



Kutztown Area School District Curriculum (Unit Map)

*High School Geometry
Written by Stephen Pizzuto*

Course Description: Geometry emphasizes the development of the structure of geometry as an organized discipline through deductive reasoning and study of points, lines, planes, angles, parallel lines and planes, triangles, congruence and similarity, quadrilaterals, inequalities, right triangles, circles, and area and volume of two and three dimensional figures.

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Unit #/Title	1/Points, Lines, Planes and Angles	Time Frame	2-3 Weeks
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Standards	
<p>Standards of Mathematical Practices</p> <ol style="list-style-type: none"> 1. Construct viable arguments and critique the reasoning of others. 2. Use appropriate tools strategically. <p>C.2.3.HS.A.3 Verify and apply geometric theorems as they relate to geometric figures. CC.2.3.HS.A.14 Apply geometric concepts to model and solve real world problems. CC.2.2.HS.D.2 Write expressions in equivalent forms to solve problems. CC.2.2.HS.D.9 Use reasoning to solve equations and justify the solution method. CC.2.2.HS.D.10 Represent, solve, and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically.</p>	
Big Ideas	Essential Questions
<ul style="list-style-type: none"> • The number line pairs geometric points with numbers and introduces coordinates, length, distance and absolute values. 	<ul style="list-style-type: none"> • What is the difference between a point, a line, a line segment and a ray and how are they related and why is it important to distinguish between them with notation? • Why are points, lines and planes the building blocks of geometry? • What are the different types of angles and their relationships?
Content	Skills
<ul style="list-style-type: none"> • Angle measures (actual and estimated)...protractor postulate. • Distances between points...ruler postulate. • Points, lines, line segments, rays, planes 	<ul style="list-style-type: none"> • Add and subtract angles • Calculate distance between points using a number line • Measure (using a protractor) angles and estimate angles (no protractor) • Solve equations involving lengths

Unit #/Title	2/Using Deductive Reasoning	Time Frame	2-3 Weeks
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Standards
<p>Standards of Mathematical Practices</p> <ul style="list-style-type: none"> • Make sense of problems and persevere in solving them. • Reason abstractly and quantitatively. • Construct viable arguments and critique the reasoning of others. <p>CC.2.3.HS.A.2 Verify and apply geometric theorems as they relate to geometric figures. CC.2.3.HS.A.14 Apply geometric concepts to model and solve real world problems.</p>

<p>CC.2.2.HS.D.10 Represent, solve, and interpret equations algebraically.</p> <p>CC.2.2.HS.D.9 Use reasoning to solve equations and justify the solution method.</p> <p>CC.2.2.HS.D.2 Write expressions in equivalent forms to solve problems.</p>	
Big Ideas	Essential Questions
<ul style="list-style-type: none"> Numbers and operations require an understanding of numbers and their relationships, operations and their meanings and the ability to compute fluently and with facility. Algebraic concepts require representing, transitioning between, and manipulating situations numerically, symbolically, graphically, and contextually. 	<ul style="list-style-type: none"> Why are counterexamples important in geometry? What are the properties of congruence?
Content	Skills
<ul style="list-style-type: none"> Hypothesis, conclusion, converses, counterexamples Properties of algebra Perpendicular lines, complementary/supplementary, vertical angles 	<ul style="list-style-type: none"> Form equations using complementary, supplementary and vertical angles Identify the hypothesis and the conclusion of conditionals Recognize the properties of algebra Use counterexamples to disprove statements Plan proofs and write them in 2 column form

Unit #/Title	3/Parallel Lines and Planes	Time Frame	3-4 Weeks
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Standards	
<p>Standards of Mathematical Practices</p> <ul style="list-style-type: none"> Make sense of problems and persevere in solving them. Reason abstractly and quantitatively. Use appropriate tools strategically. Attend to precision. Look for and make use of structure. <p>CC.2.3.HS.A.2 Verify and apply geometric theorems as they relate to geometric figures.</p> <p>CC.2.3.HS.A.14 Apply geometric concepts to model and solve real world problems.</p> <p>CC.2.2.HS.D.9 Use reasoning to solve equations and justify the solution method.</p> <p>CC.2.2.HS.D.10 Represent, solve, and interpret equations algebraically.</p>	
Big Ideas	Essential Questions
<ul style="list-style-type: none"> Geometry requires the analysis of characteristics and properties of two- and three-dimensional shapes, describing spatial relationships, and using geometric models to solve problems. 	<ul style="list-style-type: none"> What types of angles are created by a transversal that intersects parallel lines? Why is the significance of the polygon angle sum formula?

<ul style="list-style-type: none"> Measurement requires an understanding of measurable attributes and applying appropriate techniques, tools, units, and formulas to quantify them. 	
Content	Skills
<ul style="list-style-type: none"> Parallel and skew lines Special angles(alternate interior/exterior, corresponding, same side interior/exterior) Proving lines parallel Different types of triangles(scalene, isosceles, equilateral, acute, obtuse, right, equiangular) Interior and exterior angles of polygons Exterior angle of a triangle and remote interior angles 	<ul style="list-style-type: none"> Identify the difference between parallel and skew lines. Identify the special angles Calculate the interior angle sum of a convex polygon Calculate individual interior angles and individual exterior angles of convex polygons Classify triangles according to sides and angles. The students will classify special angles formed by 2 lines and a transversal. Use the special angle relationships to prove lines parallel. Identify the special types of triangles Calculate the total number of degrees inside a specific figure as well as outside a figure Calculate individual interior and exterior angles of a specific figure.

Unit #/Title	4/Congruent Triangles	Time Frame	2-3 Weeks
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Standards	
<p>Standards of Mathematical Practices</p> <ul style="list-style-type: none"> Make sense of problems and persevere in solving them. Reason abstractly and quantitatively. Construct viable arguments and critique the reasoning of others. Model with mathematics. Use appropriate tools strategically. Attend to precision. Look for and make use of structure. Look for and express regularity in repeated reasoning <p>CC.2.3.HS.A.2 Apply rigid transformations to determine and explain congruence. CC.2.3.HS.A.4 Apply the concept of congruence to create geometric constructions. CC.2.2.HS.D.10 Represent, solve, and interpret equations algebraically.</p>	
Big Ideas	Essential Questions
<ul style="list-style-type: none"> Geometry requires the analysis of characteristics and properties of two- and three-dimensional shapes, describing spatial relationships, and using geometric models to solve problems. 	<ul style="list-style-type: none"> What are the methods to prove that triangles are congruent? Why doesn't the SSA method always work?

Content	Skills
<ul style="list-style-type: none"> • Congruent figures and triangles • 5 ways to prove triangles congruent(SSS, SAS, ASA, AAS, HL) • Isosceles triangle theorems • Medians, altitudes and perpendicular bisectors 	<ul style="list-style-type: none"> • Prove triangles congruent using one of the five methods in a proof. • Apply the theorems of isosceles triangles. • Apply the theorems about a point on an angle bisector and a point on a perpendicular bisector. • Deduce information about segments and angles after proving that two triangles are congruent(CPCT) • Prove that overlapping triangles are congruent. • Prove two triangles congruent, then using their congruent parts prove two other triangles are congruent. • Apply the theorems about a point on an angle bisector and a point on a perpendicular bisector.

Unit #/Title	5/Quadrilaterals	Time Frame	3-4 Weeks
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Standards	
<p>Standards of Mathematical Practices</p> <ul style="list-style-type: none"> • Reason abstractly and quantitatively. • Construct viable arguments and critique the reasoning of others. • Attend to precision. • Look for and make use of structure. • Look for and express regularity in repeated reasoning <p>CC.2.3.HS.A.3 Verify and apply geometric theorems as they relate to geometric figures. CC.2.3.HS.A.14 Apply geometric concepts to model and solve real world problems. CC.2.2.HS.D.9 Use reasoning to solve equations and justify the solution method. CC.2.2.HS.D.10 Represent, solve, and interpret equations algebraically.</p>	
Big Ideas	Essential Questions
<ul style="list-style-type: none"> • Algebraic concepts require representing, transitioning between, and manipulating situations numerically, symbolically, graphically, and contextually. • Geometry requires the analysis of characteristics and properties of two- and three-dimensional shapes, describing spatial relationships, and using geometric models to solve problems. • Measurement requires an understanding of measurable attributes and applying appropriate techniques, tools, units, and formulas to quantify them. 	<ul style="list-style-type: none"> • How are geometric shapes classified? • How are squares and rhombuses related/different? • How are squares and rectangles related/different? • What are the special properties of a trapezoid and why is it not considered to be a parallelogram?

Content	Skills
<ul style="list-style-type: none"> • Properties of parallelograms as well as special parallelograms such as squares, rectangles and rhombuses. • 5 Ways to prove a quadrilateral is a parallelogram • Theorems involving parallel lines • Properties of trapezoids 	<ul style="list-style-type: none"> • Identify the special properties of different types of quadrilaterals. • Apply theorems about parallel lines and the segment that joins the midpoints of two sides of a triangle. • Apply the definitions and identify the properties of a trapezoid and an isos trapezoid.

Unit #/Title	6/Similar Polygons	Time Frame	2-3 Weeks
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Standards	
<p>Standards of Mathematical Practices</p> <ul style="list-style-type: none"> • Make sense of problems and persevere in solving them. • Reason abstractly and quantitatively. • Construct viable arguments and critique the reasoning of others. <p>CC.2.3.HS.A.6 Verify and apply theorems involving similarity as they relate to plane figures. CC.2.3.HS.A.14 Apply geometric concepts to model and solve real world problems. CC.2.2.HS.D.9 Use reasoning to solve equations and justify the solution method. CC.2.2.HS.D.10 Represent, solve, and interpret equations algebraically. CC.2.1.HS.F.4 Use units as a way to understand problems and to guide the solution of multi-step problems.</p>	
Big Ideas	Essential Questions
<ul style="list-style-type: none"> • Numbers and operations require an understanding of numbers and their relationships, operations and their meanings and the ability to compute fluently and with facility. • Geometry requires the analysis of characteristics and properties of two- and three-dimensional shapes, describing spatial relationships, and using geometric models to solve problems. 	<ul style="list-style-type: none"> • What needs to be true for two shapes to be similar to one another? • What are the three methods to proving triangles similar? • How can it be shown mathematically that two shapes are similar to one another? • What is the difference between congruent polygons and similar polygons?
Content	Skills
<ul style="list-style-type: none"> • Ratios and proportions • Similar polygons • Similar triangles • Proportional lengths 	<ul style="list-style-type: none"> • Construct ratios and construct/solve proportions • State and apply the properties of similar polygons • Use the AA similarity postulate, SAS similarity postulate and SSS similarity theorem • Use similar triangles to deduce information about segments or angles.

Unit #/Title	7/Right Triangles	Time Frame	3-4 Weeks
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Standards

Standards of Mathematical Practices

- Make sense of problems and persevere in solving them.
- Reason abstractly and quantitatively.
- Use appropriate tools strategically.
- Attend to precision.
- Look for and make use of structure.

CC.2.3.HS.A.7 Apply trigonometric ratios to solve problems involving right triangles.

CC.2.3.HS.A.14 Apply geometric concepts to model and solve real world problems.

CC.2.2.HS.D.9 Use reasoning to solve equations and justify the solution method.

CC.2.2.HS.D.10 Represent, solve, and interpret equations algebraically.

Big Ideas	Essential Questions
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- Numbers and operations require an understanding of numbers and their relationships, operations and their meanings and the ability to compute fluently and with facility.
- Geometry requires the analysis of characteristics and properties of two- and three-dimensional shapes, describing spatial relationships, and using geometric models to solve problems.
- Measurement requires an understanding of measurable attributes and applying appropriate techniques, tools, units, and formulas to quantify them.

- What are the rules of 30-60-90 and 45-45-90 triangles?
- How can sin, cos, and the tan trig functions be used to solve for missing angles and side lengths of right triangles?
- How can the Pythagorean Theorem be used to solve for missing side lengths?

Content	Skills
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- Similarity in right triangles
- Pythagorean Theorem
- Converse of Pythagorean Thm
- Special right triangles (30-60-90, 45-45-90)
- Trigonometry ratios (sine, cosine, tangent)

- Use proportions to solves for unknown parts of similar right triangles
- Calculate the missing side of a right triangle when the other 2 sides are known
- Determine the type of triangle when the side lengths are known
- Use trig ratios to solve for missing parts(sides and angles) of right triangles

Unit #/Title	8/Circles	Time Frame	3-4 Weeks
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Standards	
<p>Standards of Mathematical Practices</p> <ul style="list-style-type: none"> • Make sense of problems and persevere in solving them. • Model with mathematics. • Use appropriate tools strategically. • Attend to precision. <p>CC.2.3.HS.A.9 Extend the concept of similarity to determine arc lengths and areas of sectors of circles.</p> <p>CC.2.3.HS.A.8 Apply geometric theorems to verify properties of circles</p> <p>CC.2.3.HS.A.14 Apply geometric concepts to model and solve real world problems.</p> <p>CC.2.2.HS.D.9 Use reasoning to solve equations and justify the solution method.</p> <p>CC.2.2.HS.D.10 Represent, solve, and interpret equations algebraically.</p>	
Big Ideas	Essential Questions
<ul style="list-style-type: none"> • Numbers and operations require an understanding of numbers and their relationships, operations and their meanings and the ability to compute fluently and with facility. • Algebraic concepts require representing, transitioning between, and manipulating situations numerically, symbolically, graphically, and contextually. • Geometry requires the analysis of characteristics and properties of two- and three-dimensional shapes, describing spatial relationships, and using geometric models to solve problems. 	<ul style="list-style-type: none"> • What is the difference between tangents, chords and secants? • How are inscribed angles and central angles calculated?
Content	Skills
<ul style="list-style-type: none"> • Basic Terms(center, radius, diameter, chord, secant, tangent, point of tangency, sphere, concentric circles, common external/internal tangents, externally/internally tangent circles) • Arcs, central angle, inscribed angles, other angles relationships with each other • Lengths of segments inside and outside circles 	<ul style="list-style-type: none"> • The student will be able to define a circle, sphere and terms related to them' • Recognize circumscribed and inscribed polygons • Apply theorems that relate tangents and radii • Define and apply properties of arcs and central angles. • Apply theorems about the chords of a circle. • Solve problems involving inscribed angles, angles formed by chords, secant segments and tangents. • Solve problems involving lengths of chords, secant segments and tangent segments,

Unit #/Title	9/Areas of Plane Figures	Time Frame	3-4 Weeks
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Standards

Standards of Mathematical Practices

- Make sense of problems and persevere in solving them.
- Reason abstractly and quantitatively.
- Model with mathematics.
- Attend to precision.
- Look for and express regularity in repeated reasoning

CC.2.3.HS.A.14 Apply geometric concepts to model and solve real world problems.

CC.2.2.HS.D.9 Use reasoning to solve equations and justify the solution method.

CC.2.2.HS.D.10 Represent, solve, and interpret equations algebraically.

Big Ideas	Essential Questions
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- Geometry requires the analysis of characteristics and properties of two- and three-dimensional shapes, describing spatial relationships, and using geometric models to solve problems.
- Measurement requires an understanding of measurable attributes and applying appropriate techniques, tools, units, and formulas to quantify them.

- Why is the calculation of areas and perimeters of shapes important in everyday life?
- If the area of a trapezoid formula is forgotten, how else can it's area be calculated?

Content	Skills
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- Basic terms(height, base, diagonal, pi, circumference, arc length, sector)
- Area and perimeter of squares, rectangles, triangles, parallelograms, trapezoids
- Area of regular polygons
- Circumference and area of circles
- Arc lengths and area of sectors

- Calculate the height of a parallelogram, a trapezoid or a triangle using Pythagorean Theorem or special triangle rules.
- Calculate the area of parallelograms, trapezoids, triangles.
- Recall basic formulas of area and perimeter of parallelograms, trapezoids and triangles.
- Calculate circumference and area of circles
- Calculate arc length and area of sectors

Unit #/Title	10/Areas and Volumes of Solids	Time Frame	3-4 Weeks
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Standards

Standards of Mathematical Practices

- Make sense of problems and persevere in solving them.
- Model with mathematics.
- Attend to precision.
- Look for and make use of structure.
- Look for and express regularity in repeated reasoning

CC.2.3.HS.A.12 Explain volume formulas and use them to solve problems.

CC.2.3.HS.A.13 Analyze relationships between two-dimensional and three-dimensional objects.

CC.2.3.HS.A.14 Apply geometric concepts to model and solve real world problems.

CC.2.2.HS.D.9 Use reasoning to solve equations and justify the solution method.

CC.2.2.HS.D.10 Represent, solve, and interpret equations algebraically.

Big Ideas	Essential Questions
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- Geometry requires the analysis of characteristics and properties of two- and three-dimensional shapes, describing spatial relationships, and using geometric models to solve problems.
- Measurement requires an understanding of measurable attributes and applying appropriate techniques, tools, units, and formulas to quantify them.

- How are the area and volume formulas of prisms related to the area and volume formulas of cylinders?
- How are the area and volume formulas of pyramids related to the area and volume formulas of cones?
- How do the perimeters, areas, and volumes of similar polygons and solids compare?

Content	Skills
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- Basic terms(height, lateral edge, bases, slant height)
- lateral area, total area, volume of prisms, pyramids, cylinders and cones
- Total area and volume of spheres
- Areas and volumes of similar solids.
- Ratio and area of similar solids.

- Calculate heights using Pythagorean Theorem or special triangle rules
- Calculate the areas and volumes of prisms, pyramids, cones, cylinders and spheres.
- Be able to go back and forth between the scale factor, the ratio of the area and the ratio of the volume between similar solids.

Unit #/Title	11/Coordinate Geometry	Time Frame	3 Weeks
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Standards

Standards of Mathematical Practices

- Make sense of problems and persevere in solving them.
- Attend to precision.
- Look for and make use of structure.
- Look for and express regularity in repeated reasoning

CC.2.3.HS.A.11 Apply coordinate geometry to prove simple geometric theorems algebraically.

CC.2.2.HS.D.9 Use reasoning to solve equations and justify the solution method.

CC.2.3.HS.A.14 Apply geometric concepts to model and solve real world problems.

CC.2.2.HS.D.7 Create and graph equations or inequalities to describe numbers or relationships.

CC.2.2.HS.D.10 Represent, solve, and interpret equations algebraically.

Big Ideas	Essential Questions
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- Geometry requires the analysis of characteristics and properties of two- and three-dimensional shapes, describing spatial relationships, and using geometric models to solve problems.
- Algebraic concepts require representing, transitioning between, and manipulating situations numerically, symbolically, graphically, and contextually.

- How are two lines shown to be parallel/perpendicular/neither?
- How is the distance formula and the equation of a circle related?
- How can the distance formula be used to show that three points are collinear?

Content	Skills
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- Distance Formula
- Slope
- Parallel and perpendicular lines
- Vectors
- Midpoint formula
- Graphing and writing linear equations

- State and apply the distance formula, general equation of a circle, midpoint formula and the slope formula.
- Determine whether two lines are parallel, perpendicular or neither.
- Understand the basic properties of vectors.
- Identify the slope and y-intercept of a line specified by a given equation.
- Determine the intersection of two lines.
- Write the equation of a line when given either one point and the slope of the line, or two points of the line.
- Draw the graph of the line specified by a given equation.