

NYS Geometry Mathematics Learning Standards (Revised 2017)

**Geometry
Congruence (G-CO)**

		Standard Code	Standard	Additional Clarification/Examples
Cluster	A. Experiment with transformations in the plane.	G.CO.A.1	Know precise definitions of angle, circle, perpendicular lines, parallel lines, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc as these exist within a plane.	
		G.CO.A.2	Represent transformations as geometric functions that take points in the plane as inputs and give points as outputs. Compare transformations that preserve distance and angle measure to those that do not.	<u>Note</u> : Instructional strategies may include drawing tools, graph paper, transparencies and software programs.
		G.CO.A.3	Given a regular or irregular polygon, describe the rotations and reflections (symmetries) that map the polygon onto itself.	<u>Note</u> : The inclusive definition of a trapezoid will be utilized which states a trapezoid being defined as “A quadrilateral with at least one pair of parallel sides.”
		G.CO.A.4	Develop definitions of rotations, reflections, and translations in terms of points, angles, circles, perpendicular lines, parallel lines, and line segments.	<u>Notes</u> : Includes point reflections. A translation displaces every point in the plane by the same distance (in the same direction) and can be described using a vector in addition to T_x, y . The definition of a rotation requires knowing the center (point) and the measure/direction of the angle of rotation. The definition of a reflection requires a line and the knowledge of perpendicular bisectors.
		G.CO.A.5	Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure. Specify a sequence of transformations that will carry a given figure onto another.	<u>Notes</u> : Instructional strategies may include graph paper, tracing paper, and geometry software. A point reflection or glide reflection could be used here. Students can investigate compositions of transformations and the single transformation that is equivalent.

NYS Geometry Mathematics Learning Standards (Revised 2017)

**Geometry
Congruence (G-CO)**

		Standard Code	Standard	Additional Clarification/Examples
Cluster	B. Understand congruence in terms of rigid motions.	G.CO.B.6	Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure. Given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.	<p><u>Notes:</u> Description needs to be reproducible.</p> <p>A translation displaces every point in the plane by the same distance (in the same direction) and can be described using a vector in addition to T_x, y.</p> <p>The definition of a rotation requires knowing the center (point) and the measure/direction of the angle of rotation.</p> <p>The definition of a reflection requires a line and the knowledge of perpendicular bisectors.</p>
		G.CO.B.7	Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.	
		G.CO.B.8	Explain how the criteria for triangle congruence (ASA, SAS, SSS, AAS and HL (Hypotenuse Leg)) follow from the definition of congruence in terms of rigid motions.	

NYS Geometry Mathematics Learning Standards (Revised 2017)

Geometry
Congruence (G-CO)

		Standard Code	Standard	Additional Clarification/Examples
Cluster	C. Prove geometric theorems.	G.CO.C.9	Prove and apply theorems about lines and angles.	<p><u>Note</u>: Include multi-step proofs and algebraic problems built upon these concepts.</p> <p>Examples of theorems include but are not limited to:</p> <ul style="list-style-type: none"> • Vertical angles are congruent • If two parallel lines are cut by a transversal, then the alternate interior angles are congruent. • The points on a perpendicular bisector are equidistant from the endpoints of the line segment.
		G.CO.C.10	Prove and apply theorems about the properties triangles.	<p><u>Note</u>: Include multi-step proofs and algebraic problems built upon these concepts.</p> <p>Examples of theorems include but are not limited to:</p> <p>Angle Relationships:</p> <ul style="list-style-type: none"> • The sum of the interior angles of a triangle is 180 degrees. • The measure of an exterior angle of a triangle is equal to the sum of the two non-adjacent interior angles of the triangle. <p>Side Relationships:</p> <ul style="list-style-type: none"> • The length of one side of a triangle is less than the sum of the lengths of the other two sides. • In a triangle, the segment joining the midpoints of any two sides will be parallel to the third side and half its length. <p>Isosceles Triangles</p> <ul style="list-style-type: none"> • Base angles of an isosceles triangle are congruent.

NYS Geometry Mathematics Learning Standards (Revised 2017)

Geometry
Congruence (G-CO)

		Standard Code	Standard	Additional Clarification/Examples
Cluster	C. Prove geometric theorems.	G.CO.C.11	Prove and apply theorems about parallelograms.	<p><u>Notes:</u> Include multi-step proofs and algebraic problems built upon these concepts. Based on the inclusive definition of a trapezoid (specifically a quadrilateral with at least one pair of parallel sides), a parallelogram is a trapezoid.</p> <p>Examples theorems include but are not limited to:</p> <ul style="list-style-type: none"> • A diagonal divides a parallelogram into two congruent triangles. • Opposite sides of a parallelogram are congruent. • The diagonals of parallelogram bisect each other. • If the diagonals of quadrilateral bisect each other, then quadrilateral is a parallelogram. • If the diagonals of a parallelogram are congruent then the parallelogram is a rectangle. <p>Additional theorems covered allow for proving a given quadrilateral a particular parallelogram (rhombus, rectangle, square) based on given properties.</p>

NYS Geometry Mathematics Learning Standards (Revised 2017)

Geometry
Congruence (G-CO)

		Standard Code	Standard	Additional Clarification/Examples
Cluster	D. Make geometric constructions.	G.CO.D.12	Make, justify and apply formal geometric constructions.	<p><u>Notes:</u> Examples of constructions include but are not limited to:</p> <ul style="list-style-type: none"> • Copy segments and angles. • Bisect segments and angles. • Construct perpendicular lines including through a point on or off a given line. • Construct a line parallel to a given line through a point not on the line. • Construct a triangle with given lengths. • Construct points of concurrency of a triangle (centroid, circumcenter, incenter, and orthocenter). • Constructions of transformations, (see G.CO.A.5) <p>This standard is a fluency recommendation for Geometry. Fluency with the use of construction tools, physical and computational, helps students draft a model of a geometric phenomenon and can lead to conjectures and proofs. See definition for fluency in the Glossary of Verbs Associated with the New York State Math Standards</p>
		G.CO.D.13	Make and justify the constructions for inscribing an equilateral triangle, a square and a regular hexagon in a circle.	

NYS Geometry Mathematics Learning Standards (Revised 2017)

Geometry

Similarity, Right Triangles and Trigonometry (G-SRT)

		Standard Code	Standard	Additional Clarification/Examples
Cluster	A. Understand similarity in terms of similarity transformations.	G.SRT.A.1	Verify experimentally the properties of dilations given by a center and a scale factor.	
		G.SRT. A.1a	Verify experimentally that dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged.	
		G.SRT. A.1b	Verify experimentally that the dilation of a line segment is longer or shorter in the ratio given by the scale factor.	
		G.SRT. A.2	Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar. Explain using similarity transformations that similar triangles have equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.	<p><u>Note</u>: Description needs to be reproducible.</p> <p>The center and scale factor of the dilation must always be specified with dilation.</p> <p>A translation displaces every point in the plane by the same distance (in the same direction) and can be described using a vector in addition to $T_{x,y}$.</p> <p>The definition of a rotation requires knowing the center (point) and the measure/direction of the angle of rotation.</p> <p>The definition of a reflection requires a line and the knowledge of perpendicular bisectors.</p>
		G.SRT. A.3	Use the properties of similarity transformations to establish the AA~, SSS~, and SAS~ criterion for two triangles to be similar.	

NYS Geometry Mathematics Learning Standards (Revised 2017)

Geometry

Similarity, Right Triangles and Trigonometry (G-SRT)

		Standard Code	Standard	Additional Clarification/Examples
Cluster	B. Prove theorems involving similarity.	G.SRT. B.4	Prove and apply similarity theorems about triangles.	<p><u>Notes:</u> Include multi-step proofs and algebraic problems built upon these concepts.</p> <p>Examples theorems include but are not limited to:</p> <ul style="list-style-type: none"> • If a line parallel to one side of a triangle intersects the other two sides of the triangle, then the line divides these two sides proportionally (and conversely) . • The length of the altitude drawn from the vertex of the right angle of a right triangle to its hypotenuse is the geometric mean between the lengths of the two segments of the hypotenuse. • The centroid of the triangle divides each median in the ratio 2:1.
		G.SRT. B.5	Use congruence and similarity criteria for triangles to: <ol style="list-style-type: none"> Solve problems algebraically and geometrically. Prove relationships in geometric figures. 	<p><u>Notes:</u> ASA, SAS, SSS, AAS, and Hypotenuse-Leg (HL) theorems are valid criteria for triangle congruence. AA~, SAS~, and SSS~ are valid criteria for triangle similarity.</p> <p>This standard is a fluency recommendation for Geometry. Fluency with the triangle congruence and similarity criteria will help students throughout their investigations of triangles, quadrilaterals, circles, parallelism, and trigonometric ratios. These criteria are necessary tools in many geometric modeling tasks. See definition for fluency in the Glossary of Verbs Associated with the New York State Math Standards.</p>

NYS Geometry Mathematics Learning Standards (Revised 2017)

Geometry

Similarity, Right Triangles and Trigonometry (G-SRT)

		Standard Code	Standard	Additional Clarification/Examples
Cluster	C. Define trigonometric ratios and solve problems involving right triangles.	G.SRT. C.6	Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of sine, cosine and tangent ratios for acute angles.	
		G.SRT. C.7	Explain and use the relationship between the sine and cosine of complementary angles.	
		G.SRT. C.8	Use sine, cosine, tangent, the Pythagorean Theorem and properties of special right triangles to solve right triangles in applied problems. ★	<u>Note:</u> Special right triangles refer to the 30-60-90 and 45-45-90 triangles.

NYS Geometry Mathematics Learning Standards (Revised 2017)

Geometry

Similarity, Right Triangles and Trigonometry (G-SRT)

		Standard Code	Standard	Additional Clarification/Examples
Cluster				
	D. Apply Trigonometry to general triangles.	G.SRT. D.9	Justify and apply the formula $A = \frac{1}{2}ab \sin(C)$ to find the area of any triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side.	

NYS Geometry Mathematics Learning Standards (Revised 2017)

**Geometry
Circles (G-C)**

		Standard Code	Standard	Additional Clarification/Examples
Cluster	A. Understand and apply theorems about circles.	G.C.A.1	Prove that all circles are similar.	
		G.C.A.2a	Identify, describe and apply relationships between the angles and their intercepted arcs of a circle.	<p><u>Note:</u> These relationships that pertain to the circle may be utilized to prove other relationships in geometric figures, e.g., the opposite angles in any quadrilateral inscribed in a circle are supplements of each other.</p> <p>Also includes algebraic problems built upon these concepts.</p>
		G.C.A.2b	Identify, describe and apply relationships among radii, chords, tangents, and secants of a circle.	

NYS Geometry Mathematics Learning Standards (Revised 2017)

Geometry

Expressing Geometric Properties with Equations (G-GPE)

	Standard Code	Standard	Additional Clarification/Examples
Cluster A. Translate between the geometric description and the equation of a conic section.	G.GPE. A.1	1a. Derive the equation of a circle of given center and radius using the Pythagorean Theorem. Find the center and radius of a circle, given the equation of the circle.	<u>Note</u> for 1a. Finding the center and radius could involve completing the square. The completing the square expectation for Geometry follows Algebra I: leading coefficients will be 1 (after possible removal of GCF) and the coefficients of the linear terms will be even.
		1b. Graph circles given their equation.	<u>Note</u> for 1b. For circles being graphed, the center will be an ordered pair of integers and the radius an integer. Students need to be able to graph circles in Algebra II with respect to standard A-REI.C.7, solving quadratic and linear systems algebraically and graphically.

NYS Geometry Mathematics Learning Standards (Revised 2017)

Geometry

Expressing Geometric Properties with Equations (G-GPE)

		Standard Code	Standard	Additional Clarification/Examples
Cluster	B. Use coordinates to prove simple geometric theorems algebraically.	G.GPE. B.4	On the coordinate plane, algebraically prove geometric theorems and properties.	<p><u>Notes:</u></p> <p>Examples include but not limited to:</p> <p>Given points and/or characteristics, prove or disprove a polygon is a specified quadrilateral or triangle based on its properties.</p> <p>Given a point that lies on a circle with a given center, prove or disprove that a specified point lies on the same circle.</p> <p>This standard is a fluency recommendation for Geometry. Fluency with the use of coordinates to establish geometric results, calculate length and angle, and use geometric representations as a modeling tool are some of the most valuable tools in mathematics and related fields. See definition for fluency in the Glossary of Verbs Associated with the New York State Math Standards.</p>
		G.GPE. B.5	On the coordinate plane: a) Explore the proof for the relationship between slopes of parallel and perpendicular lines; b) Determine if lines are parallel, perpendicular, or neither, based on their slopes; and c) Apply properties of parallel and perpendicular lines to solve geometric problems.	<p><u>Note:</u> This standard is a fluency recommendation for Geometry. Fluency with the use of coordinates to establish geometric results, calculate length and angle, and use geometric representations as a modeling tool are some of the most valuable tools in mathematics and related fields. See definition for fluency in the Glossary of Verbs Associated with the New York State Math Standards.</p>
		G.GPE. B.6	Find the point on a directed line segment between two given points that partitions the segment in a given ratio.	<p><u>Note:</u> Midpoint formula is a derivative of this standard.</p>

		G.GPE. B.7	Use coordinates to compute perimeters of polygons and areas of triangles and rectangles. ★	<p><u>Note</u>: This standard is a fluency recommendation for Geometry. Fluency with the use of coordinates to establish geometric results, calculate length and angle, and use geometric representations as a modeling tool are some of the most valuable tools in mathematics and related fields. See definition for fluency in the Glossary of Verbs Associated with the New York State Math Standards.</p>
--	--	-------------------	---	--

NYS Geometry Mathematics Learning Standards (Revised 2017)

Geometry

Geometric Measurement and Dimension (G-GMD)

		Standard Code	Standard	Additional Clarification/Examples
Cluster	A. Explain volume formulas and use them to solve problems.	G.GMD. A.1	Provide informal arguments for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone.	
		G.GMD. A.3	Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems. ★	

NYS Geometry Mathematics Learning Standards (Revised 2017)

Geometry

Geometric Measurement and Dimension (G-GMD)

		Standard Code	Standard	Additional Clarification/Examples
Cluster	B. Visualize relationships between two-dimensional and three-dimensional objects.	G.GMD. B.4	Identify the shapes of plane sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.	<u>Note</u> : Plane sections are not limited to being parallel or perpendicular to the base.

NYS Geometry Mathematics Learning Standards (Revised 2017)

Geometry
Modeling with Geometry (G-MG) ★

		Standard Code	Standard	Additional Clarification/Examples
Cluster	A. Apply geometric concepts in modeling situations.	G.MG.A.1	Use geometric shapes, their measures, and their properties to describe objects.	
		G.MG.A.2	Apply concepts of density based on area and volume of geometric figures in modeling situations.	
		G.MG.A.3	Apply geometric methods to solve design problems.	<u>Note:</u> Applications could include designing an object or structure to satisfy constraints such as area, volume, mass and cost.

