Benchmark Results

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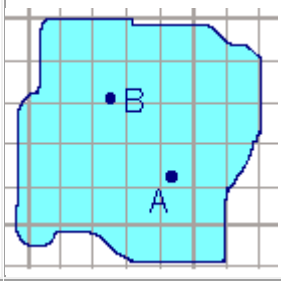
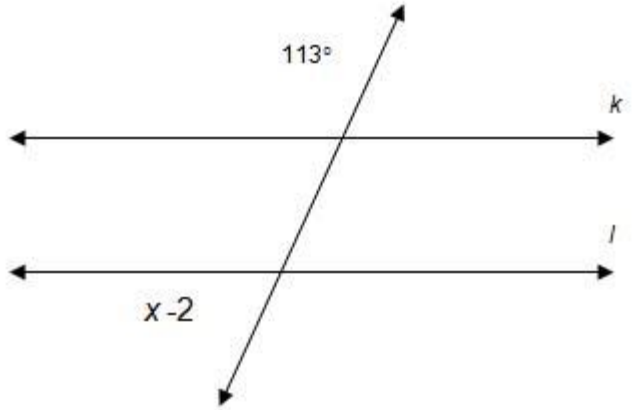
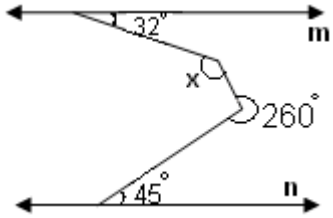
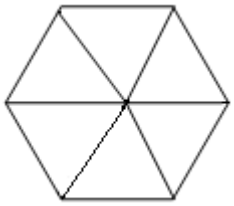
Benchmark#	Description	Remarks/Example	Idea/Standard	Subje
MA.912.G.1.1	Find the lengths and midpoints of line segments in two-dimensional coordinate systems.	Example: Find the length and midpoint of the line segment joining the points A (3, -8) and B (9, 0).	Points, Lines, Angles, and Planes	1
MA.912.G.1.2	Construct congruent segments and angles, angle bisectors, and parallel and perpendicular lines using a straight edge and compass or a drawing program, explaining and justifying the process used.	Example 1: Draw a triangle ABC. Duplicate it using your compass and straightedge. Example 2: Construct the perpendicular bisector of a given line segment, justifying each step of the process. Example 3: The city shown below has two offices (A and B) for the same newspaper. The two offices want to divide the city into two regions so that any location in one region is always closer to their own newspaper office than to the other one. Copy the map and locate the dividing line. Explain why this line meets the given criteria. Select several points in each region and make sure they are closer to their newspaper office than they are to the other one.  	Points, Lines, Angles, and Planes	1
MA.912.G.1.3	Identify and use the relationships between special pairs of angles formed by parallel lines and transversals.	Example: In the diagram, the lines k and l are parallel. Find the value of x. Find all angle values in the diagram. Explain your answer.	Points, Lines, Angles, and Planes	1

		 Example 2: In the diagram, the lines m and n are parallel. Find the value of x. Explain your answer. 		
MA.912.G.1.4	Use coordinate geometry to find slopes, parallel lines, perpendicular lines, and equations of lines.	Example 1: Given points P(2,-1), Q(-4, 2), and M(5,3), find the coordinates of a point N such that $\overleftrightarrow{PQ}$ and $\overleftrightarrow{MN}$ are parallel. Find coordinates of a point K such that $\overleftrightarrow{MK}$ is perpendicular to $\overleftrightarrow{PQ}$.	Points, Lines, Angles, and Planes	1
MA.912.G.2.1	Identify and describe convex, concave, regular, and irregular polygons.	Example 1: Draw a hexagon. Is it convex or concave? Is it regular or irregular? Explain your answers. Example 2: Define the terms convex, concave, regular and irregular polygon and draw a picture of the tern next to the definition.	Polygons	1
MA.912.G.2.2	Determine the measures of interior and exterior angles of polygons, justifying the method used.	Example 1: Calculate the measure of one interior angle and one exterior of a regular octagon. Explain your method. Example 2: Suppose that you will make a picture frame like the one shown below. To make the regular hexagonal frame, you will use identical trapezoidal pieces. What are the measures of the angles of the trapezoids? Explain your answer. 	Polygons	1
MA.912.G.2.3	Use properties of	Example: Suppose a building is in the shape of a regular	Polygons	1

	congruent and similar polygons to solve mathematical or real-world problems.	hexagon. The architect wants to put walkways as indicated. Show that the triangles formed are equal in size and shape. 		
MA.912.G.2.4	Apply transformations (translations, reflections, rotations, dilations, and scale factors) to polygons. to determine congruence, similarity, and symmetry. Know that images formed by translations, reflections, and rotations are congruent to the original shape. Create and verify tessellations of the plane using polygons.	Physical objects, drawings, and dynamic geometry software might help students explore this benchmark. Students' early work in elementary and middle school should form a base for teaching this benchmark (see MA.3.G.3.3, MA.4.G.5.2, and MA.7.G.4.2). Students should explore different types of transformations and observe that some transformations (translations, reflections, and rotations) result in congruent shapes. Example: Explore regular polygons through manipulatives and/or drawing programs. Describe which of the polygons would be best for tiling a rectangular floor. Explain your reasoning.	Polygons	1
MA.912.G.2.5	Explain the derivation and apply formulas for perimeter and area of polygons (triangles, quadrilaterals, pentagons, etc.).	Example 1: A rectangle of area 360 square yards is ten times as long as it is wide. Find its length and width. Example 2: Explain the derivation of the formula for the area of a triangle. Example 3: The design below is called the Ohio Star. Assuming that it measures 9 inches by 9 inches, calculate the total area of all the orange patches, the total area of all the yellow patches, and the total area of all the green patches. How much fabric of each color will you need to cover an area that measures 72 inches by 90 inches? 	Polygons	1
MA.912.G.2.6	Use coordinate geometry to prove properties of congruent, regular and similar	Example: Draw the polygon defined by the following vertices (1, 3), (-1, 3), (3, 1), (-3, 1), (1, -3), (-1, -3), (-3, -1), (3, -1). Is this polygon regular? Justify your answer.	Polygons	1

	polygons, and to perform transformations in the plane.	Example: Is the polygon formed by connecting the points (2, 1), (6, 2), (5, 6), and (1, 5) a square? Justify your answer.		
MA.912.G.2.7	Determine how changes in dimensions affect the perimeter and area of common geometric figures.	Example: If the lengths of each side of a trapezoid are tripled, determine the change in its area, and justify your answer.	Polygons	1
MA.912.G.3.1	Describe, classify, and compare relationships among quadrilaterals including the square, rectangle, rhombus, parallelogram, trapezoid, and kite.	This benchmark examines properties of quadrilaterals one at a time. Example: Explore a trapezoid through manipulatives, drawings and/or technology. Draw the diagonals and determine whether they are perpendicular. Give a convincing argument that your judgment is correct.	Quadrilaterals	1
MA.912.G.3.2	Compare and contrast special quadrilaterals on the basis of their properties.	This benchmark examines similarities and differences between different types of quadrilaterals. Example: Explain the similarities and differences between a rectangle, rhombus, and kite. Create a Venn diagram to match your explanation.	Quadrilaterals	1
MA.912.G.3.3	Use coordinate geometry to prove properties of congruent, regular, and similar quadrilaterals.	Coordinate geometry is used while students prove quadrilaterals to be congruent, similar, or regular. Coordinate geometry is used to prove properties of quadrilaterals. Example: Given a quadrilateral with vertices (0, 0), (5/2, 5sqrt(3)/2), (5, 0), (7, 7sqrt(3)/3), prove that the diagonals of this quadrilateral are perpendicular. Example: Is rectangle *ABCD* with vertices at A(0, 0), B(4, 0), C(4, 2), D(0, 2) congruent to rectangle *PQRS* with vertices at P(-2, -1), Q(2, -1), R(2, 1), S(-2, 1)? Justify your answer.	Quadrilaterals	1
MA.912.G.3.4	Prove theorems involving quadrilaterals.	Example: Prove that the diagonals of a rectangle are congruent.	Quadrilaterals	1
MA.912.G.4.1	Classify, construct, and describe triangles that are	Students may use a compass and straightedge or a drawing program to construct and classify triangles, and describe the attributes of each triangle.	Triangles	1

	right, acute, obtuse, scalene, isosceles, equilateral, and equiangular.			
MA.912.G.4.2	Define, identify, and construct altitudes, medians, angle bisectors, perpendicular bisectors,orthocenter, centroid, incenter, and circumcenter.	Example: Draw several triangles. Construct their angle bisectors. What do you observe from your drawings?	Triangles	1
MA.912.G.4.3	Construct triangles congruent to given triangles.	Example: Given a triangle, construct a congruent triangle and prove that the two triangles are congruent.	Triangles	1
MA.912.G.4.4	Use properties of congruent and similar triangles to solve problems involving lengths and areas.	Example: Of two similar triangles, the second has sides half the length of the first. The area of the first triangle is 20 cm^2. What is the area of the second triangle?	Triangles	1
MA.912.G.4.5	Apply theorems involving segments divided proportionally.	Example: In triangle ABC shown below, $\overline{PQ}$ is parallel to $\overline{BC}$. What is the length of $\overline{AQ}$? 	Triangles	1
MA.912.G.4.6	Prove that triangles are congruent or similar and use the concept of corresponding parts of congruent triangles.	Example: Prove that triangles ABC and APQ are similar. 	Triangles	1
MA.912.G.4.7	Apply the inequality theorems: triangle inequality, inequality in one triangle, and the Hinge Theorem.	Example: Can you draw a triangle with sides of length 7 cm, 4 cm, and 15 cm? Explain your answer.	Triangles	1
MA.912.G.4.8	Use coordinate geometry to prove properties of congruent, regular,	Example: Draw a triangle with vertices at (1, 3), (2, 5), and (6, 1). Draw another triangle with vertices at (-3, -1), (-2, 1), and (2, -3). Are these triangles congruent, similar or neither? Defend your answer.	Triangles	1

	and similar triangles.			
MA.912.G.5.1	Prove and apply the Pythagorean Theorem and its converse.	Example: Determine if the triangle with side lengths of 10, 12, and 18 is a right triangle. Justify your reasoning.	Right Triangles	1
MA.912.G.5.2	State and apply the relationships that exist when the altitude is drawn to the hypotenuse of a right triangle.	Example: Find the value of x in the right triangle below. 	Right Triangles	1
MA.912.G.5.3	Use special right triangles (30° - 60° - 90° and 45° - 45° - 90°) to solve problems.	Example: An isosceles right triangle has one leg 6 cm long. Find the lengths of the other two sides.	Right Triangles	1
MA.912.G.5.4	Solve real-world problems involving right triangles.	Example: The distance of the base of a ladder from the wall it leans against should be at least 1/3 of the ladder's total length. Suppose a 12-ft ladder is placed according to these guidelines. Give the minimum distance of the base of the ladder from the wall. How far up the wall will the ladder reach? Explain and include a sketch in your explanation.	Right Triangles	1
MA.912.G.6.1	Determine the center of a given circle. Given three points not on a line, construct the circle that passes through them. Construct tangents to circles. Circumscribe and inscribe circles about and within triangles and regular polygons.	Example: Given a circle, find its center by drawing the perpendicular bisectors of two chords. Example: Given a circle and a point on the circle, construct a tangent to the circle, passing through the given point. Example: Draw an acute triangle and construct the circumscribed circle.	Circles	1
MA.912.G.6.2	Define and identify: circumference, radius, diameter, arc, arc length, chord, secant, tangent and concentric circles.	Example: What is the angle between a tangent to a circle and the radius at the point where the tangent meets the circle?	Circles	1
MA.912.G.6.3	Prove theorems related to circles,	Example: Prove that a segment from the center of a circle perpendicular to a chord, bisects the chord.	Circles	1

	including related angles, chords, tangents, and secants.			
MA.912.G.6.4	Determine and use measures of arcs and related angles (central, inscribed, and intersections of secants and tangents).	Example: Find the measure of angle ABC in the diagram below. 	Circles	1
MA.912.G.6.5	Solve real-world problems using measures of circumference, arc length, and areas of circles and sectors.	Example: Which will give you more: three 6-inch pizzas or two 8-inch pizzas? Explain your answer.	Circles	1
MA.912.G.6.6	Given the center and the radius, find the equation of a circle in the coordinate plane or given the equation of a circle in center-radius form, state the center and the radius of the circle.	Example: Find the equation of the circle with radius 10 and center (6, -3).	Circles	1
MA.912.G.6.7	Given the equation of a circle in center-radius form or given the center and the radius of a circle, sketch the graph of the circle.	Example: Sketch the graph of the circle whose equation is 	Circles	1
MA.912.G.7.1	Describe and make regular, non-regular, and oblique polyhedra, and sketch the net for a given polyhedron and vice versa.	Example: Make a net for a tetrahedron out of poster board and fold it up to make the tetrahedron. Is this a regular polyhedron? Explain why or why not.	Polyhedra and Other Solids	1
MA.912.G.7.2	Describe the relationships between the faces, edges, and vertices of polyhedra.	Example: Use manipulatives to investigate the relationships between faces, edges, and vertices of polyhedra; i.e., Euler's Theorem.	Polyhedra and Other Solids	1

MA.912.G.7.3	Identify, sketch, find areas and/or perimeters of cross sections of solid objects.	Example: What cross sections can you get from each of these figures?	Polyhedra and Other Solids	1
MA.912.G.7.4	Identify chords, tangents, radii, and great circles of spheres	Example: On Earth, is the equator a great circle? Explain your answer. 	Polyhedra and Other Solids	1
MA.912.G.7.5	Explain and use formulas for lateral area, surface area, and volume of solids.	Example: A gold class ring is dropped into a glass that is a right cylinder with a 6 cm diameter. The water level rises 1 mm. What is the volume of the ring? Example: Given the composite solid consisting of a hemisphere and a cone, calculate the surface area and the volume. 	Polyhedra and Other Solids	1
MA.912.G.7.6	Identify and use properties of congruent and similar solids.	Example: Explain how the surface area and volume of similar cylinders are related	Polyhedra and Other Solids	1
MA.912.G.7.7	Determine how changes in dimensions affect the surface area and volume of common geometric solids.	Example: Explain how changing the radius or height of a cylinder affects its surface area and volume.	Polyhedra and Other Solids	1
MA.912.G.8.1	Analyze the structure of Euclidean geometry as an axiomatic system. Distinguish between undefined terms, definitions, postulates, and theorems.	Example: Classify each of the following as an undefined term, defined term, postulate, or theorem: • Line • Isosceles triangle • Regular hexagon • Pythagorean Therom Students should also explore non-Euclidean geometries including hyperbolic and elliptic geometries.	Mathematical Reasoning and Problem Solving	1
MA.912.G.8.2	Use a variety of problem-solving strategies, such as drawing a diagram, making a chart,	Example: How far does the tip of the minute hand of a clock move in 20 minutes if the tip is 4 inches from the center of the clock?	Mathematical Reasoning and Problem Solving	1

	guess-and-check, solving a simpler problem, writing an equation, and working backwards.			
MA.912.G.8.3	Determine whether a solution is reasonable in the context of the original situation.	Example: The area of a circle is 49p and George determined that the diameter is 7. Is his answer reasonable? Why or why not?	Mathematical Reasoning and Problem Solving	1
MA.912.G.8.4	Make conjectures with justifications about geometric ideas. Distinguish between information that supports a conjecture and the proof of a conjecture.	Example: Calculate the ratios of side lengths in several different-sized triangles with angles of 90°, 50°, and 40°. What do you notice about the ratios? How might you prove that your observation is true (or show that it is false)?	Mathematical Reasoning and Problem Solving	1
MA.912.G.8.5	Write geometric proofs, including proofs by contradiction and proofs involving coordinate geometry. Use and compare a variety of ways to present deductive proofs, such as flow charts, paragraphs, two-column, and indirect proofs.	Example: Prove that the sum of the measures of the interior angles of a triangle is 180°. Example: Prove that the perpendicular bisector of line segment AB is the set of all points equidistant from the endpoints A and B. Example: Prove that two lines are parallel if and only if the alternate interior angles the lines make with a transversal are equal.	Mathematical Reasoning and Problem Solving	1
MA.912.G.8.6	Perform basic constructions using straightedge and compass, and/or drawing programs describing and justifying the procedures used. Distinguish between sketching, constructing, and drawing geometric figures.	Example: Construct a line parallel to a given line through a given point not on the line, explaining and justifying each step.	Mathematical Reasoning and Problem Solving	1