New York State Next Generation Mathematics Learning Standards		
Geometry Crosswalk		
Geometry **Congruence (G.CO)**		
Cluster	**NYS P-12 CCLS**	**NYS Next Generation Learning Standard**
Experiment with transformations in the plane.	**G-CO.1** Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.	**GEO-G.CO.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.2 Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not ~~(e.g., translation versus horizontal stretch)~~.	**GEO-G.CO.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. Note: Instructional strategies may include drawing tools, graph paper, transparencies and software programs.
	G-CO.3 Given a ~~rectangle, parallelogram, trapezoid, or~~ regular polygon, describe the rotations and reflections that carry it onto itself. Note: Trapezoid is defined as "a quadrilateral with at least one pair of parallel sides."	**GEO-G.CO.3** Given a **regular or irregular polygon**, describe the rotations and reflections **(symmetries)** that **map the polygon** onto itself**.** Note: The inclusive definition of a trapezoid will be utilized, which defines a trapezoid as "A quadrilateral with at least one pair of parallel sides."

New York State Next Generation Mathematics Learning Standards		
Geometry Crosswalk		
Geometry **Congruence (G.CO)**		
Cluster	**NYS P-12 CCLS**	**NYS Next Generation Learning Standard**
Experiment with transformations in the plane.	**G-CO.4** Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.	**GEO-G.CO.4** Develop definitions of rotations, reflections, and translations in terms of **points**, angles, circles, perpendicular lines, parallel lines, and line segments. **Notes: 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.** **A rotation requires knowing the center (point) and the measure/direction of the angle of rotation.** **A line reflection requires a line and the knowledge of perpendicular bisectors**.
	G-CO.5 Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.	**GEO-G.CO.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. Notes: Instructional strategies may include graph paper, tracing paper, and geometry software. **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.** **A rotation requires knowing the center (point) and the measure/direction of the angle of rotation.** **A line reflection requires a line and the knowledge of perpendicular bisectors.** **Singular transformations that are equivalent to a sequence of transformations may be utilized, such as a glide reflection. However, glide reflections are not an expectation of the course.**

New York State Next Generation Mathematics Learning Standards		
Geometry Crosswalk		
Geometry **Congruence (G.CO)**		
Cluster	**NYS P-12 CCLS**	**NYS Next Generation Learning Standard**
Understand congruence in terms of rigid motions.	**G-CO.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.	**GEO-G.CO.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. **Notes:** **A translation displaces every point in the plane by the same distance (in the same direction) and can be described using a vector.** **A rotation requires knowing the center (point) and the measure/direction of the angle of rotation.** **A line reflection requires a line and the knowledge of perpendicular bisectors.**
	G-CO.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.	**GEO-G.CO.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.8 Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.	**GEO-G.CO.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.

New York State Next Generation Mathematics Learning Standards		
Geometry Crosswalk		
Geometry **Congruence (G.CO)**		
Cluster	**NYS P-12 CCLS**	**Next Generation Learning Standard (2017)**
Prove geometric theorems.	**G-CO.9** Prove theorems about lines and angles. *Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.* Note: Theorems include but are not limited to the listed theorems. Example: theorems that involve complementary or supplementary angles.	**GEO-G.CO.9** Prove and **apply** theorems about lines and angles. **Note: Include multi-step proofs and algebraic problems built upon these concepts.** **Examples** of theorems **include but are not limited to**: • 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.10 Prove theorems about triangles. *Theorems include: measures of interior angles of a triangle sum to 180°; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.* Note: Theorems include but are not limited to the listed theorems. Example: an exterior angle of a triangle is equal to the sum of the two non-adjacent interior angles of the triangle.	**GEO-G.CO.10** Prove and **apply** theorems about triangles. **Note: Include multi-step proofs and algebraic problems built upon these concepts.** **Examples** of theorems **include but are not limited to**: Angle Relationships: • 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. Side Relationships: • 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. Isosceles Triangles • Base angles of an isosceles triangle are congruent.

New York State Next Generation Mathematics Learning Standards		
Geometry Crosswalk		
Geometry **Congruence (G.CO)**		
Cluster	**NYS P-12 CCLS**	**Next Generation Learning Standard (2017)**
Prove geometric theorems.	**G-CO.11** Prove theorems about parallelograms. *Theorems include: opposite sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals.* Note: Theorems include but are not limited to the listed theorems. Example: rhombus is a parallelogram with perpendicular diagonals.	**GEO-G.CO.11** Prove and **apply** theorems about parallelograms. **Notes: Include multi-step proofs and algebraic problems built upon these concepts.** **The inclusive definition of a trapezoid will be utilized, which defines a trapezoid as "A quadrilateral with at least one pair of parallel sides."** **Examples** of theorems **include but are not limited to**: • A diagonal divides a parallelogram into two congruent triangles. • Opposite sides/angles 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. **Additional theorems covered allow for proving that a given quadrilateral is a particular parallelogram (rhombus, rectangle, square) based on given properties.**

New York State Next Generation Mathematics Learning Standards		
Geometry Crosswalk		
Geometry **Congruence (G.CO)**		
Cluster	**NYS P-12 CCLS**	**NYS Next Generation Learning Standard**
Make geometric constructions.	**G-CO.12** Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). *Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.* Note: Constructions include but are not limited to the listed constructions. Example: constructing the median of a triangle or constructing an isosceles triangle with given lengths.	**GEO-G.CO.12** Make, **justify and apply formal** geometric constructions. Notes: **Examples** of constructions **include but are not limited to**: • 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).** • **Construct the inscribed circle of a triangle.** • **Construct the circumscribed circle of a triangle.** • **Constructions of transformations. (see GEO-G.CO.5)** **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.**
	G-CO.13 Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.	**GEO-G.CO.13** Make and **justify** the constructions for inscribing an equilateral triangle, a square and a regular hexagon in a circle.

New York State Next Generation Mathematics Learning Standards		
Geometry Crosswalk		
Geometry **Similarity, Right Triangles and Trigonometry (G.SRT)**		
Cluster	**NYS P-12 CCLS**	**NYS Next Generation Learning Standard**
Understand similarity in terms of similarity transformations.	**G-SRT.1** Verify experimentally the properties of dilations given by a center and a scale factor:	**GEO-G.SRT.1** Verify experimentally the properties of dilations given by a center and a scale factor.
	G-SRT.1a A 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.	**GEO-G.SRT.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.1b The dilation of a line segment is longer or shorter in the ratio given by the scale factor.	**GEO-G.SRT.1b Verify experimentally** that the dilation of a line segment is longer or shorter in the ratio given by the scale factor.
	G-SRT.2 Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.	**GEO-G.SRT.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. **Notes:** **The center and scale factor of the dilation must always be specified with dilation.** **A translation displaces every point in the plane by the same distance (in the same direction) and can be described using a vector.** **A rotation requires knowing the center (point) and the measure/direction of the angle of rotation.** **A line reflection requires a line and the knowledge of perpendicular bisectors.**
	G-SRT.3 Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.	**GEO-G.SRT.3** Use the properties of similarity transformations to establish the AA~, **SSS~, and SAS**~ criterion for two triangles to be similar.

New York State Next Generation Mathematics Learning Standards		
Geometry Crosswalk		
Geometry **Similarity, Right Triangles and Trigonometry (G.SRT)**		
Cluster	**NYS P-12 CCLS**	**NYS Next Generation Learning Standard**
Prove theorems involving similarity.	**G-SRT.4** Prove theorems about triangles. *Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity.* Note: Theorems include but are not limited to the listed theorems. Example: 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.	**GEO-G.SRT.4** Prove and **apply similarity theorems** about triangles. **Notes: Include multi-step proofs and algebraic problems built upon these concepts.** **Examples** of theorems **include but are not limited to**: • 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.5 Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures. Note: 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.	**GEO-G.SRT.5** Use congruence and similarity criteria for triangles to: **GEO-G.SRT.5a** Solve problems **algebraically and geometrically**. **GEO-G.SRT.5b** Prove relationships in geometric figures. Notes: 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. **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.**

New York State Next Generation Mathematics Learning Standards		
Geometry Crosswalk		
Geometry **Similarity, Right Triangles and Trigonometry (G.SRT)**		
Cluster	**NYS P-12 CCLS**	**NYS Next Generation Learning Standard**
Define trigonometric ratios and solve problems involving right triangles.	**G-SRT.6** Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of ~~trigonometric~~ ratios for acute angles.	**GEO-G.SRT.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.7 Explain and use the relationship between the sine and cosine of complementary angles	**GEO-G.SRT.7** Explain and use the relationship between the sine and cosine of complementary angles.
	G-SRT.8 Use ~~trigonometric ratios~~ and the Pythagorean Theorem to solve right triangles in applied problems. ★	**GEO-G.SRT.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.**
Apply trigonometry to general triangles.		**GEO-G.SRT.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.**

New York State Next Generation Mathematics Learning Standards		
Geometry Crosswalk		
Geometry Circles (G.C)		
Cluster	**NYS P-12 CCLS**	**NYS Next Generation Learning Standard**
Understand and apply theorems about circles.	**G-C.1** Prove that all circles are similar.	**GEO-G.C.1** Prove that all circles are similar.
	G-C.2 Identify and describe relationships among inscribed angles, radii, and chords. *Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.* Note: Relationships include but are not limited to the listed relationships. Example: angles involving tangents and secants.	**GEO-G.C.2a** Identify, describe **and apply relationships between the angles and their intercepted arcs** of a circle. **GEO-G.C.2b**. Identify, describe and **apply relationships among radii, chords, tangents, and secants** of a circle. **Note: 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.** **Also includes algebraic problems built upon these concepts.**
	G-C.3 Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.	**STANDARD REMOVED** **Constructing the incenter and circumcenter of a circle has been embedded in standard GEO-G.CO.12. The properties of the angles for a quadrilateral inscribed in a circle is now embedded in standard GEO-G.C.2a.**
Find arc lengths and area of sectors of circles.	**G-C.5** ~~Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality;~~ derive the formula for the area of a sector.	**GEO-G.C.5 Using proportionality, find one of the following given two others; the central angle, arc length, radius or area of sector.** **Note: Angle measure is in degrees.**

New York State Next Generation Mathematics Learning Standards		
Geometry Crosswalk		
Geometry **Expressing Geometric Properties with Equations (G.GPE)**		
Cluster	**NYS P-12 CCLS**	**NYS Next Generation Learning Standard**
Translate between the geometric description and the equation of a conic section.	**G-GPE.1** Derive the equation of a circle of given center and radius using the Pythagorean Theorem; ~~complete the square to~~ find the center and radius of a circle given by an equation.	**GEO-G.GPE.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. **Notes:** • **Finding the center and radius may 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.** • **Completing the square may yield a fractional radius.** **GEO-G.GPE.1b Graph circles given their equation.** **Note: For circles being graphed, the center will be an ordered pair of integers and the radius a positive integer**.

New York State Next Generation Mathematics Learning Standards		
Geometry Crosswalk		
Geometry **Expressing Geometric Properties with Equations (G.GPE)**		
Cluster	**NYS P-12 CCLS**	**NYS Next Generation Learning Standard**
Use coordinates to prove simple geometric theorems algebraically.	**G-GPE.4** Use coordinates to prove simple geometric theorems algebraically. *For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point (1, √3) lies on the circle centered at the origin and containing the point (0, 2).*	**GEO-G.GPE.4** On the coordinate plane, algebraically prove geometric theorems **and properties**. Notes: **Examples include but not limited to**: • Given points and/or characteristics, prove or disprove a polygon is a specified quadrilateral or triangle based on its properties. • Given a point that lies on a circle with a given center, prove or disprove that a specified point lies on the same circle. **This standard is a fluency recommendation for Geometry. Fluency with the use of coordinates to establish geometric results and the use of geometric representations as a modeling tool are some of the most valuable tools in mathematics and related fields.**
	G-GPE.5 ~~Prove~~ the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point).	**GEO-G.GPE.5** On the coordinate plane: **GEO-G.GPE.5a Explore the proof** for the relationship between slopes of parallel and perpendicular lines; **GEO-G.GPE.5b Determine if lines are parallel, perpendicular, or neither, based on their slopes**; and **GEO-G.GPE.5c** Apply properties of parallel and perpendicular lines to solve geometric problems. **Note: This standard is a fluency recommendation for Geometry. Fluency with the use of coordinates to establish geometric results and the use of geometric representations as a modeling tool are some of the most valuable tools in mathematics and related fields.**

New York State Next Generation Mathematics Learning Standards		
Geometry Crosswalk		
Geometry **Expressing Geometric Properties with Equations (G.GPE)**		
Cluster	**NYS P-12 CCLS**	**NYS Next Generation Learning Standard**
Use coordinates to prove simple geometric theorems algebraically.	**G-GPE.6** Find the point on a directed line segment between two given points that partitions the segment in a given ratio.	**GEO-G.GPE.6** Find the point on a directed line segment between two given points that partitions the segment in a given ratio. **Note: Midpoint formula is a derivative of this standard.**
	G-GPE.7 Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula. ★	**GEO-G.GPE.7** Use coordinates to compute perimeters of polygons and areas of triangles and rectangles. ★ **Note: This standard is a fluency recommendation for Geometry. Fluency with the use of coordinates to establish geometric results and the use of geometric representations as a modeling tool are some of the most valuable tools in mathematics and related fields.**

New York State Next Generation Mathematics Learning Standards		
Geometry Crosswalk		
Geometry **Geometric Measurement and Dimension (G.GMD)**		
Cluster	**NYS P-12 CCLS**	**NYS Next Generation Learning Standard**
Explain volume formulas and use them to solve problems.	**G-GMD.1** ~~Give~~ an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. ~~*Use dissection arguments, Cavalieri's principle, and informal limit arguments.*~~	**GEO-G.GMD.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.3 Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems. ★	**GEO-G.GMD.3** Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems. ★
Visualize relationships between two-dimensional and three-dimensional objects.	**G-GMD.4** Identify the shapes of ~~two-dimensional cross-sections~~ of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.	**GEO-G.GMD.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.**

New York State Next Generation Mathematics Learning Standards		
Geometry Crosswalk		
Geometry **Modeling with Geometry (G.MG) ⋆**		
Cluster	**NYS P-12 CCLS**	**NYS Next Generation Learning Standard**
Apply geometric concepts in modeling situations.	**G-MG.1** Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder). ★	**GEO-G.MG.1** Use geometric shapes, their measures, and their properties to describe objects. ★
	G-MG.2 Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). ★	**GEO-G.MG.2** Apply concepts of density based on area and volume of geometric figures in modeling situations. ★
	G-MG.3 Apply geometric methods to solve design problems ~~(e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios)~~. ★	**GEO-G.MG.3** Apply geometric methods to solve design problems. ★ **Note: Applications may include designing an object or structure to satisfy constraints such as area, volume, mass and cost.**