GEOMETRY POWER STANDARDS

BAISD Standards	4 – Power Standard; 3 - Almost a Power Standard; 2 – Important, but not primary; 1 – important as an example supporting a Power Standard		
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STANDARD L1: REASONING ABOUT NUMBERS, SYSTEMS, AND QUANTITATIVE SITUATIONS

L1.1 Number Systems and Number Sense

4	L1.1.6	Explain the importance of the irrational numbers $\sqrt{2}$ and $\sqrt{3}$ in basic right triangle trigonometry, and the importance of π because of its role in circle relationships.	• Explain the importance of irrational #'s… (Exact answers vs. approximate answers.) • Explain irrational #'s in basic right triangle trigonometry. (Special right triangles) • Explain importance of π in circles. (π=c/d) Note – Poor test question #1 part 1.

L1.2 Representations and Relationships

1	L1.2.3	Use vectors to represent quantities that have magnitude and direction, interpret direction and magnitude of a vector numerically, and calculate the sum and difference of two vectors.	• Use vectors to represent quantities that have magnitude and direction. • Interpret direction and magnitude of a vector. • Calculate the sum and difference of two vectors.

STANDARD L2: CALCULATION, ALGORITHMS, AND ESTIMATION

L2.3 Measurement Units, Calculations, and Scales

3	L2.3.1	Convert units of measurement within and between systems; explain how arithmetic operations on measurements affect units, and carry units through calculations correctly.	• Convert units of measurement within a system. • Convert units between systems (metric vs. English) • Explain how arithmetic operations on measurements affect units carrying through arithmetic operations on units to obtain appropriate end unit. *(Important, but imbedded in HSCE G2.3.5)*

STANDARD L3: MATHEMATICAL REASONING, LOGIC, AND PROOF

L3.1 Mathematical Reasoning

3	L3.1.1	Distinguish between inductive and deductive reasoning, identifying and providing examples of each.	• Distinguish between inductive and deductive reasoning. • Identify examples of inductive and deductive reasoning. • Provide examples of inductive and deductive reasoning.

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1	L3.1.2	Differentiate between statistical arguments (statements verified empirically using examples or data) and logical arguments based on the rules of logic.	• Recognize differences between statistical arguments (statements verified empirically using examples or data) and logical arguments.
3	L3.1.3	Define and explain the roles of axioms (postulates), definitions, theorems, counterexamples, and proofs in the logical structure of mathematics. Identify and give examples of each.	• Define the tools of justifications: ▪ axioms (postulates) ▪ definitions ▪ theorems ▪ Counterexamples ▪ proofs • Explain the roles of the following tools: ▪ axioms (postulates) ▪ definitions ▪ theorems ▪ Counterexamples ▪ proofs • Identify the following tools: ▪ axioms (postulates) ▪ definitions ▪ theorems ▪ Counterexamples ▪ proofs • Give examples of the following tools: ▪ axioms (postulates) ▪ definitions ▪ theorems ▪ Counterexamples ▪ proofs

L3.2 Language and Laws of Logic

3	L3.2.1	Know and use the terms of basic logic.	• Know terms of logic • Use terms of logic.
2	L3.2.2	Use the connectives "not," "and," "or," and "if..., then," in mathematical and everyday settings. Know the truth table of each connective and how to logically negate statements involving these connectives.	• Use connectives (not, and, or & if … then) in *mathematical settings*. • Use connectives (not, and, or & if … then) in *everyday settings*. • Use connectives in truth tables. • Know how to logically negate statements involving these connectives.

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1	L3.2.3	Use the quantifiers "there exists" and "all" in mathematical and everyday settings and know how to logically negate statements involving them.	• Use "there exists" and "all" in math and everyday settings. • Know how to logically negate "there exists" and "all" statements.
4	L3.2.4	Write the converse, inverse, and contra positive of an "If..., then..." statement. Use the fact, in mathematical and everyday settings, that the contra positive is logically equivalent to the original while the inverse and converse are not.	• Write the *converse* of an "If…then". • Write the *inverse* of a conditional • Write the *contra positive* of a conditional • Explain why the contra positive is logically equivalent to the original. • Explain why the inverse is not logically equivalent to the original. • Explain why the converse is not logically equivalent to the original.

L3.3 Proof

4	L3.3.1	Know the basic structure for the proof of an "If..., then..." statement (assuming the hypothesis and ending with the conclusion) and that proving the contra positive is equivalent.	• Know the basic structure for the proof of an "if…, then…" statement (assuming the hypothesis and ending with the conclusion). • Know that proving a conditional or the contra positive accomplish the same.
1	L3.3.2	Construct proofs by contradiction. Use counter-examples, when appropriate, to disprove a statement.	• Construct proofs by contradiction. • Use counter-examples to disprove a statement.
1	L3.3.3	Explain the difference between a necessary and a sufficient condition within the statement of a theorem. Determine the correct conclusions based on interpreting a theorem in which necessary or sufficient conditions in the theorem or hypothesis are satisfied.	• Explain the difference between necessary and sufficient condition within the statement of a theorem. • Determine the correct conclusions based on interpreting a theorem in which necessary or sufficient conditions in the theorem or hypothesis are satisfied. • • Apply knowledge of necessary and a sufficient condition to draw conclusions.

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STANDARD G1: FIGURES AND THEIR PROPERTIES

G1.1 Lines and Angles; Basic Euclidean and Coordinate Geometry

4	G1.1.1	Solve multi-step problems and construct proofs involving vertical angles, linear pairs of angles, supplementary angles, complementary angles, and right angles.	• Involve multi-step problems involving vertical angles, linear pairs of angles, complementary angles, supplementary angles, and right angles. • Construct proofs involving vertical angles, linear pairs of angles, complementary angles, supplementary angles, and right angles. (Non Triangle Proofs)
4	G1.1.2	Solve multi-step problems and construct proofs involving corresponding angles, alternate interior angles, alternate exterior angles, and same-side (consecutive) interior angles.	• Solve multi-step problems involving corresponding angles, alternate interior angles, alternate exterior angles and same-side interior angles. • Construct proofs involving corresponding angles, alternate interior angles, alternate exterior angles and same-side interior angles.
1	G1.1.3	Perform and justify constructions, including midpoint of a line segment and bisector of an angle, using straightedge and compass.	• Construct the midpoint of a line segment and an angle bisector. • Justify the construction of the midpoint of a line segment and an angle bisector.
1	G1.1.4	Given a line and a point, construct a line through the point that is parallel to the original line using straightedge and compass. Given a line and a point, construct a line through the point that is perpendicular to the original line. Justify the steps of the constructions.	• Given a point and a line, construct a line through the point that is parallel to the original line using straightedge and compass, and justify the steps. • Given a point and a line, construct a line through the point that is perpendicular to the line, and justify the steps.
4	G1.1.5	Given a line segment in terms of its endpoints in the coordinate plane, determine its length and midpoint.	• Given a line segment in terms of its endpoints in the coordinate plane, determine its length and midpoint.

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2	G1.1.6	Recognize Euclidean geometry as an axiom system. Know the key axioms and understand the meaning of and distinguish between undefined terms, axioms, definitions, and theorems.	• Recognize Euclidean geometry as an axiom system (For example, geometry is based on undefined terms (point, line, plane) & unproven statements.) • Know the key axioms (postulates) in Euclidean geometry. • Understand the meaning of undefined terms, axioms, definitions, and theorems. • Distinguish between undefined terms, axioms, definitions, and theorems.

G1.2 Triangles and Their Properties

3	G1.2.1	Prove that the angle sum of a triangle is 180° and that an exterior angle of a triangle is the sum of the two remote interior angles.	• Complete a proof that the sum of the angles in a triangle is 180°. • Complete a proof that an exterior angle of a triangle is the sum of the two remote interior angles.
4	G1.2.2	Construct and justify arguments and solve multi-step problems involving angle measure, side length, perimeter, and area of all types of triangles.	• *Construct* and *justify* arguments involving all types of triangles: ▪ Angle measure ▪ Side length ▪ Perimeter ▪ Area • Solve multi-step problems involving all types of triangles: ▪ Angle measure ▪ Side length ▪ Perimeter ▪ Area
4	G1.2.3	Know a proof of the Pythagorean Theorem, and use the Pythagorean Theorem and its converse to solve multi-step problems.	• Know a proof of the Pythagorean Theorem. • Use the Pythagorean Theorem to solve multi-step problems. • Use the converse of the Pythagorean Theorem to solve multi-step problems.

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4	G1.2.4	Prove and use the relationships among the side lengths and the angles of 30º-60º-90º triangles and 45º-45º-90º triangles.	• Prove the relationships among the side length and the angles of 30° -60° -90° and 45° -45° -90° triangles. • Use the relationships among the side lengths and the angles of 30° -60° -90° and 45° -45° -90° triangles.
2	G1.2.5	Solve multi-step problems and construct proofs about the properties of medians, altitudes and perpendicular bisectors to the sides of a triangle, and the angle bisectors of a triangle. Using straightedge and compass, construct these lines.	• Solve multi-step problems using the properties of *medians*, *altitudes*, and *perpendicular bisectors*. • Construct proofs using the properties of *medians*, *altitudes*, *and perpendicular bisectors*.

G1.3 Triangles and Trigonometry

4	G1.3.1	Define the sine, cosine, and tangent of acute angles in a right triangle as ratios of sides. Solve problems about angles, side lengths, or areas using trigonometric ratios in right triangles.	• Define the *sine*, *cosine*, and *tangent* of acute angles in a right triangle as ratios of sides. • Solve problems about angles, side lengths, or areas using trigonometric ratios in right triangles.
3	G1.3.2	Know and use the Law of Sines and the Law of Cosines and use them to solve problems. Find the area of a triangle with sides a and b and included angle using the formula Area = (1/2) absin θ.	• Know the *Law of Sines* and the *Law of Cosines*. • Solve problems using the *Law of Sines* and the *Law of Cosines*. • Use formula (1/2) absin to find the area of a triangle with sides a and b included in angle.
1	G1.3.3	Determine the exact values of sine, cosine, and tangent for 0°, 30°, 45°, 60°, and their integer multiples and apply in various contexts.	• Determine the exact values of *sine*, *cosine*, and *tangent* for 0°, 30°, 45°, and 60°. • Determine the exact values of integer multiples (unit circle applications). • Apply sine, cosine and tangent values in contextual situations.

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G1.4 Quadrilaterals and Their Properties

4	G1.4.1	Solve multi-step problems and construct proofs involving angle measure, side length, diagonal length, perimeter, and area of squares, rectangles, parallelograms, kites, and trapezoids.	• Solve multi-step problems involving angle measure, side length, diagonal length, perimeter, and the area of squares, rectangles, parallelograms, kites, and trapezoids. • Construct proofs involving angle measure, side length, diagonal length, perimeter, and the area of squares, rectangles, parallelograms, kites, and trapezoids.
2	G1.4.2	Solve multi-step problems and construct proofs involving quadrilaterals using Euclidean methods or coordinate geometry.	• Solve multi-step problems involving quadrilaterals using *Euclidean* methods and *coordinate geometry*. • Construct proofs involving quadrilaterals using *Euclidean* methods and *coordinate geometry*. • Construct proofs involving quadrilaterals and **coordinate geometry**.
4	G1.4.3	Describe and justify hierarchical relationships among quadrilaterals.	• Describe hierarchical relationships among quadrilaterals. • Justify hierarchical relationships among quadrilaterals. *Should this contain information about knowing properties of quadrilaterals specifically? Q #31*
2	G1.4.4	Prove theorems about the interior and exterior angle sums of a quadrilateral.	• Prove theorems about the interior angle sums of a quadrilateral. • Prove theorems about the exterior angle sums of a quadrilateral.

G1.5 Other Polygons and Their Properties

2	G1.5.1	Know and use subdivision or circumscription methods to find areas of polygons.	• Know subdivision and circumscription methods. • Use subdivision and circumscription methods to find areas of polygons.

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3	G1.5.2	Know, justify, and use formulas for the perimeter and area of a regular n-gon and formulas to find interior and exterior angles of a regular n-gon and their sums.	• *Know*, *justify* and use formulas for the perimeter of a regular n-gon. • *Know*, *justify* and use formulas for the area of a regular n-gon. • *Know*, *justify* and use formulas to find interior angles of a regular n-gon and their sums. • *Know*, *justify* and use formulas to find exterior angles of a regular n-gon and their sums.

G1.6 Circles and Their Properties

4	G1.6.1	Solve multi-step problems involving circumference and area of circles.	• Solve multi-step problems involving circumference and area of circles.
1	G1.6.2	Solve problems and justify arguments about chords and lines tangent to circles.	• Solve problems about chords and lines tangent to circles. • Justify arguments about chords and lines tangent to circles.
3	G1.6.3	Solve problems and justify arguments about central angles, inscribed angles, and triangles in circles.	• Solve problems about central angles, inscribed angles, and triangles in circles. • Justify arguments about central angles, inscribed angles, and triangles in circles.
3	G1.6.4	Know and use properties of arcs and sectors, and find lengths of arcs and areas of sectors.	• Know properties of arcs and sectors. • Use properties of arcs and sectors. • Find lengths of arcs and areas of sectors.

G1.8 Three-dimensional Figures

4	G1.8.1	Solve multi-step problems involving surface area and volume of pyramids, prisms, cones, cylinders, hemispheres, and spheres.	• Solve multi-step problems involving surface area of *pyramids*, *prisms*, *cones*, *cylinders*, *hemispheres*, and *spheres*. • Solve multi-step problems involving volume of *pyramids*, *prisms*, *cones*, *cylinders*, *hemispheres*, and *spheres*.
2	G1.8.2	Identify symmetries of pyramids, prisms, cones, cylinders, hemispheres, and spheres.	• Identify symmetries of *pyramids*, *prisms*, *cones*, *cylinders*, *hemispheres*, and *spheres*.

STANDARD G2: RELATIONSHIPS BETWEEN FIGURES

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G2.1 Relationships Between Area and Volume Formulas

4	G2.1.1	Know and demonstrate the relationships between the area formula of a triangle, the area formula of a parallelogram, and the area formula of a trapezoid.	• Know the area formula of a triangle, parallelogram, and a trapezoid. • Demonstrate the relationships between the area formula of a triangle, parallelogram, and a trapezoid.
3	G2.1.2	Know and demonstrate the relationships between the area formulas of various quadrilaterals.	• Know the relationships between the area formulas of various quadrilaterals. • Demonstrate the relationship between the area formulas of various quadrilaterals.
2	G2.1.3	Know and use the relationship between the volumes of pyramids and prisms.	• Know the relationship between the volumes of pyramids and prisms. • Use the relationship between the volumes of pyramids and prisms.

G2.2 Relationships Between Two-dimensional and Three-dimensional Representations

3	G2.2.1	Identify or sketch a possible three-dimensional figure, given two-dimensional views. Create a two-dimensional representation of a three-dimensional figure.	• Identify a possible three-dimensional figure, given the net or multiple 2-D views. • Sketch a possible three-dimensional figure, given the net or multiple 2-D views. • Create the net or multiple 2-D views of a three-dimensional figure.
1	G2.2.2	Identify or sketch cross sections of three-dimensional figures. Identify or sketch solids formed by revolving two-dimensional figures around lines.	• Identify and sketch cross sections of three dimensional figures. • Identify and sketch solids formed by revolving two dimensional figures around lines.

G2.3 Congruence and Similarity

4	G2.3.1	Prove that triangles are congruent using the SSS, SAS, ASA, and AAS criteria and that right triangles are congruent using the hypotenuse-leg criterion.	• Prove that triangles are congruent using the *SSS*, *SAS*, *ASA*, and *AAS* criteria and that right triangles are congruent using the *hypotenuse-leg* criterion.

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2	G2.3.2	Use theorems about congruent triangles to prove additional theorems and solve problems, with and without use of coordinates.	• Use theorems about congruent triangles to probe additional theorems with and without coordinates.
3	G2.3.3	Prove that triangles are similar by using SSS, SAS, and AA conditions for similarity.	• Complete a proof that triangles are similar by using SSS, SAS, and AA conditions for similarity.
4	G2.3.4	Use theorems about similar triangles to solve problems with and without use of coordinates.	• Use theorems about similar triangles to solve problems ~~with and~~ without use of coordinates.
4	G2.3.5	Know and apply the theorem stating that the effect of a scale factor of k relating one two-dimensional figure to another or one three-dimensional figure to another, on the length, area, and volume of the figures, is to multiply each by k, k2, and k3, respectively.	• Know the theorem stating that the effect of a scale factor of k relating one two-dimensional figure to another or one three-dimensional figure to another, on the *length*, *area*, and *volume* of the figures, is to multiply each by k, k^2, and k^3, respectively. • Apply the theorem stating that the effect of a scale factor of k relating one two-dimensional figure to another or one three-dimensional figure to another, on the *length*, *area*, and *volume* of the figures, is to multiply each by k, k^2, and k^3, respectively.

STANDARD G3: Transformations of figures in the plane

G3.1 Distance-preserving Transformations Isometries

4	G3.1.1	Define reflection, rotation, translation, and glide reflection and find the image of a figure under a given isometry.	• Define the following isometries: ▪ Reflection ▪ Rotation ▪ Translation ▪ Glide reflection • Find the image of a figure under a given isometry. ▪ Reflection ▪ Rotation ▪ Translation ▪ Glide reflection

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1	G3.1.2	Given two figures that are images of each other under an isometry, find the isometry and describe it completely.	• Given two figures that are images of each other under an isometry: ▪ find the isometry ▪ describe it completely
1	G3.1.3	Find the image of a figure under the composition of two or more isometries and determine whether the resulting figure is a reflection, rotation, translation, or glide reflection image of the original figure.	• Find the image of a figure under an isometry or the composition of two or more isometries. • Determine whether the resulting figure under an isometry or composition of isometries is a reflection, rotation, translation, or glide reflection of the original figure.

G3.2 Shape-preserving Transformations: Dilations and Isometries

3	G3.2.1	Know the definition of dilation and find the image of a figure under a given dilation.	• Know the definition of dilation. • Find the image of a figure under a given dilation.
1	G3.2.2	Given two figures that are images of each other under some dilation, identify the center and magnitude of the dilation.	• Given two figures that are images of each other under some dilation, identify the center and magnitude of the dilation.