Davison Community Schools
ADVISORY CURRICULUM COUNCIL
7-12 Mathematics Courses, CCSS aligned
Phase II, March 14, 2018

Honors Geometry

Course Essential Questions (from Phase I):

1. How do we use mathematics to analyze, describe and communicate mathematical relationships and patterns?
2. A primary goal of these standards is to enable students to achieve ***mathematical proficiency***. There are five components: Conceptual Understanding, Procedural Fluency, Strategic Competence, Adaptive reasoning, and Productive Disposition.

Unit 1: Basics of Geometry and Construction (Chapter 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 11.4,11.5,11.7, 8.8, 8.9)

Essential Question(s)	Essential Understanding(s)
1. How can I use deductive and inductive reasoning in everyday life? 2. How do axioms, definitions, theorems, and counterexamples relate to proofs for vertical angles, parallel lines, and divided line segments? 3. How can we use known angles to find unknown angles?	● Area is the amount of space inside a two-dimensional shape. ● Axioms, definitions, theorems, and counterexamples are used in geometry to solve problems that relate to the real-world.

Curriculum Standards

Geometry – Congruence:

Experiment with transformations in the plane

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. (DOK 1,2)

Prove geometric theorems

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.* (DOK 1,2)

Make geometric constructions

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.* (DOK 1,2)

Geometry – Circles:

Find arc lengths and areas of sectors of circles

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. (DOK 1,2)

Geometry – Modeling with Geometry:

Apply geometric concepts in modeling situations

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).

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) (DOK 1,2,3)	
LEARNING TARGETS	
Knowledge/Content **I Know …**	**Skills/Processes** **I Can …**
● Units of measurement are converted using appropriate proportions. ● Use the correct units to provide solutions to practical problems. ● Apply appropriate unit of measurement concepts to area and volume problems. ● Inductive reasoning uses patterns to draw to conclusions and deductive reasoning uses theorems/postulates to draw conclusions. ● Examples are given of inductive and deductive reasoning in daily life decisions. ● Geometric constructions follow from logical arguments while straightedge and compass constructions are physical. ● Many examples stem from early civilizations (Nile river problem, Napoleon estimating river width, etc…) ● Axioms, definitions, theorems, and counterexamples are used deductively to draw conclusions about vertical angles, parallel lines, and divided line segments. ● We can use the properties of vertical angles, alternate interior angles, alternate exterior angles, corresponding angles, linear pairs, complementary angles, and supplementary angles to solve for unknown angles. ● Point, line, and plane are the three undefined terms in Euclidean Geometry. ● Calculate distance and midpoint of a line segment given its endpoints using the distance/midpoint formula. ● Area of a circle can be calculated by the formula πr^2. Circumference can be calculated by the formula $2\pi r$. ● Pi is the ratio between a circle's circumference divided by its diameter. ● Area is the number of square units that will cover a surface. ●	● Operate in the set of rational and irrational numbers. ● Provide an exact and approximate solution using irrational numbers. ● Convert units in the English system. ● Convert units in the Metric system. ● Convert units between the English and the Metric system. ● Distinguish appropriate units for linear, area, and volume solutions. ● Identify and use inductive and deductive reasoning. ● Give an example of inductive and deductive reasoning used everyday. ● Draw at least one connection between geometric constructions and world history. ● Apply axioms, definitions, theorems, and counter examples to solve basic geometry problems. ● Use the properties of Euclidean geometry to find unknown angles. ● Know the three undefined terms of geometry. ● Find the distance/midpoint of a given line segment. ● Use the formulas for area and circumference of a circle. ● Setup a situation similar to "within a 10-mile radius" using a circle. ● Explain the concept of area and use appropriate formulas to solve problems about area. ●

Unit 2: Mathematical Logic & Reasoning (Chapter 2.1, 2.2, 2.3, 2.4, 2.7, 11.1, 11.2)	
Essential Question(s) 1. How do we use inductive and deductive reasoning? 2. How can I use deductive and inductive reasoning in everyday life?	**Essential Understanding(s)** ● Inductive reasoning uses prior knowledge to draw to conclusions and deductive reasoning uses facts/statistics to draw conclusions. ● Examples are given of inductive and deductive reasoning in daily life decisions.

Curriculum Standards

PREPARATION FOR: Geometry – Congruence:

Experiment with transformations in the plane

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. (DOK 1,2)

Prove geometric theorems

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.* (DOK 1,2,3)

LEARNING TARGETS

Knowledge/Content **I Know …**	**Skills/Processes** **I Can …**
● Inductive reasoning uses prior knowledge to draw to conclusions and deductive reasoning uses facts/statistics to draw conclusions. ● Examples are given of inductive and deductive reasoning in daily life decisions. ● A good definition is reversible, uses clearly understood terms, and is precise. ● A counterexample is where the hypothesis is true and the conclusion is false. A counterexample is used to prove an if-then statement is false. ● Inductive reasoning ● Deductive reasoning ● "Good" definitions ● Counterexample ● Two-Column proof ● Contradiction ● Conclusion ● Necessary and sufficient conditions	● Identify and use inductive and deductive reasoning. ● Give an example of inductive and deductive reasoning used every day. ● Identify or make a good definition. ● Identify or make a counterexample ● Construct two-column proofs ● Construct a proof by contradiction (In-direct Proof). ● Know the necessary conditions for a valid conclusion.

Unit 3: Beginning Geometry (Chapter 3.1 – 3.9)	
Essential Question(s) 1. What theorems can we apply to find missing angles in a triangle? 2. What is a regular polygon? 3. What are the properties of regular polygons?	**Essential Understanding(s)** ● The Triangle Angle Sum Theorem shows there are 180 degrees in all triangles. Exterior angles form linear pairs. Exterior angle measures are equal to the sum of the two remote interior angles. ● A regular polygon has congruent sides and equal interior angle measures. ● Regular polygons have specific names based on number of sides. We can use the ((n-2) * 180)/ n formula for interior angle measures.

Curriculum Standards

Geometry – Congruence:

Experiment with transformations in the plane

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. (DOK 1,2)

Prove geometric theorems

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.* (DOK 1,2)

Geometry – Similarity, Right Triangles, and Trigonometry:

Define trigonometric ratios and solve problems involving right triangles

8. Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems. (DOK 1,2,3)

Geometry – Expressing Geometric Properties with Equations:

Use coordinates to prove simple geometric theorems algebraically

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).* (DOK 1,2)

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). (DOK 1,2)

6. Find the point on a directed line segment between two given points that partitions the segment in a given ratio. (DOK 1,2)

7. Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula. (DOK 1,2)

Geometry – Geometric Measurement & Dimension:

Explain volume formulas and use them to solve problems

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.* (DOK 1,2,3)

Geometry – Modeling with Geometry:
Apply geometric concepts in modeling situations
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). (DOK 1,2)
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) (DOK 1,2,3)

LEARNING TARGETS	
Knowledge/Content **I Know …**	**Skills/Processes** **I Can …**
• A transversal intersects two coplanar lines at different points. • The Triangle Angle Sum Theorem shows there are 180 degrees in all triangles. Exterior angles form linear pairs. Exterior angle measures are equal to the sum of the two remote interior angles. • A regular polygon has congruent sides and equal interior angle measures. • Regular polygons have specific names based on number of sides. We can use the ((n-2) * 180)/ n formula for interior angle measures. • Using the interior angle sum formula we can solve for missing angles in regular polygons. • Corresponding Angles have a sum of 90 degrees • Alternate Interior/Exterior Angles are congruent • Same Side Interior Angles are supplementary • Parallel/Perpendicular Lines • Triangle Angle Sum Theorem • Regular Polygon • Interior Angle Sum • Exterior Angle Sum • N-gon	• Identify a transversal. • Use the Triangle Angle Sum Theorem to solve for missing angles in a triangle. • Know why a polygon is considered regular. • Know the properties of the regular polygons (up to 12 sided.)

Unit 4: Triangle Relationships (Chapter 1.7, 2.6, 6.2, 8.4, 8.6, 11.8, 13.1, 13.2, 13.3, PHB 5.2, 5.3)	
Essential Question(s) 1. How do we classify triangles according to their side lengths and angles? 2. How are the Pythagorean Theorem and its converse related?	**Essential Understanding(s)** ● Statements are negated by reversing the possible true and false outcomes. ● Triangles can be classified based on their side lengths as scalene, isosceles, or equilateral. Triangles can be classified based on their angle measures as acute, obtuse, or right. ● The Pythagorean Theorem uses two given side lengths of a right triangle to find the third. Its converse can prove three given side lengths form a right triangle.

Curriculum Standards

Geometry – Congruence:

Experiment with transformations in the plane

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. (DOK 1,2)

Prove geometric theorems

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.* (DOK 1,2)

Make geometric constructions

13. Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle. (DOK 1,2)

Geometry – Similarity, Right Triangles, and Trigonometry:

Prove theorems involving similarity

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.* (DOK 1,2,3)

Define trigonometric ratios and solve problems involving right triangles

8. Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.

Geometry – Circles:

Understand and apply theorems about circles

3. Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle. (DOK 1,2,3)

Geometry – Expressing Geometric Properties with Equations:

Use coordinates to prove simple geometric theorems algebraically

7. Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula. (DOK 1,2)

Geometry – Modeling with Geometry:

Apply geometric concepts in modeling situations

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). (DOK 1,2,3)

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) (DOK 1,2,3)	
LEARNING TARGETS	
Knowledge/Content **I Know …**	**Skills/Processes** **I Can …**
• Statements are negated by reversing the possible true and false outcomes. • Triangles can be classified based on their side lengths as scalene, isosceles, or equilateral. Triangles can be classified based on their angle measures as acute, obtuse, or right. • The Pythagorean Theorem uses two given side lengths of a right triangle to find the third. Its converse can prove three given side lengths form a right triangle. • The Triangle Side Length Inequality can determine if three given side lengths will form a triangle. • A median connect midpoints of 2 triangle sides and medians intersect in a centroid. • The altitudes connect a vertex perpendicular to the opposite side and intersect in the orthocenter. • Angle bisectors cut each vertex angle in half and intersect in the incenter. • Perpendicular bisectors cut each side in half and form 90 degree angles and they intersect in the circumcenter. • Half of a rectangle/parallelogram is a triangle. A trapezoid is "made up" of rectangles and triangles, which have non-overlapping areas that can be added together. • Negation • Pythagorean Theorem • Median • Altitude • Perpendicular bisector • Angle bisector • Incenter • Centroid • Circumcenter • Orthocenter • Scalene • Isosceles	• Negate a given statement • Classify a triangle based on its side lengths and/or angle measures. • Use the converse of the Pythagorean Theorem to determine if a triangle is right, acute, or obtuse. • Use the Triangle Inequality to determine if three given side lengths will form a triangle. • Use the Pythagorean Theorem to solve for a missing side in a right triangle. • Sketch and use medians, altitudes, angle bisectors, and perpendicular bisectors in triangles. • Explain how the formulas for the area of a triangle, parallelogram, and trapezoid are all derived from the area of a rectangle. o

• Equilateral • Obtuse • Acute • Right • Area of plane figures	

<table>
<tr><th colspan="2">Unit 5: Isometries (Chapter 4.1 – 4.7, 6.1, 6.7)</th></tr>
<tr><td>Essential Question(s)
1. What is a vector?
2. How are translations, reflections, and rotations different/similar?
3. What is an isometry?</td><td>Essential Understanding(s)
● A vector is a direction and magnitude description of movement.
● Vectors can be added/subtracted by the coordinate method or the “tip-to-tail” method.
● Vectors are converted to Cartesian coordinates (and visa-versa) using trigonometry, special right triangles, and the Pythagorean Theorem.
● Translations, reflections, and rotations are all isometries. Translations and rotations preserve orientation while reflections do not.
● An isometry is a distance preserving transformation.</td></tr>
<tr><th colspan="2">Curriculum Standards</th></tr>
<tr><td colspan="2">Geometry – Congruence:
Experiment with transformations in the plane
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). (DOK 1,2)
3. Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself. (DOK 1,2)
4. Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments. (DOK 1,2)
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. (DOK 1,2)

Understand congruence in terms of rigid motions
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. (DOK 1,2)

Geometry – Modeling with Geometry:
Apply geometric concepts in modeling situations
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).
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) (DOK 1,2,3)</td></tr>
<tr><th colspan="2">LEARNING TARGETS</th></tr>
</table>

Knowledge/Content **I Know …**	**Skills/Processes** **I Can …**
• A vector • Resultant vector • Magnitude & Direction • Cartesian Coordinate • "Tip-to-Tail" • Translation • Reflection • Rotation • Orientation • Transformation • Isometry • Image • Pre-Image	• Describe a vector (or resultant vector) in magnitude and direction or a Cartesian coordinate. • Calculate a resultant vector. • Convert vectors from Cartesian coordinates to magnitude and direction (and visa-versa.) • Sketch a vector or sequence of vectors. • Identify a translation, reflection, or rotation and know the properties of each. • Construct the translation/rotation/reflection of a given figure. • Identify transformations as an isometry or not. • Apply the idea of reflections in an "ideal condition" to correctly aim a pool ball or golf ball to "bank" in the direction needed.

<table>
<tr><th colspan="2">Unit 6: Triangle Congruence and Proofs (Chapter 5.1 – 5.6, 7.1, - 7.6)</th></tr>
<tr><td>Essential Question(s)
1. What makes two triangles congruent?
2. How does the idea of transitivity help us prove figures are congruent?
3. What are the five theorems that ensure triangle congruence?
4. How do axioms, theorems, definitions, and counterexamples relate to proofs?
5. What is the logical structure of a proof?</td><td>Essential Understanding(s)
●There are five sufficient conditions for triangle congruence.
●If a figure A is congruent to figure B, and figure B is congruent to figure C, then figure A is congruent to figure C.
●The five theorems that ensure triangle congruence are SSS, SAS, ASA, AAS, and HL.
●Axioms, theorems, definitions, and counterexamples to draw logical conclusions from given information.
●A proof is a logical structure of conclusions following from previous known information.</td></tr>
<tr><th colspan="2">Curriculum Standards</th></tr>
<tr><td colspan="2">Geometry – Congruence:
Understand congruence in terms of rigid motions
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. (DOK 1,2)
8. Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions. (DOK 1,2)

Prove geometric theorems
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. (DOK 1,2,3)

Geometry – Expressing Geometric Properties with Equations:
Use coordinates to prove simple geometric theorems algebraically
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). (DOK 1,2,3)</td></tr>
<tr><th colspan="2">LEARNING TARGETS</th></tr>
<tr><th>Knowledge/Content
I Know …</th><th>Skills/Processes
I Can …</th></tr>
<tr><td>● There are five sufficient conditions for triangle congruence.
● If a figure A is congruent to figure B, and figure B is congruent to figure C, then figure A is congruent to figure C.</td><td>● Prove two triangles are congruent.
● Use transitivity to prove figures are congruent.
● Use the SSS, SAS, ASA, AAS and HL congruence theorems to prove triangles are congruent.</td></tr>
</table>

• The five theorems that ensure triangle congruence are SSS, SAS, ASA, AAS, and HL. • Axioms, theorems, definitions, and counterexamples to draw logical conclusions from given information. • A proof is a logical structure of conclusions following from previous known information. • SSS • SAS • ASA • AAS • HL • Transitivity	

Unit 7: Quadrilaterals (Chapter 6.4, 6.5, 6.6, 7.7, 7.8, 7.9, 11.4)	
Essential Question(s) 1. What are the properties of quadrilaterals in general? 2. What are the properties of the specific quadrilaterals? (parallelogram, trapezoid, isosceles trapezoid, rectangle, rhombus, kite, square) 3. What is the hierarchy of quadrilaterals?	**Essential Understanding(s)** ● Quadrilaterals are 4 sided polygons with an interior angle sum of 360 degrees. ● Parallelograms are quadrilaterals that have 2 pairs of parallel sides. Trapezoids are quadrilaterals that have exactly 1 pair of parallel sides. Isosceles Trapezoids are quadrilaterals that have exactly 1 pair of parallel sides and the non-parallel sides are congruent. A rectangle is a quadrilateral 4 right angles. A rhombus is a quadrilateral with 4 congruent sides. A kite is a quadrilateral with 2 pairs of adjacent sides that are congruent. A square is a quadrilateral with 4 right angles and 4 congruent sides. ● The hierarchy of quadrilaterals relates them based on number of parallel sides and number of congruent sides.

Curriculum Standards

Geometry – Congruence:

Prove geometric theorems

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. (DOK 1,2,3)*

Geometry – Expressing Geometric Properties with Equations:

Use coordinates to prove simple geometric theorems algebraically

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, $\sqrt{3}$) lies on the circle centered at the origin and containing the point (0, 2). (DOK 1,2,3)*

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). *(DOK 1,2,3)*

7. Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula. *(DOK 1,2)*

Geometry – Modeling with Geometry:

Apply geometric concepts in modeling situations

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). *(DOK 1,2)*

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) *(DOK 1,2,3)*

<table>
<tr><th colspan="2">LEARNING TARGETS</th></tr>
<tr><th>Knowledge/Content
I Know …</th><th>Skills/Processes
I Can …</th></tr>
<tr><td>

Using given angle measures and side lengths we can draw conclusions about parallel (or not parallel) lines to help classify quadrilaterals.
Quadrilaterals with a given perpendicular base and height have an area of base * height (parallelogram area formula.) Other quadrilaterals have defined formulas for area derived from the parallelogram area formula.
Half of a rectangle/parallelogram is a triangle. A trapezoid is “made up” of rectangles and triangles, which have non-overlapping areas that can be added together.
Quadrilateral
Parallelogram
Trapezoid
Kite
Rhombus
Square
Rectangle
Hierarchy
Area
Diagonal
Area of plane figures

</td><td>

Solve for a missing angle measure in a quadrilateral.
Know the properties of a __________. (parallelogram, trapezoid, isosceles trapezoid, rectangle, rhombus, kite, square)
Know the hierarchy of quadrilaterals and how they are divided.
Solve for missing angle measures and side lengths in a given quadrilateral.
Know and use the area formulas for all quadrilaterals.
Explain how the formulas for the area of a triangle, parallelogram, and trapezoid are all derived from the area of a rectangle.

</td></tr>
</table>

Unit 8: Polygons (Chapter 5.7, 14.2, 8.1 – 8.9)	
Essential Question(s) 1. How do we (or how does nature) use polygons? 2. How can I find the area of a polygon? 3. How can I use area to calculate theoretical probability? 4. What are the angles in a circle? 5. How can I find the length of an arc or area of a sector? 6. What is π?	**Essential Understanding(s)** ● Polygons are used artistically and structurally by humans and by nature (i.e. Honeycomb.) ● We can divide a polygon into triangles and/or rectangles to calculate its area.
Curriculum Standards	
Geometry – Congruence: **Prove geometric theorems** 13. Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle. (DOK 1,2,3) Geometry – Modeling with Geometry: **Apply geometric concepts in modeling situations** 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). (DOK 1,2) 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) DOK (1,2,3)	
LEARNING TARGETS	
Knowledge/Content **I Know …**	**Skills/Processes** **I Can …**
● By calculating the area of a "success" and the total area, we can calculate a theoretical probability as (Area of success) / (Total Area.) ● Area of a circle can be calculated by the formula πr^2. Circumference can be calculated by the formula $2\pi r$. ● Use the measure of central angles to calculate arc length and sector areas. ● Pi is the ratio between a circle's circumference and its diameter. ● Theoretical probability ● Subdivide ● Arc ● Sector	● Give an example of regular polygons used everyday. ● Solve for missing angle measures in regular polygons. ● Use the appropriate area formula to find the area of a polygon. ● Use area to calculate a theoretical probability.

Unit 9: Similarity (Chapter 3.7, 12.1 – 12.4, 12.6, 12.7)	
Essential Question(s) 1. What is a vector? 2. What are the requirements for two figures to be similar?	**Essential Understanding(s)** ● A vector is a direction and magnitude description of movement. ● For two figures to be similar all corresponding sides are proportionate and all corresponding angles are congruent.
Curriculum Standards	
Geometry – Similarity, Right Triangles, and Trigonometry: **Understand similarity in terms of similarity transformations** 1. Verify experimentally the properties of dilations given by a center and a scale factor: DOK (1,2) a. 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. b. The dilation of a line segment is longer or shorter in the ratio given by the scale factor. 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. DOK (1,2) 3. Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar. DOK (1,2) **Prove theorems involving similarity** 5. Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.	
LEARNING TARGETS	
Knowledge/Content **I Know …**	**Skills/Processes** **I Can …**
● Vectors can be added/subtracted by the coordinate method or the “tip-to-tail” method. ● Vectors are converted to Cartesian coordinates (and visa-versa) using trigonometry, special right triangles, and the Pythagorean Theorem. ● The three theorems that ensure triangle similarity are SSS, SAS, and AA. ● For two figures to be similar all corresponding sides are proportionate and all corresponding angles are congruent. ● A proportion is two ratios that are equivalent. ● We can setup proportions to solve for missing sides in given similar figures. Corresponding angles are congruent.	● Describe a vector (or resultant vector) in magnitude and direction or a Cartesian coordinate. ● Calculate a resultant vector. ● Convert vectors from Cartesian coordinates to magnitude and direction (and visa-versa.) ● Sketch a vector or sequence of vectors. ● Calculate the K ratio ● Use the SSS, SAS, SSA, and HL congruence theorems to prove triangles are congruent. ● Use the SSS, SAS, and AA similarity theorems to prove that triangles are similar. ● Know the requirements for two figures to be similar.

• If we have dilations of scale factor k, then the two figures have an area change factor of k^2 and a volume change factor of k^3. • All dilations result in similar figures. • Dilations preserve angle measure, betweenness, co-linearity, and orientation. • Connecting corresponding vertices of figures/solids under dilation will identify the center at the intersection of those lines. • A vector • Resultant vector • Magnitude & Direction • Cartesian Coordinate • "Tip-to-Tail" • K ratio for similar polygons • SSS • SAS • AA • Dilation • Center • Magnitude • Similar • Betweenness • Orientation • Scale factor • Similarity • Similarity ratio • Proportion	• Recognize the difference between a ratio and a proportion and use them accordingly. • Use the properties of similar figures to solve for missing sides and angles. • Show how all dilations of scale factor k result in similar figures/solids of area factor k^2 and volume factor k^3. • Show that all dilations result in similar figures. • Show that angle measure, betweenness, and co-linearity are preserved by dilations, translations, reflections, and rotations. • Identify the center of dilation.

Unit 10: Special Right Triangles and Trigonometry (Chapter 8.7, 13.4 – 13.6)

Essential Question(s)	**Essential Understanding(s)**
1. How are irrational numbers used in Geometry? 2. How can the Pythagorean Theorem give us templates for special right triangles? 3. What is trigonometry and how is it used?	● Irrational numbers relate to Geometry because they are used to give exact answers to questions about circle area, circumference, trigonometry, measurements/area/volume problems involving right triangles. ● Applying the Pythagorean Theorem to the square and equilateral triangle situations (above) can determine side lengths of the special right triangles. ● Trigonometry is the use established ratios that exist in right triangles.

Curriculum Standards

Geometry – Similarity, Right Triangles, and Trigonometry:

Define trigonometric ratios and solve problems involving right triangles.

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. DOK (1,2)

7. Explain and use the relationship between the sine and cosine of complementary angles. DOK (1,2)

8. Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems. DOK (1,2)

Apply trigonometry to general triangles

9. Derive the formula $A = 1/2\ ab \sin(C)$ for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side. DOK (1,2,3)

10. Prove the Laws of Sines and Cosines and use them to solve problems. DOK (3)

11. Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces).DOK (1)

Geometry – Modeling with Geometry:

Apply geometric concepts in modeling situations

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). DOK (1,2)

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) DOK (1,2,3)

LEARNING TARGETS

Knowledge/Content **I Know …**	**Skills/Processes** **I Can …**

● Irrational numbers relate to Geometry because they are used to give exact answers to questions about circle area, circumference, trigonometry, measurements/area/volume problems involving right triangles. ● A vector is a direction and magnitude description of movement. ● Vectors can be added/subtracted by the coordinate method or the "tip-to-tail" method. ● Vectors are converted to Cartesian coordinates (and visa-versa) using trigonometry, special right triangles, and the Pythagorean Theorem. ● Cutting a square in half results in a 45-45-90 triangle. ● Constructing the altitude of an equilateral triangle results in two 30-60-90 triangles. ● Applying the Pythagorean Theorem to the square and equilateral triangle situations (above) can determine side lengths of the special right triangles. ● Trigonometry is the use established ratios that exist in right triangles. ● The charted trigonometric ratios of sine, cosine, and tangent are used to solve for missing side lengths and angles in right triangles without using the Pythagorean Theorem. ● We can use trigonometric ratios and setup right triangles to solve real-world problems such as the height of a building using its shadow. ● The Law of Sines is a relationship between the angles of *any* triangle and their opposite sides. The Law of Cosines is a method of solving for the opposite side of *any* triangle given two sides and the angle between – or – solving for a missing angle when all three side lengths are given. ● The formula ½ * abSin C can be used to find triangle area given two sides and their included angle. ● Irrational Numbers ● Rational Numbers ● A vector ● Resultant vector ● Magnitude & Direction	● Operate in the set of rational and irrational numbers. ● Provide an exact and approximate solution using irrational numbers. ● Describe a vector (or resultant vector) in magnitude and direction or a Cartesian coordinate. ● Calculate a resultant vector. ● Convert vectors from Cartesian coordinates to magnitude and direction (and visa-versa.) ● Sketch a vector or sequence of vectors. ● Show how a 45-45-90 right triangle is derived from a square. ● Show how a 30-60-90 right triangle is derived from an equilateral triangle. ● Use the templates for special right triangles to solve for missing side lengths. ● Setup the proper trigonometry ratio for a given situation. ● Know the sine, cosine, and tangent ratios. ● Use the trigonometry ratios to solve for missing sides and angles in right triangles. ● Use trigonometry in real-world applications. ● Know and use the Law of Sines and Law of Cosines to solve practical problems.

• Cartesian Coordinate • Special right triangles • “Tip-to-Tail” • Trigonometry • Sine • Cosine • Tangent • Law of Sines • Law of Cosines • Triangle Area formula with Sine • Ratio	

<table>
<tr><th colspan="2">Unit 11: Solids (Chapter 9.2, 9.3, 9.6, 9.9, 9.10, 10.1 – 10.7, PHB 1.2, 11.1))</th></tr>
<tr><td>Essential Question(s)
1. How do we name solids?
2. What is volume?
3. What is an isometric drawing?
4. What is a cross section?</td><td>Essential Understanding(s)
● We name in two ways: The first part comes from the shape of the base. Secondly, a solid with two parallel bases is a prism while a solid with one base extended to a point (vertex) is a pyramid.
● Volume is the number of cubic units that will “fill up” a solid.
● A cross section is the 2-dimensional intersection of a plane and a solid.</td></tr>
<tr><th colspan="2">Curriculum Standards</th></tr>
<tr><td colspan="2">Geometry – Geometric Measurement & Dimension:
Explain volume formulas and use them to solve problems
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. DOK (1,2)
2. Give an informal argument using Cavalieri’s principle for the formulas for the volume of a sphere and other solid figures. DOK (1,2)
3. Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems. DOK (1,2)

Visualize relationships between two-dimensional and three-dimensional objects
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. DOK (1,2)

Geometry – Modeling with Geometry:
Apply geometric concepts in modeling situations

1. Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). DOK (1,2,3)</td></tr>
<tr><th colspan="2">LEARNING TARGETS</th></tr>
<tr><th>Knowledge/Content
I Know …</th><th>Skills/Processes
I Can …</th></tr>
<tr><td>● Irrational numbers relate to Geometry because they are used to give exact answers to questions about circle area, circumference, trigonometry, measurements/area/volume problems involving right triangles.</td><td>● Operate in the set of rational and irrational numbers.
● Provide an exact and approximate solution using irrational numbers.
● Distinguish appropriate units for linear, area, and volume
● solutions.</td></tr>
</table>

• A regular solid has a regular polygon for a base. A right solid has lateral faces that are perpendicular to the base. • We name in two ways: The first part comes from the shape of the base. Secondly, a solid with two parallel bases is a prism while a solid with one base extended to a point (vertex) is a pyramid. • Prisms have rectangular lateral faces while pyramids have triangle lateral faces. • Right prisms have number of symmetry planes equal to the number of lines of symmetry in the base plus 1. Right pyramids have planes of symmetry equal to number of lines of symmetry in the base. • Surface area of a sphere is calculated by the formula $4\pi r^2$. Volume of a sphere is calculated by the formula $4/3\pi r^3$. • Volume is the number of cubic units that will "fill up" a solid. • Pyramids have exactly 1/3 the volume of a prism with congruent base area and height. • A solid is a 3 dimensional figure made up of plane figures joined at one edge. • An isometric drawing is a 3-dimensional drawing on 2-dimensional paper showing depth by skewing lines. • A net is a drawing of a solid "folded out flat." • A cross section is the 2-dimensional intersection of a plane and a solid. • When revolving around a line, circular solids are made. • Irrational Numbers • Rational Numbers • Surface area • Volume • Pyramid • Prism • Cone • Cylinder • Hemisphere • Sphere • Symmetry of solids • Cubic Units • Isometric drawing • Net • Cross section	• Know why some solids are considered regular and/or right. • Name a given solid. • Know the properties of prisms and pyramids. • Find the number of symmetry planes in a solid. • Find surface area of a given right solid. • Find the volume of a given solid. • Explain the concept of volume and use appropriate formulas to solve problems about volume. • Know that all pyramids have 1/3 the volume of a prism with a congruent base. • Show the 2-D polygons included in a 3-D solid. • Make/read an isometric drawing. • Make a net from a solid (and make a solid from a net.)

• Revolve	

Unit 12: Further Work with Circles (Chapter 14.1, 14.3 – 14.7, 11.6)	
Essential Question(s) 1. What is a chord? 2. What is a tangent? 3. What is a secant?	**Essential Understanding(s)** ● A chord is a segment with endpoints on the circle. ● A tangent is a line that intersects the circle in exactly one point. It forms a 90 degree angle at the point of tangency when connected to radius. ● A line that intersects a circle in exactly 2 points is a secant.

Curriculum Standards

Geometry – Circles:

Understand and apply theorems about circles

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.* DOK (1,2)
4. Construct a tangent line from a point outside a given circle to the circle. DOK (1,2)

Geometry – Expressing Geometric Properties with Equations:

Translate between the geometric description and the equation for a conic section

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. DOK (1,2)
2. Derive the equation of a parabola given a focus and directrix. DOK (1,2)
3. Derive the equations of ellipses and hyperbolas given the foci, using the fact that the sum or difference of distances from the foci is constant. DOK (1,2)

Geometry – Modeling with Geometry:

Apply geometric concepts in modeling situations

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). DOK (1,2)
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) DOK (1,2)

LEARNING TARGETS

Knowledge/Content **I Know …**	**Skills/Processes** **I Can …**
● A circle contains central angles that sum to 360 degrees; there are inscribed angles, and angles formed by 2 chords. ● A chord is a segment with endpoints on the circle. ● An inscribed angle has a vertex on the circle formed by chords.	● Use properties of angles in a circle to find missing measures ● Recognize a chord and use its properties to solve for missing lengths. ● Recognize an inscribed angle and use its properties to solve for missing lengths and angles.

• A tangent is a line that intersects the circle in exactly one point. It forms a 90 degree angle at the point of tangency when connected to radius. • A line that intersects a circle in exactly 2 points is a secant. • Chord • Tangent • Central angle • Inscribed angle • Secant	• Recognize a tangent and use its properties to solve for missing lengths and angles. • Recognize a secant and use its properties to solve for missing lengths and angles.