HOWELL TOWNSHIP
PUBLIC SCHOOLS

MATHEMATICS CURRICULUM FRAMEWORK

GEOMETRY

BOARD APPROVED: August 23, 2017

Geometry Curricular Framework

Overview	NJSLS Standards	Unit Focus	Standards for Mathematical Practices
Unit 1			1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with Mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.
Congruence and Constructions	G.CO.A.1 G.CO.B.6 G.CO.B.7 G.CO.B.8 G.CO.D.12 G.CO.D.13 G.CO.A.2 G.CO.A.3 G.CO.A.4 G.CO.A.5	• Experiment with transformations in the plane • Understand congruence in terms of rigid motions • Make geometric constructions	
Unit 2			
Congruence, Similarity & Proof	G.SRT.A.1 G.SRT.A.2 G.SRT.A.3 G.CO.C.9 G.CO.C.10 G.CO.C.11 G.SRT.B.4 G.SRT.B.5	• Understand similarity in terms of similarity transformations • Prove geometric theorems. • Prove theorems involving similarity	
Unit 3			
Trigonometric Ratios & Geometric Equations	G.GPE.B.4 G.GPE.B.5 G.GPE.B.6	• Use coordinates to prove simple geometric theorems	

	G.GPE.B.7 G.SRT.C.6 G.SRT.C.7 G.C.A.2 G.C.A.3 G.C.B.5 G.SRT.C.8 G.GPE.A.1 G.C.A.1	• Define trigonometric ratios and solve problems involving right triangles • Translate between the geometric description and the equation for a conic section • Understand and apply theorems about circles • Find arc lengths and areas of sectors of circles	
Unit 4			
Geometric Modeling	G.MG.A.1 G.GMD.A.3 G.GMD.B.4 G.MG.A.2 G.MG.A.3 G.GMD.A.1	• Explain volume formulas and use them to solve problems. • Visualize relationships between two dimensional and three-dimensional objects • Apply geometric concepts in modeling situations	

Unit 1: **Congruence and Constructions**
Learning Goal: Learning Goal 1: Use the undefined notion of a point, line, distance along a line and distance around a circular arc to develop definitions for angles, circles, parallel lines, perpendicular lines and line segments. Learning Goal 2: Represent transformations in the plane using transparencies, describe and explain transformations as functions, and compare rigid transformations to dilations, horizontal stretches and vertical stretches. Learning Goal 3: Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself. Learning Goal 4: Develop formal definitions of rotations, reflections, and translations. Learning Goal 5: Draw transformed figures using graph paper, tracing paper, and/or geometry software and identify a sequence of transformations required in order to map one figure onto another.

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Learning Goal 6: Use rigid transformations to determine and explain congruence of geometric figures.
Learning Goal 7: Show and explain that two triangles are congruent by using corresponding pairs of sides and corresponding pairs of angles, and by using rigid motions (transformations).
Learning Goal 8: Show and explain how the criteria for triangle congruence extend from the definition of congruence in terms of rigid motion.
Learning Goal 9: Make formal constructions using a variety of tools (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.) and methods.

Learning Target:

- Measure and construct angles
- Use properties of parallel line and perpendicular lines
- write equations of parallel and perpendicular lines
- Translate, reflect and rotate a figure
- Perform congruence transformations
- Dilate a figure
- Perform similarity transformations
- Classify triangles and angles
- Use SAS, SSS, ASA and AAS Congruence Theorems
- Use congruent triangles and prove constructions

Prerequisite Skills:

- Write equations in one variable and use them to solve problems.
- Solve multi-step linear equations using inverse operations.
- Solve systems of linear equations.
- Find the slope of a line and write equations in slope intercept form.
- Graph linear equations.
- Identify and write equations of parallel and perpendicular lines.
- Use parallel and perpendicular lines in real-life problems.
- Translate, reflect, stretch, and shrink graphs of functions.
- Combine transformations of graphs of functions.
- Use slope to solve real-life problems.
- Solve linear equations that have variables on both sides.
- Graph points and lines in the coordinate plane.

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● Use properties of radicals to simplify expressions.			
Content Standards	Mathematical Practices	Enduring Understandings	Essential Questions
Math : G.CO.A.1 G.CO.B.6 G.CO.B.7 G.CO.B.8 G.CO.D.12 G.CO.D.13 G.CO.A.2 G.CO.A.3 G.CO.A.4 G.CO.A.5 Technology Standards:8.1.8.A.1, 8.1.8.A.4 Career Readiness Practices:CRP2., CRP4., CRP7., CRP8.	MP.1 MP.2 MP.3 MP.4 MP.5 MP.6 MP.7	Students are able to: · use point, line, distance along a line and/or distance around a circular arc to give a precise definition of - angle; - circle (the set of points that are the same distance from a single point - the center); - perpendicular line (two lines are perpendicular if an angle formed by the two lines at the point of intersection is a right angle); - parallel lines (distinct lines that have no point in common); - and line segment. · represent transformations with transparencies and geometry software. · describe transformations as functions (points defining the pre-image as the input and the points defining the image as the output). · describe a transformation F of the plane as a rule that assigns to each point P in the plane a point F(P) of the plane. compare rotations, reflections, and translations to a horizontal stretch, vertical stretch and to dilations, distinguishing preserved distances and angles from those that are not preserved.	● How can you measure and construct a line segment ● How can you find the midpoint and length of a line segment in a coordinate plane ● What does it mean when two lines are parallel, intersecting, coincident or skew ● What conjectures can you make about parallel and perpendicular lines ● How can you translate a figure in a coordinate plane. ● How can you reflect a figure in a coordinate plane ● What does it mean to dilate a figure ● What can you conclude about two triangles when you know that two pairs of corresponding sides and corresponding included angles are congruent ● What can you conclude about two triangles when you know the corresponding sides are congruent ● How are the angle measures of a triangle related

		· develop formal mathematical definitions of a rotation, reflection, and translation. · draw the transformed figure using, graph paper, tracing paper, and/or geometry software given a geometric figure and a rotation, reflection, or translation. · identify the sequence of transformations required to carry one figure onto another. · given that two triangles are congruent based on rigid motion, show that corresponding pairs of sides and angles are congruent. · given that corresponding pairs of sides and angles of two triangles are congruent, show, using rigid motion (transformations) that they are congruent. · show and explain the criteria for Side-Side-Side triangle congruence. · explain the relation of the criteria for triangle congruence to congruence in terms of rigid motion.	● Given two congruent triangles, how can you use rigid motions to map one triangle to the other triangle. ● What conjectures can you make about the side lengths and angle measures of an isosceles triangle ● What information is sufficient to determine whether two triangles are congruent ● How can you use reasoning to solve problems ● In a diagram, what can be assumed and what needs to be labeled ● How can algebraic properties help you solve an equations ● How can you prove a mathematical statement ● What does it mean when two lines are parallel, intersecting, coincident or skew
Assessments: STAR Math – Fall Chapter Assessments Trimester Assessments			

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Unit 1 Resources:

Big Ideas Learning www.bigideasmath.com

G.CO.A.1 Defining Parallel Lines
G.CO.A.1 Defining Perpendicular Lines
G.CO.A.2 Horizontal Stretch of the Plane
G.CO.A.3 Seven Circles II
G.CO.A.3 Symmetries of rectangles
G.CO.A.4 Defining Rotations
G.CO.A.5 Showing a triangle congruence
G.CO.B.7 Properties of Congruent Triangles
G.CO.B.8 Why does SAS work?
G.CO.B.8 Why does SSS work?
G.CO.B.8 Why does ASA work?
G.CO.D.12 Bisecting an angle
G.CO.D.12 Angle bisection and midpoints of line segments
G.CO.D.13 Inscribing an equilateral triangle in a circle

Unit 2: **Congruence, Similarity & Proof**

Learning Goal:

Learning Goal 1: Verify the properties of dilations given by a center and a scale factor.
Learning Goal 2: Use the definition of similarity in terms of similarity transformations to decide if two given figures are similar and explain, using similarity transformations, the meaning of triangle similarity.
Learning Goal 3: Use the properties of similarity transformations to establish the Angle-Angle criterion for two triangles to be similar.
Learning Goal 4: Construct and explain formal proofs of theorems involving lines, angles, triangles, and parallelograms.
Learning Goal 5: Prove theorems about triangles.
Learning Goal 6: Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.

Learning Target:

- Write conditional and biconditional statement
- Use inductive and deductive reasoning
- Write proofs
- Find corresponding lengths, perimeters and areas of similar polygons
- Use AA , SSS and SAS Similarity Theorems

- Use the Triangle Proportionality Theorem and its converse
- Use and find the circumcenter and incenter of a triangle
- Use medians and altitudes
- Use midsegments
- Use the Triangle Inequality Theorem
- Us the Hinge Theorem

Prerequisite Skills:

- Solve literal equations.
- Solve multi-step linear equations.
- Identify and extend arithmetic and geometric sequences.
- Write and solve linear equations in one variable.
- Use linear equations to solve real-life problems.
- Graph in the coordinate plane.
- Find the slope of a line.
- Identify and use parallel and perpendicular lines in real-life problems.

Content Standards	Mathematical Practices	Enduring Understandings	Essential Questions
Math Standards : G.SRT.A.1 G.SRT.A.2 G.SRT.A.3 G.CO.C.9 G.CO.C.10 G.CO.C.11 G.SRT.B.4 G.SRT.B.5 Technology Standards:8.1.8.A.1, 8.1.8.A.4 Career Readiness Practices:CRP2., CRP4., CRP7., CRP8.	MP1. MP2. MP3. MP4. MP5. MP6. MP7. MP8.	Students are able to: · perform dilations in order to verify the impact of dilations on lines and line segments. · Angle-Angle criterion for similarity · explain Angle-Angle criterion and its relationship to similarity transformations and properties of triangles. · construct and explain proofs of theorems about triangles including: - a line parallel to one side of a triangle divides the other two sides proportionally;	● In a diagram, what can be assumed and what needs to be labeled ● Can algebraic properties help you solve an equation ● How can you prove a mathematical statement ● Write a proof to prove a geometric relationship ● How are similar polygons related ● Use AA similarity theorem ● What proportionality relationships exist in a triangle

		- and the Pythagorean Theorem (using triangle similarity).	intersected by an angle bisector of by a line parallel to one of the sides ● What conjectures can you make about a point on the perpendicular bisector of a segment and point on the bisector of an angle ● What conjectures can you make about the medians and altitudes of a triangle ● If two sides of one triangle are congruent to two sides of another triangle ●

Unit 2 Resources:

Big Ideas Learning www.bigideasmath.com

G.SRT.A.1 Dilating a Line

G.SRT.A.2 Are They Similar?

G.SRT.A.2 Similar Triangles

G.SRT.A.3 Similar Triangles

G.CO.C.9 Congruent Angles made by parallel lines and a transverse

G.CO.C.9 Points equidistant from two points in the plane

G.CO.C.10 Midpoints of Triangle Sides

G.CO.C.10 Sum of angles in a triangle

G.CO.C.11 Midpoints of the Sides of a Parallelogram

G.CO.C.11 Is this a parallelogram?

G.SRT.B.4 Joining two midpoints of sides of a triangle

G.SRT.B.4 Pythagorean Theorem

G.SRT.B.5 Tangent Line to Two Circles

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Assessments:
STAR Math – Fall
Chapter Assessments
Trimester Assessments

Unit 3 : **Trigonometric Ratios & Geometric Equations**

Learning Goal:

Learning Goal 1: Use coordinates to prove simple geometric theorems algebraically.
Learning Goal 2: Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems.
Learning Goal 3: Find the point on a directed line segment between two given points that partitions the segment in a given ratio and use coordinates to compute perimeters of polygons and areas of triangles and rectangles.
Learning Goal 4: Show and explain that definitions for trigonometric ratios derive from similarity of right triangles.
Learning Goal 5: Explain and use the relationship between the sine and cosine of complementary angles; use trigonometric ratios and the Pythagorean Theorem to compute all angle measures and side lengths of triangles in applied problems.
Learning Goal 6: Derive the equation of a circle of given the center and radius using the Pythagorean Theorem. Given an equation, complete the square to find the center and radius of the circle.
Learning Goal 7: Prove that all circles are similar
Learning Goal 8: Identify and describe relationships among inscribed angles, radii, and chords; use these relationships to solve problems.
Learning Goal 9: Find arc lengths and areas of sectors of circles; use similarity to show that the length of the arc intercepted by an angle is proportional to the radius. Derive the formula for the area of a sector.
Learning Goal 10: Prove the properties of angles for a quadrilateral inscribed in a circle and construct inscribed and circumscribed circles of a triangle using geometric tools and geometric software.

Learning Target:

- Use the Pythagorean Theorem and its converse
- Find side lengths in special right triangles
- Use the trig ratios
- Use inverse trig ratios and solve right triangles
- Identify and draw tangents
- Find arc measure
- Use chords to find lengths and arc measures
- Use inscribed angles and inscribed polygons

- Find angle and arc meares and use circumscribed angles
- Use segments of chords, tangents, and secants
- Write and graph equations of circles

Prerequisite Skills:

- Write equations in one variable.
- Solve linear equations in one variable.
- Use multi-step equations to solve real-life problems
- Rewrite and use area formulas and other common formulas.
- Multiply binomials.
- Solve quadratic equations using square roots and by completing the square.
- Graph points and functions in the coordinate plane.

Content Standards	Mathematical Practices	Enduring Understandings	Essential Questions
Math: G.GPE.B.4 G.GPE.B.5 G.GPE.B.6 G.GPE.B.7 G.SRT.C.6 G.SRT.C.7 G.C.A.2 G.C.A.3 G.C.B.5 G.SRT.C.8 G.GPE.A.1 G.C.A.1 Technology Standards:8.1.8.A.1, 8.1.8.A.4 Career Readiness Practices:CRP2., CRP4., CRP7., CRP8.	MP1. MP2. MP3. MP4. MP5. MP6. MP7. MP8.	Students are able to: · Use coordinates to prove geometric theorems including: - prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle (or other quadrilateral); - and prove or disprove that a given point lies on a circle of a given center and radius or point on the circle. · prove the slope criteria for parallel lines (parallel lines have equivalent slopes). · prove the slope criteria for perpendicular lines (the product of the slopes of perpendicular lines equals -1).	● How can you prove the Pythagorean Theorem ● What is the relationship among the side lengths of 45-45-90 triangles, 30-6-90 triangles ● How are altides and geometric means of right triangles related ● How is aright triangle used to find the sine and cosine of an acute angle ● How can you find the measures of two acute triangles ● What are the Law of Sines and the Law of Cosines

		· solve problems using the slope criteria for parallel and perpendicular lines. · locate the point on a directed line segment that creates two segments of a given ratio. · find perimeters of polygons using coordinates, the Pythagorean theorem and the distance formula. · find areas of triangle and rectangles using coordinates. · show and explain that definitions for trigonometric ratios derived from similarity of right triangles. · determine and compare sine and cosine ratios of complementary angles in a right triangle. · solve right triangles (determine all angle measures and all side lengths) using trigonometric ratios and the Pythagorean Theorem. · given the center and radius, derive the equation of a circle (using the Pythagorean Theorem). · given an equation of a circle in any form, use the method of completing the square to determine the center and radius of the circle. · construct a formal proof of the similarity of all circles. · use the relationship between inscribed angles, radii and chords to solve problems. · use the relationship between central, inscribed, and circumscribed angles to solve problems. · identify inscribed angles on a diameter as right angles.	● What are two ways to determine when a chord is a diameter of a circle ● How are inscribed angles related to their intercepted arcs. ● How are the angles of an inscribed quadrilateral related to each other ● When a chord intersects a tangent line or another chord,what relationships exist among the angles and arcs formed ● What relationships exist among the segments formed by two intersecting chords or among segments of two secants that intersect outside a circle ● What is the equation of a circle

		· identify the radius of a circle as perpendicular to the tangent where the radius intersects the circle. · use similarity to derive the fact that the length of the arc intercepted by an angle is proportional to the radius. · define radian measure of an angle as the constant of proportionality when the length of the arc intercepted by an angle is proportional to the radius. · derive the formula for the area of a sector. · compute arc lengths and areas of sectors of circles. · construct the inscribed circle of a triangle. · construct the circumscribed circle of a triangle. · prove properties of the angles of a quadrilateral that is inscribed in a circle.	
Unit 3 Resources: Big Ideas Learning www.bigideasmath.com G.GPE.B.4,5 A Midpoint Miracle G.GPE.B.5 Slope Criterion for Perpendicular G.GPE.B.7 Triangle Perimeters G.SRT.C.6 Defining Trigonometric Ratio G.SRT.C.7 Sine and Cosine of Complimentary Angles G.SRT.C.8 Constructing Special Angles G.GPE.A.1 Explaining the equation for a circle G.C.A.1 Similar circles G.C.A.2 Right triangles inscribed in circles I G.C.A.3 Circumscribed Triangles			

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Assessments:
STAR Math – Fall
Chapter Assessments
Trimester Assessments

Unit 4 : **Geometric Modeling**

Learning Goal:

Learning Goal 1: Model real-world objects with geometric shapes based upon their measures and properties, and solve problems using volume formulas for cylinders, pyramids, cones, and spheres. Identify cross-sections, three-dimensional figures, and identify three-dimensional objects created by the rotation of two-dimensional objects.
Learning Goal 2: Apply concepts of density based on area and volume in modeling situations.
Learning Goal 3: Solve design problems using geometric methods
Learning Goal 4: Using dissection arguments, Cavalieri's principle, and informal limit arguments, develop informal arguments for formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone.

Learning Target:

- Find circumference and arc length
- Find areas of circles and sectors
- Find areas of polygons
- Classify solids and describe cross sections
- Find volumes of prisms, cylinders, pyramids, cones and spheres
- Find the interior and exterior angles measures of polygons
- Identify the properties of parallelograms
- Prove that a quadrilateral is a parallelogram
- Identify the properties of rectangles, rhombuses, and squares
- Identify the properties of trapezoids and kites

Prerequisite Skills:

- Create equations in one variable.
- Write and solve linear equations in one variable.

- Graph points in a coordinate plane.
- Identify and write equations of parallel and perpendicular lines.
- Rewrite and use literal equations and formulas for area.
- Use multi-step linear equations to solve real-life problems.
- Use unit analysis to model real-life problems.
- Solve quadratic equations in one variable.

Content Standards	Mathematical Practices	Enduring Understandings	Essential Questions
Math: G.MG.A.1 G.GMD.A.3 G.GMD.B.4 G.MG.A.2 G.MG.A.3 G.GMD.A.1 Technology Standards:8.1.8.A.1, 8.1.8.A.4 Career Readiness Practices:CRP2., CRP4., CRP7., CRP8.	MP1. MP2. MP3. MP4. MP5. MP6. MP7. MP8.	Students are able to: · identify cross-sections of three dimensional objects. · identify three-dimensional objects generated by rotation of two-dimensional objects. · solve problems using volume formulas for cylinders, pyramids, cones, and spheres. · model real-world objects with geometric shapes. · describe the measures and properties of geometric shapes that best represent a real-world object. · model real-world situations, applying density concepts based on area. · model real-world situations, applying density concepts based on volume. · design objects or structures satisfying physical constraints · design objects or structures to minimize cost. · solve design problems.	● What is the sum of the measures of the interior angles of a polygon? ● What are the properties of parallelograms? ● How can you prove that a quadrilateral is a parallelogram? ● What are the properties of the diagonals of rectangles, rhombuses, and squares? ● What are some properties of trapezoids and kites? ● How can you find the length of a circular arc? ● How can you find the area of a sector of a circle? ● How can you find the area of a regular polygon? ● What is the relationship between the numbers of vertices V, edges E, and faces F of a polyhedron? ● How can you find the volume of a prism or cylinder that is

			not a right prism or right cylinder? ● How can you find the volume of pyramid? ● How can you find the surface area and volume of a cone? ● How can you find the surface area and the volume of sphere?
Unit 4 Resources: Big Ideas Learning www.bigideasmath.com G.MG.A.1Toilet Roll G.GMD.A.3 The Great Egyptian Pyramids G.GMD.B.4 Tennis Balls in a Can G.MG.A.2 How many cells are in the human body? G.MG.A.3 Ice Cream Cone G.GMD.A.1 Area of a circle			
Assessments: STAR Math – Fall Chapter Assessments Trimester Assessments			