ILLINOIS STATE BOARD OF EDUCATION

MATHEMATICS HIGH SCHOOL GEOMETRY

Theory of Action: Academic standards represent a collective commitment around what students should learn each year. The state assessment asks students to demonstrate their knowledge, skills, and understanding related to these standards using a common measure. The resulting data allows us to see patterns in performance that should guide school and district improvement, helping identify areas of strength and opportunity.

Role of Performance Level Descriptors in Defining Proficiency: Performance level descriptors bridge the state assessment to classroom instruction and the systems of formative assessments that guide local instruction and choices about individual students. ***Academic proficiency represents a range of observable student performance characteristics***. There are multiple pathways to proficiency, and students rely upon their strengths differently within that range of performance.

Proficiency and Difficulty: A student's ability to demonstrate proficiency is influenced by the complexity of the texts or stimuli presented, tasks they're asked to complete, and the contexts in which they are engaged. As student performance improves, students are typically able to handle more challenging texts/stimuli, tasks, and contexts, and are able to demonstrate their skills and knowledge more accurately and consistently.

Geometry Claim 1	***Student performance indicates the ability to…*** Below Proficient	Approaching Proficient	Proficient	Above Proficient
CO.1-5	Apply the precise definition of each of the following: angle, circle, perpendicular line, parallel line, and line segment.	Recognize a single-step sequence of preimage-image rigid transformations (e.g., rotations, reflections, and translations). Identify a rigid vs. nonrigid transformation in the preimage-image single-step sequence. (i.e., does the transformation preserve the properties of the preimage or not, congruent vs. noncongruent transformations?)	Use a point mapping to compare the sequence of transformations between the pre-image and image, including reflections, rotations, dilations, translations. Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure.	Use a point mapping to compare image to pre-image, such as a rectangle, parallelogram, trapezoid, or regular polygon. Describe the rotations and reflections.
CO.6-8	Given two geometric shapes, determine if they are congruent by inspection (identify corresponding sides, angles, etc.). Perform a sequence of rigid transformations on a geometric shape. Write congruence statements for corresponding parts of congruent figures.	Use a sequence of transformations to show that two congruent shapes can be mapped on to each other. Given a preimage-image pair, identify the transformations that occurred.	If two shapes can be mapped on to each other, explain why these shapes must be congruent (i.e., overlapping triangles). Know and apply triangle congruence criteria of ASA, SAS, and SSS.	Cite a sequence of rigid transformations to justify triangle congruence criteria (ASA, SAS, and SSS). Cite a sequence of rigid transformations to justify triangle congruence criteria (ASA, SAS, and SSS).

Claim 1	Below Proficient	Approaching Proficient	Proficient	Above Proficient
CO.9	Identify supplementary and complementary relationships between angles.	Argue that points on a perpendicular bisector are equidistant from the endpoints of the segment.	Given two parallel lines cut by a transversal, prove congruence or supplementary relationship between two angles in regards to their location. (e.g., vertical angles, alternate interior/exterior angles, corresponding, consecutive interior/exterior angles.)	Use multiple theorems to find missing angles (e.g., triangle sum theorem, isosceles triangle theorem, exterior angle theorem, angle bisector theorem, midpoint theorem).
	Calculate the measure of a missing angle in a linear pair. Classify line pairs as parallel, perpendicular, or transversal from diagrams.		Given two parallel lines cut by a transversal, prove congruence or supplementary relationship between two angles in regards to their location. (e.g., vertical angles, alternate interior/exterior angles, corresponding, consecutive interior/exterior angles.)	
	Identify a perpendicular bisector of a line segment.			
	Identify pairs of congruent angles given parallel lines cut by a transversal -- corresponding, alternating interior, vertical, consecutive angles, etc.			
CO.10	Know and apply that the angles of a triangle measure 180 degrees.	Prove that the angles of a triangle measure 180 degrees.	Prove that the midline of a triangle is parallel to the third side and half the length of the third side.	Prove that the medians of a triangle are concurrent using a transformational argument or a coordinate geometry approach.
	Know and apply that the base angles of an isosceles triangle are congruent.	Prove that the base angles of an isosceles triangle are congruent.	Know and apply that the medians of a triangle are all concurrent.	Use justification of concurrence of medians to derive 2:1 ratio of median by point of concurrency.
		Identify midlines of triangles and use the properties of midlines to solve problems.		

Claim 1	Below Proficient	Approaching Proficient	Proficient	Above Proficient
CO.11	Know and apply properties of parallelograms. Opposite sides are parallel, opposite sides are congruent, opposite angles are congruent, and diagonals bisect each other.	Know and apply properties of rectangles. All properties of parallelograms, all angles congruent, and diagonals congruent.	Prove/justify that opposite sides of a parallelogram are congruent.	Prove and apply the properties of kites to determine equivalency and congruence of angles, diagonals, and resulting isosceles triangles.
		Identify that parallelograms have 180 degree rotational symmetry about their center.	Prove/justify that the opposite angles of a parallelogram are congruent.	Prove and apply the properties of trapezoids to determine the congruence of adjacent angles and parallel relation of the bases.
			Prove/justify the diagonals of parallelogram bisect each other.	
			Prove/justify that the diagonals of a rectangle are congruent.	
CO.12-13	Draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions that lead to unique shapes or satisfy more than one unique shape. The version of this standard can be assessed with the correct selection of the diagrams, construction steps, etc.	Identify the correct methodology in using tools (string, compass, paper folding, software etc.) to copy or construct an angle, a line segment, or bisection of angles and segments. Describe the steps in creating perpendicular or parallel lines w/o an external point. Examine the construction of equilateral triangles, squares, or regular hexagons.	Examine if the sequence of steps would lead to the construction of parallel or perpendicular lines w/ and w/o the point not on the line. Constructing an angle or a segment from bisections of other angles or segments. Construct (or select from a set of steps necessary for accurate construction given various tools) an equilateral triangle, square, or a regular hexagon.	Calculate a composite area given the relationship between inscribed/circumscribed shapes. Examine the construction of regular polygons given available tools. Apply constructive strategies to abstract problems where the composite area is not provided but has to be derived from the context of the problem.

Geometry	***Student performance indicates the ability to…***			
Claim 2	**Below Proficient**	**Approaching Proficient**	**Proficient**	**Above Proficient**
SRT.1	Given two figures, identify if the two images represent the same shape (congruent angles) or not.	Given the preimage-image pair of figures, visually identify the center of dilation and determine the scale factor.	Verify experimentally that dilations take lines to parallel lines, and that lines that pass through the center of dilation map to themselves.	Prove/justify that dilations take lines to lines, segments to segments, and circles to circles. Generalize that dilation takes any geometric shape to the same type of geometric shape.
	Determine if the two images represent an enlargement or reduction preimage-image.	Perform dilations using technology or by hand on simple geometric objects (point, line segments, etc.) using simple scale factors (e.g., 3 or 1/2) with the center of dilation in the origin.	Verify experimentally that dilations take line segments to line segments, where the length of the line segment is multiplied by the scale factor.	Given two circles, find the two possible centers of dilation for the circles and explain connection between these centers of dilation and internal/ external tangents for circles.
SRT.2-5	Identify pairs of corresponding sides and angles in a dilated preimage/image pair.	Classify two geometric shapes as similar if all pairs of corresponding sides are proportional and corresponding angles are congruent.	Prove the similarity between two triangles with postulates AA, SAS, and SSS.	Calculate the inaccessible measures given the proportional relationship between similar triangles (e.g., bowtie in optics).
	Given two dilated images, determine the coefficient of proportionality.	Find missing sides/angles given two similar figures (e.g., scale factor, coefficient of proportionality, angle relationships, etc.).	Examine and prove that a line parallel to one side of a triangle divides the other two proportionally as it effectively creates two similar triangles that share an angle and have two sets of proportional corresponding sides (two non-parallel sides as two transversals intersecting two parallel lines form pairs of congruent corresponding angles).	Combine multiple postulates and/or theorems to solve a multi-step question, specifically. questions that involve finding an intermediate value to find the intended value.
			Prove that the altitude of a right triangle drawn from its vertex divides the hypotenuse into two segments, and the length of the altitude is the geometric mean of those two segments. The altitude of a triangle creates three similar triangles.	Combine multiple postulates and/or theorems to solve a multi-step question, specifically. questions that involve finding an intermediate value to find the intended value.

Claim 2	Below Proficient	Approaching Proficient	Proficient	Above Proficient
SRT.6-8	Correctly identify the hypotenuse and legs of the right triangles..	Correctly identify the legs of a right triangle as opposite or adjacent to a given angle.	Describe and identify trigonometric ratios in terms of the sides of a right triangle. Define sine, cosine, and tangent ratios in terms of side lengths of right triangles.	Apply the trig ratios to non-right triangles to find missing angles or side lengths. Extend the trigonometric ratios to the laws of sines and cosines to calculate missing angles, side lengths, and areas.
	Use the Pythagorean theorem to solve for missing side lengths in right triangles.	Given that two triangles are similar, use ratios to find missing lengths of corresponding segments of the triangle (e.g., sides, altitudes, medians, angle bisectors, etc.).	Calculate the missing side length or angle measure given basic trigonometric ratios in right triangles.	
	Find missing angles using angle sum theorem (interior and exterior.	Identify which trigonometric ratio should be used to find a missing part of a right triangle.	Apply the relationship between two complementary angles in right triangles (e.g., sin(x)=cos(90-x)) to find missing angles or side lengths in right triangles). Use similarity to justify the consistency of these definitions and values (e.g., that sin (37) will be the same value for all right triangles with a 37-degree base angle). Identify the maximum or minimum value of the function from the vertex form.	

Geometry	***Student performance indicates the ability to…***			
Claim 3	**Below Proficient**	**Approaching Proficient**	**Proficient**	**Above Proficient**
G-C.1-3	Identify parts of the circle and its related segments -- radius, diameter, circumference, area, arc, sector, central angle, etc.	Conclude that all radii are congruent to find missing lengths or to prove triangles congruent.	Given appropriate information, calculate the measures of central or inscribed angles.	Use inscribed angles, central angles, radii, chords, and tangents to find the area of sectors.
		angle.		
		Find area and circumference.	Apply the diameter/radius to tangent relationship.	Construct inscribed and circumscribed circles of a triangle or quadrilateral.
		Given that one side of an inscribed angle is the diameter, find the measure of the inscribed arc and central angle.	Use inscribed angles, central angles, radii, chords, and tangents to answer a one or two step question to find missing angle, arcs, segment lengths.	
			Prove/justify the angle relationships of an inscribed quadrilaterals.	
			When given an inscribed or circumscribed triangle or quadrilateral, find missing sides, angles, or arcs.	
			Define similarity/proportionality between two circles in terms of the relationship between their radii.	
G-C.5	Identify and name major and minor arcs of a circle.	Define radian angle measure as the proportion between the length of an arc and the radius of a circle.	Understand the definition of radian to be consistent (e.g., same size angle will have the same radian measure regardless of the size of the circle).	Given radius of circle and angle measurement in radians, derive the formula for area of a sector.
	Identify and name sectors of a circle. Find circumference and area of a circle given the radius.		Solve for arc lengths in circles given radius and angle measure, either in degrees or radians.	
			Solve for areas of sectors in circles given radius and angle measure, either in degrees or radians.	

Geometry Claim 4	*Student performance indicates the ability to...* Below Proficient	Approaching Proficient	Proficient	Above Proficient
G-GPE.1-2	Identify the center and radius of a given circle on the coordinate plane.	Use the Pythagorean theorem to write an equation for a circle on the coordinate plane given center and radius.	Write an equation for a given circle on the coordinate plane given center and radius.	Derive the equation of a parabola with center and directrix at any location on the coordinate plane.
	Write an equation of a given quadratic function graphed on the coordinate plane.	Generalize this process to derive the equation of a circle on the coordinate plane.	Given an equation of a circle in standard form, use completing the square to find the center and radius of the circle.	Derive the equation of an ellipse given a center and focus length.
G.GPE.4-7	Calculate the slope between two given points on the coordinate plane and find the slope of a line given on a coordinate plane.	Use coordinates to find perimeters and areas of triangles and rectangles on the coordinate plane.	Write equations of lines that pass through given points and are parallel or perpendicular to given lines.	Find the point on a directed line segment between two points that partitions the segment in a given ratio.
	Determine the slope of a line when given the equation for that line.	Informally justify that parallel lines have the same slope when graphed in the coordinate plane.	Given a figure defined by four points on the coordinate plane, classify the figure as rectangle, square, rhombus, parallelogram, or trapezoid.	Prove that perpendicular lines on the coordinate plane have slopes that multiply to -1.

Geometry Claim 5	*Student performance indicates the ability to...* Below Proficient	Approaching Proficient	Proficient	Above Proficient
G-GMD.1,3	Use given formulas to find the circumference and area of a circle.	Informally justify the area of a circle using the similarity of all circles and that the area of a circle with radius 1 is pi.	Justify the volume of a cylinder informally using Cavalieri's principle (i.e., a cylinder is a stack of circles).	Use Cavalier's principle to justify the volume of a sphere.
	Use given formulas to find the volume of cylinders, pyramids, and cones.	Justify the circumference of a circle using an informal limit argument by rearranging a circle into many congruent isosceles triangles and comparing the areas.	Informally justify the volume of a square pyramid with height congruent to the base using volume of a cube.	Solve applied geometric modeling of three-dimensional figures using volume formulas.
			Informally justify the volume of a cone using a limit argument (i.e., a cone is a limit of a pyramid with regular polygon base).	

Claim 5	Below Proficient	Approaching Proficient	Proficient	Above Proficient
G-GMD.4	Identify two-dimensional and three-dimensional shapes, and the relationships between them (e.g., a sphere is the 3D analog to a circle).	Given a three-dimensional object, identify the shape of horizontal and vertical two-dimensional cross sections.	Given a three-dimensional object, identify the shape of any two-dimensional cross section. Given a three-dimensional object and a two-dimensional shape, identify the cross section needed to generate the two-dimensional shape.	Given a two-dimensional shape, identify the three-dimensional object generated by rotating the two-dimensional shape. Consider different three-dimensional shapes generated from different rotations of the same two-dimensional shape, and compare them. (e.g., do they have the same volume? Same surface area?)
G-MG.1-3	Use given formulas for area, perimeter, volume, and surface area to calculate requested quantities of a given shape (e.g., find the volume and surface area of a given cylinder).	Given appropriate area and perimeter formulas, decompose two-dimensional object into smaller pieces and use formulas to answer applied questions (e.g., find area and/or perimeter).	Given appropriate volume and surface area formulas, decompose three-dimensional object into smaller pieces and use formulas to answer applied questions (e.g., find volume and/or surface area). Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).	Apply geometric formulas to solve design problems (e.g., minimize surface area of while maintain volume constant to reduce production cost).