendicularity of pairs of lines

(vi) derive the midpoint formula

(vii) use the midpoint formula to verify geometric relationships

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

(i) 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:

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

(i)r15 (2.9DC -0.i3 (i)-0 (o)-1.9 (o)6.1 0.6 (a)2 (d)4.1.8 (fof)3.6fo)6.(s)7.76 -0..74railan anhd5 (2.9DC -0.i3 (i)-0 (o)-1.9 (o)1 0.

(ii) investigate patterns to make conjectures about geometric relationships, including criteria required for triangle congruence choosing from a variety of tools

(iii) inveiga5v6.1 (a)1.9 (t)7.7 (t)1.6 (e)3 .5 .8 (to m)2.6 (a)6 (ke)1 ( )6.4 (c)-2.1 (on)-1.9 (j)-0.6 (e)7 (c)-2.1 (tu)-1.9 (r)1.7

(i)

(ii) apply the relationships in special right triangles 45°-45°-90° to solve problems

(iii) apply the relationships in 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

(i) identify the shapes of two-dimensional cross-sections of prisms

(ii) identify the shapes of two-dimensional cross-sections of pyramids

(iii) identify the shapes of two-dimensional cross-sections of cylinders

(iv) identify the shapes of two-dimensional cross-sections of cones

(v) identify the shapes of two-dimensional cross-sections of spheres

(vi) identify three-dimensional objects generated by rotations of two-dimensional shapes

(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.

(i)

(iii) apply the formulas for the total surface area of three-dimensional figures, including cones, to solve problems using appropriate units of measure

(iv) apply the formulas for the total surface area of three-dimensional figures, including cylinders, to solve problems using appropriate units of measure

(v) apply the formulas for the total surface area of three-dimensional figures, including spheres, to solve problems using appropriate units of measure

(vi) apply the formulas for the total surface area of three-dimensional figures, including composite figures, to solve problems using appropriate units of measure

(vii) apply the formulas for the lateral surface area of three-dimensional figures, including prisms, to solve problems using appropriate units of measure

(viii) apply the formulas for the lateral surface area of three-dimensional figures, including pyramids, to solve problems using appropriate units of measure

(ix) apply the formulas for the lateral surface area of three-dimensional figures, including cones, to solve problems using appropriate units of measure

(x) apply the formulas for the lateral surface area of three-dimensional figures, including cylinders, to solve problems using appropriate units of measure

(xi) apply the formulas for the lateral surface area of three-dimensional figures, including spheres, to solve problems using appropriate units of measure

(xii) apply the formulas for the lateral surface area of three-dimensional figures, including composite figures, to solve problems using appropriate units of measure

(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.

(i) apply the formulas for the volume of three-dimensional figures, including prisms, to solve problems using appropriate units of measure

(ii) apply the formulas for the volume of three-dimensional figures, including pyramids, to solve problems using appropriate units of measure

(iii) apply the formulas for the volume of three-dimensional figures, including cones, to solve problems using appropriate units of measure

(iv) apply the formulas for the volume of three-dimensional figures, including cylinders, to solve problems using appropriate units of measure

(v) apply the formulas for the volume of three-dimensional figures, including spheres, to solve problems using appropriate units of measure

(vi) apply the formulas for the volume of three-dimensional figures, including composite figures, to solve

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

(i) 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;

(i) 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

(i) 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

(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), $(x - h)^2 + (y - k)^2 = r^2$

(i) show that the equation of a circle with center at the origin and radius r is $x^2 + y^2 = r^2$

(ii) 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-worl(o)2.1 1 1 Tf-0q84 81g.1 (ba)t[0.228001 Tw 07b0