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9th Grade Honors Geometry/Trigonometry Curriculum Framework
Full Year Course

Big Idea(s) for 1st nine weeks	Concept(s) of 1st nine weeks	Competencies of 1st nine weeks	Essential Questions for 1st nine weeks
Geometry is a mathematical system built on accepted facts, basic terms, and definitions. Number operations can be used to find and compare the lengths of segments and the measures of angles. Special angle pairs can be used to identify geometric relationships and to find angle measures.	Students will know… ● points, lines and planes ● segment addition ● midpoint and distance ● measuring angles ● pairs of angles ● intersecting lines ● parallel lines and transversals ● parallel lines and angle ● angles in pictures ● triangles ● polygons ● corresponding parts of Congruent Figures Theorem ● non-overlapping triangle proofs ● overlapping triangle proofs	Students will be able to… ● describe points, lines and planes ● solve relationships using the segment addition postulate ● compute midpoint and distance ● identify and measure angles ● classify pairs of angles ● identify and solve angles relationships formed by intersecting lines ● sketch and identify angles formed by parallel lines and transversals ● solve relationships formed by parallel lines and corresponding angle measures ● separate the various angle types to solve for angle measures in pictures ● construct line segments, angles, and points of intersection using a compass or online application ● construct equilateral and isosceles triangles using a compass or online application ● construct regular polygons	How are the three undefined terms used to establish definitions in geometry? What is segment addition and how is it used? How do we identify adjacent,vertical, complementary and supplementary angles and calculate the measures of pairs of angles? What is the relationship between the measures of the angles formed when a transversal intersects two parallel lines? How can we use the relationship between angles formed when a transversal intersects two parallel lines to solve problems? What are the ways to prove triangles congruent? How can we identify corresponding parts of congruent triangles?

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		using a compass or online application ● summarize and apply the corresponding parts of congruent figures theorem ● plan and generate non-overlapping triangle proofs ● plan and generate overlapping triangle proofs	
Unit/Chapter/Selection of Study Unit 1: Definitions and Properties ● Points, Lines and Planes ● Segment Addition ● Midpoint and Distance ● Measuring Angles ● Pairs of Angles	**Approx # of weeks - % of time** 3 weeks	**PA Core Standards** CC.2.3.HS.A.11 Apply coordinate geometry to prove simple geometric theorems algebraically. CC.2.3.HS.A.3 Verify and apply geometric theorems as they relate to geometric figures.	**Assessment Anchors & Eligible Content** G.2.1.2.1 Calculate the distance and/or midpoint between two points on a number line or on a coordinate plane. G.2.1.2.3 Use slope, distance, and/or midpoint between two points on a coordinate plane to establish properties of a two-dimensional shape. G.2.2.2.1 Estimate area, perimeter, or circumference of an irregular figure.

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Unit 2: Lines and Angle Relations in a Plane ● Intersecting Lines ● Parallel Lines and Transversals ● Parallel Lines and Angle ● Angles in Pictures	3 weeks	CC.2.3.HS.A.3 Verify and apply geometric theorems as they relate to geometric figures.	G.2.2.1.1 Use properties of angles formed by intersecting lines to find the measures of missing angles G.2.2.1.2 Use properties of angles formed when two parallel lines are cut by a transversal to find the measures of missing angles.
Unit/Chapter/Selection of Study	**Approx # of weeks - % of time**	**PA Core Standards**	**Assessment Anchors & Eligible Content**
Unit 3: Constructions ● Line Segments, Angles, and Points ● Triangles ● Polygons	2 weeks	CC.2.3.HS.A.4 Apply the concept of congruence to create geometric constructions.	N/A
Unit/Chapter/Selection of Study	**Approx # of weeks - % of time**	**PA Core Standards**	**Assessment Anchors & Eligible Content**
Unit 4: Congruence and Proofs Triangle Congruence Statements ● Corresponding Parts of Congruent Figures Theorem	1 week (continues into the 2nd nine weeks)	CC.2.3.HS.A.3 Verify and apply geometric theorems as they relate to geometric figures. CC.2.3.HS.A.6 Verify and apply theorems involving similarity as they	G.1.3.2.1 Write, analyze, complete, or identify formal proofs (e.g., direct and/or indirect proofs/proofs by contradiction).

• Non-Overlapping Triangle Proofs • Overlapping Triangle Proofs		relate to plane figures. CC.2.3.HS.A.13 Analyze relationships between two-dimensional and three-dimensional objects.	G.1.2.1.1 Identify and/or use properties of triangles. G.1.2.1.2 Identify and/or use properties of quadrilaterals. G.1.2.1.3 Identify and/or use properties of isosceles and equilateral triangles. G.1.2.1.4 Identify and/or use properties of regular polygons G.1.3.2.1 Write, analyze, complete, or identify formal proofs (e.g., direct and/or indirect proofs/proofs by contradiction).

Big Idea(s) for 2nd nine weeks	Concept(s) of 2nd nine weeks	Competencies of 2nd nine weeks	Essential Questions for 2nd nine weeks
Given information, definitions, properties, postulates, and previously proven theorems can be used as reasons in proof. Two geometric figures are similar when corresponding lengths are proportional and corresponding	Students will know… • corresponding parts of Congruent Figures Theorem • non-overlapping triangle proofs • overlapping triangle proofs • similar polygons • similar triangles theorems • proportionality use	Students will be able to… • summarize and apply the corresponding parts of congruent figures theorem • plan and generate non-overlapping triangle proofs • plan and generate overlapping triangle proofs • apply the concept of	What strategy can be used to prove that overlapping triangles are congruent? How can we create and solve proportions to find missing parts of similar figures? How can we apply proportionality and

angles are congruent. It is often possible to verify complex truths by reasoning from simpler ones by using deductive reasoning.	● Pythagorean Theorem ● special right triangles ● right triangle trigonometry ● Law of Cosines and Sines ● area of a triangle SAS and SSS	proportional thinking to similar polygons ● deduce and use the similar triangles theorems ● apply the concept of proportionality to polygons ● discover and practice the use of the Pythagorean theorem ● develop and use the relationships associated with special right triangles ● discover the three right triangle trigonometry relationships and apply them to problem situations ● use the law of cosine and law of sines to solve for missing parts of a triangle ● modify the area of a triangle formula to find the area of a triangle when given two sides and the angle between them and three sides of a triangle	triangles angle bisector theorems? How do we apply similarity relationships in right triangles to solve problems? What are the trigonometric ratios and how do we use them to solve right triangles? How can trigonometric ratios be used to solve real-world problems?

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Unit 4: Congruence and Proofs Triangle Congruence Statements ● Corresponding Parts of Congruent Figures Theorem ● Non-Overlapping Triangle Proofs ● Overlapping Triangle Proofs	2 weeks (continues from the 1st nine weeks)	CC.2.3.HS.A.3 Verify and apply geometric theorems as they relate to geometric figures. CC.2.3.HS.A.6 Verify and apply theorems involving similarity as they relate to plane figures. CC.2.3.HS.A.13 Analyze relationships between two-dimensional and three-dimensional objects.	G.1.3.2.1 Write, analyze, complete, or identify formal proofs (e.g., direct and/or indirect proofs/proofs by contradiction). G.1.2.1.1 Identify and/or use properties of triangles. G.1.2.1.2 Identify and/or use properties of quadrilaterals. G.1.2.1.3 Identify and/or use properties of isosceles and equilateral triangles. G.1.2.1.4 Identify and/or use properties of regular polygons G.1.3.2.1 Write, analyze, complete, or identify formal proofs (e.g., direct and/or indirect proofs/proofs by contradiction).

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Unit 5: Similarity ● Similar Polygons ● Similar Triangles Theorems ● Proportionality Use	2 weeks	CC.2.3.HS.A.1 Use geometric figures and their properties to represent transformations in the plane. CC.2.3.HS.A.2 Apply rigid transformations to determine and explain congruence CC.2.3.HS.A.5 Create justifications based on transformations to establish similarity of plane figures. CC.2.3.HS.A.6 Verify and apply theorems involving similarity as they relate to plane figures.	G.1.3.1.1 Identify and/or use properties of congruent and similar polygons or solids. G.1.3.1.2 Identify and/or use proportional relationships in similar figures. G.1.3.1.1 Identify and/or use properties of congruent and similar polygons or solids. G.1.3.1.2 Identify and/or use proportional relationships in similar figures.
Unit/Chapter/Selection of Study	**Approx # of weeks - % of time**	**PA Core Standards**	**Assessment Anchors & Eligible Content**
Unit 6: Trigonometry ● Pythagorean Theorem ● Special Right Triangles ● Right Triangle Trigonometry ● Law of Cosines and Sines ● Area of a Triangle SAS and SSS	5 weeks (continues into 3rd nine weeks)	CC.2.3.HS.A.3 Verify and apply geometric theorems as they relate to geometric figures. CC.2.3.HS.A.7 Apply trigonometric ratios to solve problems involving right triangles. CC.2.2.HS.C.9 Prove the Pythagorean identity and use it to calculate trigonometric ratios.	G.1.2.1.1 Identify and/or use properties of triangles. G.2.1.1.1 Use the Pythagorean theorem to write and/or solve problems involving right triangles. G.2.1.1.2 Use trigonometric ratios to write and/or solve problems involving right triangles.

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			G.1.3.2.1 Write, analyze, complete, or identify formal proofs (e.g., direct and/or indirect proofs/proofs by contradiction).

Big Idea(s) for 3rd nine weeks	Concept(s) of 3rd nine weeks	Competencies of 3rd nine weeks	Essential Questions for 3rd nine weeks
Perimeter and area are two different ways of measuring the size of geometric figures. Some attributes of geometric figures, such as length, area, volume, and angle measure, are measurable. Units are used to describe these attributes.	Students will know… ● Pythagorean Theorem ● special right triangles ● right triangle trigonometry ● Law of Cosines and Sines ● area of a triangle SAS and SSS ● perimeter and area of parallelograms, rectangles and squares ● perimeter and area of trapezoids and kites ● circumference and area of a circle ● composite area ● circle basics ● central, inscribed, interior and exterior angles ● chord, secant, and tangent length ● converting between degrees and radians	Students will be able to… ● discover and practice the use of the Pythagorean theorem ● develop and use the relationships associated with special right triangles ● discover the three right triangle trigonometry relationships and apply them to problem situations ● use the law of cosine and law of sines to solve for missing parts of a triangle ● modify the area of a triangle formula to find the area of a triangle when given two sides and the angle between them and three sides of a triangle ● compute the perimeter and area of parallelograms, rectangles and squares ● compute the perimeter and	What are the Law of Sine and Law of Cosine and how can we use the Law of Sines and the Law of Cosines to solve triangles? How can we develop and apply formulas for the perimeters and areas of triangles and special quadrilaterals? How can we develop and apply formulas for the area and circumference of a circle? How can we find the areas of composite figures? What are the basic components of a circle? How do we find the measures of angles formed by lines that intersect

	● unit circle and exact values ● equations for parallel and perpendicular lines ● equations of circles	area of trapezoids and kites ● compute the circumference and area of a circle ● deconstruct figures to calculate composite area ● identify the basic concepts associated with circles ● analyze central, inscribed, interior and exterior angles for their relationships independently and to each other ● compute values for chord, secant, and tangent length ● transfer between degrees and radians ● apply triangle relationships to the unit circle and find exact values for sinusoidal functions ● produce and evaluate equations for parallel and perpendicular lines ● deconstruct equations of circles to understand the various concepts within them	circles? How do we find the lengths of segments formed by lines that intersect circles? How do we derive the equation of a circle and identify its' center and radius? How can you use slope to determine if lines are parallel, perpendicular, or neither?

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Unit 6: Trigonometry ● Pythagorean Theorem ● Special Right Triangles ● Right Triangle Trigonometry ● Law of Cosines and Sines ● Area of a Triangle SAS and SSS	2 weeks (continues from 3rd nine weeks)	CC.2.3.HS.A.3 Verify and apply geometric theorems as they relate to geometric figures. CC.2.3.HS.A.7 Apply trigonometric ratios to solve problems involving right triangles CC.2.2.HS.C.9 Prove the Pythagorean identity and use it to calculate trigonometric ratios.	G.1.2.1.1 Identify and/or use properties of triangles. G.2.1.1.1 Use the Pythagorean theorem to write and/or solve problems involving right triangles. G.2.1.1.2 Use trigonometric ratios to write and/or solve problems involving right triangles. G.1.3.2.1 Write, analyze, complete, or identify formal proofs (e.g., direct and/or indirect proofs/proofs by contradiction).
Unit/Chapter/Selection of Study	**Approx # of weeks - % of time**	**PA Core Standards**	**Assessment Anchors & Eligible Content**
Unit 7: Perimeter and Area of Polygons ● Perimeter and Area of Parallelograms, Rectangles and Squares ● Perimeter and Area of Trapezoids and Kites ● Circumference and Area of a Circle ● Composite Area	3 weeks	CC.2.3.HS.A.3 Verify and apply geometric theorems as they relate to geometric figures. CC.2.3.HS.A.8 Apply geometric theorems to verify properties of circles CC.2.3.HS.A.9 Extend the concept of similarity to determine arc lengths and areas of sectors of circles.	G.2.2.2.1 Estimate area, perimeter, or circumference of an irregular figure G.2.2.2.2 Find the measurement of a missing length, given the perimeter, circumference, or area G.2.2.2.3 Find the side lengths of a polygon with a given perimeter to maximize the area of the polygon.

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		CC.2.3.HS.A.13 Analyze relationships between two-dimensional and three-dimensional objects. CC.2.2.HS.C.1 Use the concept and notation of functions to interpret and apply them in terms of their context. CC.2.3.HS.A.14 Apply geometric concepts to model and solve real world problems.	G.2.2.2.4 Develop and/or use strategies to estimate the area of a compound/composite figure. G.2.2.2.5 Find the area of a sector of a circle. G.2.2.3.1 Describe how a change in the linear dimension of a figure affects its perimeter, circumference, and area (e.g., How does changing the length of the radius of a circle affect the circumference of the circle?). G.1.2.1.3 Identify and/or use properties of isosceles and equilateral triangles. G.1.2.1.2 Identify and/or use properties of quadrilaterals. G.1.2.1.4 Identify and/or use properties of regular polygons. G.2.2.4.1 Use area models to find probabilities.

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Unit 8: Circles ● Circle Basics ● Central, Inscribed, Interior and Exterior Angles ● Chord, Secant, and Tangent Length ● Converting between Degrees and Radians ● Unit Circle and Exact Values	3 weeks	CC.2.3.HS.A.8 Apply geometric theorems to verify properties of circles CC.2.3.HS.A.9 Extend the concept of similarity to determine arc lengths and areas of sectors of circles. CC.2.3.HS.A.13 Analyze relationships between two-dimensional and three-dimensional objects.	G.2.2.3.1 Describe how a change in the linear dimension of a figure affects its perimeter, circumference, and area (e.g., How does changing the length of the radius of a circle affect the circumference of the circle?). G.1.1.1.1 Identify, determine, and/or use the radius, diameter, segment, and/or tangent of a circle G.1.1.1.2 Identify, determine, and/or use the arcs, semicircles, sectors, and/or angles of a circle. G.1.1.1.3 Use chords, tangents, and secants to find missing arc measures or missing segment measures. G.1.1.1.4 Identify and/or use the properties of a sphere or cylinder. G.1.3.2.1 Write, analyze, complete, or identify formal proofs (e.g., direct and/or indirect proofs/proofs by contradiction).

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Unit 9: Coordinate Geometry ● Equations for Parallel and Perpendicular Lines ● Equations of Circles ● Distance and Midpoints on a Plane and in Space	1 week (continues into 4th nine weeks)	CC.2.3.HS.A.10 Translate between the geometric description and the equation for a conic section. CC.2.3.HS.A.11 Apply coordinate geometry to prove simple geometric theorems algebraically.	A2.2.1.1.4 Identify and/or determine the characteristics of an exponential, quadratic, or polynomial function (e.g., intervals of increase/decrease, intercepts, zeros, and asymptotes). A2.2.2.1.1 Create, interpret, and/or use the equation, graph, or table of a polynomial function (including quadratics). G.2.1.2.1 Calculate the distance and/or midpoint between two points on a number line or on a coordinate plane. G.2.1.2.2 Relate slope to perpendicularity and/or parallelism (limit to linear algebraic equations). G.2.1.2.3 Use slope, distance, and/or midpoint between two points on a coordinate plane to establish properties of a two-dimensional shape

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Big Idea(s) for 4th nine weeks	Concept(s) of 4th nine weeks	Competencies of 4th nine weeks	Essential Questions for 4th nine weeks
Connection between the equation and the graph of a periodic function can be established and used to describe real world situations. It is possible to verify some complex truths on the coordinate plane using deductive reasoning in combination with distance, midpoint, and slope formulas.	Students will know… ● equations for parallel and perpendicular lines ● equations of circles ● prisms and cylinders ● pyramids and cones ● spheres ● composite figures ● graph sine and cosine functions ● graph functions with vertical, horizontal, periodic and amplitude shifts ● application of circular functions to solve circular motion problems	Students will be able to… ● produce and evaluate equations for parallel and perpendicular lines ● deconstruct equations of circles to understand the various concepts within them ● identify prisms and cylinders and calculate their volume and surface area ● identify pyramids and cones and calculate their volume and surface area ● calculate the volume and surface area of spheres ● construct or deconstruct composite figures and calculate their volume and surface area ● discover the various concepts associated with the graph sine and cosine functions ● graph sinusoidal functions with different amplitude, periods, and shifts ● write equations for sinusoidal functions from their graphs ● apply circular functions to solve circular motion problems	How can the Pythagorean Theorem be used to derive a distance formula for finding distance in a plane and in space? How are geometric solids classified? How can we apply the formulas for prisms, cylinders, pyramids, cones, and spheres to find surface area and volume? How does a change in a linear dimension of a figure affect its surface area or volume? What do the graphs of the Sine and Cosine functions look like and how can we transform them within the coordinate plane? How do we use circular functions to solve real-world situations?

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Unit 9: Coordinate Geometry ● Equations for Parallel and Perpendicular Lines ● Equations of Circles ● Distance and Midpoints on a Plane and in Space	2 weeks (continues from 3rd nine weeks)	CC.2.3.HS.A.10 Translate between the geometric description and the equation for a conic section. CC.2.3.HS.A.11 Apply coordinate geometry to prove simple geometric theorems algebraically.	A2.2.1.1.4 Identify and/or determine the characteristics of an exponential, quadratic, or polynomial function (e.g., intervals of increase/decrease, intercepts, zeros, and asymptotes). A2.2.2.1.1 Create, interpret, and/or use the equation, graph, or table of a polynomial function (including quadratics). G.2.1.2.1 Calculate the distance and/or midpoint between two points on a number line or on a coordinate plane. G.2.1.2.2 Relate slope to perpendicularity and/or parallelism (limit to linear algebraic equations). G.2.1.2.3 Use slope, distance, and/or midpoint between two points on a coordinate plane to establish properties of a two-dimensional shape

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Unit 10: Surface Area and Volume of Polyhedra ● Prisms and Cylinders ● Pyramids and Cones ● Spheres ● Composite Figures	5 weeks	CC.2.3.HS.A.3 Verify and apply geometric theorems as they relate to geometric figures. CC.2.3.HS.A.8 Apply geometric theorems to verify properties of circles. 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.	G.1.2.1.5 Identify and/or use properties of pyramids and prisms. G.1.1.1.4 Identify and/or use the properties of a sphere or cylinder. G.2.3.1.1 Calculate the surface area of prisms, cylinders, cones, pyramids, and/or spheres. Formulas are provided on a reference sheet G.2.3.1.2 Calculate the volume of prisms, cylinders, cones, pyramids, and/or spheres. Formulas are provided on a reference sheet. G.2.3.1.3 Find the measurement of a missing length given the surface area or volume G.2.3.2.1 Describe how a change in the linear dimension of a figure affects its surface area or volume (e.g., How does changing the length of the edge of a cube affect the volume of the cube?).

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Unit 11: Circular Functions and Their Graphs ● Graph sine and cosine functions ● Graph functions with vertical, horizontal, periodic and amplitude shifts ● Application of circular functions to solve circular motion problems	2 weeks	CC.2.3.HS.A.10 Translate between the geometric description and the equation for a conic section.	A2.2.1.1.4 Identify and/or determine the characteristics of an exponential, quadratic, or polynomial function (e.g., intervals of increase/decrease, intercepts, zeros, and asymptotes). A2.2.2.1.1 Create, interpret, and/or use the equation, graph, or table of a polynomial function (including quadratics).

Standards Legend: Essential Important Supplementary

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