High School (9-12)
Gateway High School
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Gateway School District
Curriculum Map

Curriculum Map: Mathematics

Course: Geometry
Grade(s): 9-12

Unit 1: Tools of Geometry

Brief Summary of Unit
Using inductive reasoning to formulate conjectures will promote an intuitive understanding of principles that are later presented as postulates and theorems. Coordinate geometry will be used throughout the course to solve problems and complete proofs. The concepts of perimeter, circumference, and area reviewed here will be studied in more detail in later chapters. Students are asked to identify various figures and express the relationship presented in postulates. Memorizing definitions and postulates may be counterproductive if students are able only to repeat them but are unable to apply them to problem situations. Concept recognition and application are the key skills.

Stage One—Desired Results	
Established Goals: (Standards of Learning, Content Standards) 1. Complete patterns using inductive reasoning and make conjectures 2. Name basic geometric figures and identify types of angles 3. Find the length of segments using the ruler and segment addition postulates 4. Find the measure of unknown angles using the angle addition postulate 5. Find the distance or midpoint between 2 points using the distance or midpoint formula 6. Find perimeter and area of squares, rectangles, and circles using the formulas	
Understandings: 1. **Lengths of segments can be found using the ruler postulate or the distance formula depending on where the segment is (space or coordinate plane).** 2. **Other formulas and properties can help in finding the perimeter and area of various figures.**	**Essential Questions:** **1.** What is the process of using inductive reasoning? **2.** What are the basic terms of geometry? **3.** What are the relationships between the basic building blocks of geometry? **4.** What are segments and rays and parallel lines?

3. **Geometry is a mathematical system built on accepted facts, basic terms, and definitions.** 4. **Special angle pairs can be used to identify geometric relationships and to find angle measures.** 5. **Formulas can be used to find the midpoint and length of any segment in the coordinate plane.** 6. **Perimeter and area are two different ways of measuring the size of geometric figures.**	**5.** What is the distance between two points in a coordinate plane? **6.** What is the midpoint of two points in a coordinate plane? **7.** What is the perimeter of a geometric figure? **8.** What is the area of a geometric figure?
Stage Two—Assessment Evidence	
Performance Tasks:	
Other Evidence: :(quizzes, tests and so on)	
Stage Three—Learning Plan	

Unit 2: Reasoning and Proof

Brief Summary of Unit
Most of this chapter emphasizes hypotheses and conclusions in deductive reasoning. Students will apply the basic rules of deduction to solve algebraic equations, justifying each step. The chapter culminates in simple paragraph proofs involving intuitively obvious theorems about angle relationships. This chapter sets the stage for subsequent proofs by presenting proofs as convincing arguments, similar to the justifications students regularly employ in everyday life.
Stage One—Desired Results
Established Goals: (Standards of Learning, Content Standards) 1. Recognize and write conditional statements and biconditional statements 2. Write the converse of conditional statements 3. Recognize good definitions 4. Connect reasoning in algebra and geometry 5. Identify angle pairs (vertical, adjacent, supplementary and complementary angles)

Understandings:	**Essential Questions:**
1. Hypothesis and conclusions and two key parts of conditional, converse and biconditional statements. **2. Definitions in mathematics must be biconditional statements** **3. Proofs are simply convincing logical arguments in which the specified conclusion necessarily follows from known facts.**	**1.** How do you write a good definition? **2.** How do you write a conditional, converse and biconditional statement?

	3. How do you justify steps in an algebraic equation?

Stage Two—Assessment Evidence

Performance Tasks:

Other Evidence: :(quizzes, tests and so on)

Stage Three—Learning Plan

Unit 3: Parallel & Perpendicular Lines

Brief Summary of Unit

Students will build on their knowledge of angles to prove and use properties of parallel lines. They will use these properties to prove that the sum of the measures of the angles in a triangle is 180, and to find the formula for the sum of the angle measures in a polygon having *n* sides. Students will learn the relationship that different forms of linear equations have with the slopes of parallel and perpendicular lines.

Stage One—Desired Results

Established Goals: (Standards of Learning, Content Standards)

6. Graph linear equations / functions
7. Write linear equations using various given information
8. Make predictions from linear models
9. Write linear equation of parallel and perpendicular lines.
10. Identify the different special pairs of angles formed by two lines and a transversal.
11. (alternate interior, alternate exterior, same-side interior, corresponding, vertical, linear pairs)

Understandings:	**Essential Questions:**
4. Linear equations represent and model real world situations. **5. Comparing the slopes of two lines can show whether the lines are parallel or perpendicular.** **6. A line can be graphed and its equation written when certain facts**	**4.** How do you prove that two lines are parallel or perpendicular?

about the line, such as its slope and a point on a line are known. **7. Predictions can be made about real world situations using linear relationships.** **8. Not all lines and not all planes intersect.** **9. When a line intersects two or more lines, the angles formed at intersection points create special angle pairs.** **10. Certain angle pairs can be used to decide whether two lines are parallel.** **11. The relationships of two lines to a third line can be used to decide whether two lines are parallel or perpendicular to each other.**	**5.** How do you write an equation of a line in the coordinate plane?

Stage Two—Assessment Evidence

Performance Tasks:

Other Evidence: :(quizzes, tests and so on)

Stage Three—Learning Plan

Unit 4: Congruent Triangles

Brief Summary of Unit

Students will use their knowledge of corresponding parts of congruent polygons to study and apply postulates and theorems related to triangle congruence. These included SSS, SAS, ASA, AAS, and HL, and the Isosceles Triangle Theorem.

Stage One—Desired Results

Established Goals: (Standards of Learning, Content Standards)

1. Identify congruent polygons and name the corresponding parts
2. Identify congruent triangles using the congruence postulates (SSS, SAS, ASA, AAS), HL Theorem
3. Use CPCTC to identify that corresponding parts of congruent triangles are congruent
4. Identify an isosceles triangle using the theorem and its converse
5. Find unknown parts of triangles using the isosceles triangle theorem and its converse

Understandings:	Essential Questions:
1. Various properties and theorems can be used in addition to the congruence postulates and theorems in order to identify congruent polygons. **2. Comparing the corresponding parts of two figures can show whether the figures are congruent.** **3. Two triangles can be proven to be congruent without having to show that all corresponding parts are congruent.** **4. Unknown parts of triangles can be found using CPCTC, properties, and theorems of triangles.** **5. The angles and sides of isosceles and equilateral triangles have special relationships.**	**1.** How do you identify corresponding parts of congruent triangles? **2.** How do you show that two triangles are congruent? **3.** How can you tell whether a triangle is isosceles or equilateral?

Stage Two—Assessment Evidence

Performance Tasks:

Other Evidence: :(quizzes, tests and so on)

Stage Three—Learning Plan

Unit 5: Triangle Relationships

Brief Summary of Unit

This chapter will focus on presenting and proving relationships within a triangle that students can, in turn, use to prove relationships within other figures. Some of the relationships involve midsegments, angle bisectors, perpendicular bisectors, altitudes, medians, and inequalities.

Stage One—Desired Results

Established Goals: (Standards of Learning, Content Standards)

1. Use properties of midsegments to solve problems
2. Use properties of perpendicular bisectors and angle bisectors
3. Identify properties of perpendicular bisectors, angle bisectors, medians, and altitudes
4. Use inequalities involving angles of triangles
5. Use inequalities involving sides of triangles

Understandings:	Essential Questions:
	1. How do you use coordinate geometry to find relationships within triangles?

1. **Perpendicular bisectors, angle bisectors, medians, and altitudes have similarities and differences.** 2. **The measures of the angles of a triangle are related to the lengths of the opposite sides.** 3. **Properties and theorems of midsegments, perpendicular bisectors, angle bisectors, medians, and altitudes can be used to find unknown lengths and angle measures in triangles.** 4. **In triangles that have two pairs of congruent sides, there is a relationship between the included angles and the third pair of sides.**	2. How do you solve problems that involve measurements of triangles? 3. How do you write indirect proofs?

Stage Two—Assessment Evidence
Performance Tasks:
Other Evidence: :(quizzes, tests and so on)
Stage Three—Learning Plan

Unit 6: Quadrilaterals

Brief Summary of Unit
Student apply triangle relationships, algebraic techniques, and methods of proof to the study of quadrilaterals. A study of parallelograms leads to an analysis of special parallelograms (rhombuses, rectangles, and squares), trapezoids, and kites.

Stage One—Desired Results	
Established Goals: (Standards of Learning, Content Standards) 1. Define and classify special types of quadrilaterals 2. Use relationships among sides and among angles of parallelograms 3. Use relationships involving diagonals of parallelograms or transversals 4. Determine whether a quadrilateral is a parallelogram and specify a type of parallelogram 5. Use properties of diagonals of rhombuses and rectangles and properties of trapezoids and kites.	
Understandings: 1. **Given information can be used to classify quadrilaterals.** 2. **Parallelograms have special properties regarding their sides, angles, and diagonals.**	**Essential Questions:** 1. How can you find the sum of the measures of polygon angles? 2. How can you classify quadrilaterals?

3. **If a quadrilateral's sides, angles, and diagonals have certain properties, it can be shown that the quadrilateral is a parallelogram.** 4. **Variables can be used to name the coordinates of a figure in the coordinate plane. This allows relationships to be shown to be true for a general case.**	3. How can you use coordinate geometry to prove general relationships?
Stage Two—Assessment Evidence	
Performance Tasks:	
Other Evidence: :(quizzes, tests and so on)	
Stage Three—Learning Plan	

Unit 7: Area

Brief Summary of Unit	
Students will use concepts from their study of triangles and quadrilaterals to develop area formulas, first for quadrilaterals and then for circles. Special area formulas will be derived for parallelograms, rhombuses, trapezoids, and kites. Students will consider arcs and sectors of circles and apply their areas to geometric probability.	
Stage One—Desired Results	
Established Goals: (Standards of Learning, Content Standards) 1. Calculate the area of various polygons 2. Calculate the area of a circle 3. Find missing dimensions of diagrams using formulas 4. Calculate geometric probability given a figure 5. Calculate lengths of arcs in circles 6. Calculate areas of sectors in circles	
Understandings: 1. **Missing parts of right triangles can be found using the Pythagorean Theorem or properties of special right triangles.** 2. **In some cases, dimensions required to calculate area must be derived using other formulas.** 3. **Geometric probability is used to make decisions about complex problems.**	**Essential Questions:** **1.** How do you find the area of polygon? **2.** How do you find the circumference of a circle? **3.** How do you find the area of a circle? **4.** How do perimeters and areas of similar polygons compare?

4. **Ratios can be used to compare the perimeters and areas of similar figures.** 5. **The area formula for a rectangle can be used to derive the area formulas for triangles, parallelograms, trapezoids, kites, and circles..**	

Stage Two—Assessment Evidence
Performance Tasks:
Other Evidence: :(quizzes, tests and so on)

Stage Three—Learning Plan

Unit 8 <u>Similarity</u>

Brief Summary of Unit
Students will learn properties of ratios and proportions that are needed to study similarity. They will learn ways to prove triangles similar using the definition of similar polygons. Students will find proportional relationships formed by parallel segments, and by angle bisectors within triangles as well as by altitudes to the hypotenuse in right triangles. Students will examine ratios of the perimeters and the areas of similar figures.

Stage One—Desired Results	
Established Goals: (Standards of Learning, Content Standards) 1. Write ratios of similar figures 2. Set up and solve proportions of similar figures using the properties of proportions 3. Find unknown lengths using indirect measurement 4. Solve proportions using theorems of similar triangles 5. Find the ratio of similarity, perimeters, and area using the others 6. Use the AA, SAS, SSS similarity postulates to show triangles are similar.	
Understandings: 1. **Ratios and proportions can be used to solve complex problems in such things as scale drawings and indirect measurement.** 2. **The Golden Ratio appears in everyday life in many common occurrences.**	**Essential Questions:** 1. How do you show two triangles are similar? 2. How do you identify corresponding parts of similar triangles?

3. **The ratio of similarity in similar figures can be used to find unknown lengths, the perimeter ratio (perimeter), and area ratio (area).** 4. **Ratios and proportions can be used to decide whether two polygons are similar and to find unknown side lengths of similar figures.** 5. **Drawing in the altitude to the hypotenuse of a right triangle forms three pairs of similar right triangles.** 6. **When two or more parallel lines intersect other lines, proportional segments are formed.**	

Stage Two—Assessment Evidence
Performance Tasks:
Other Evidence: :(quizzes, tests and so on)
Stage Three—Learning Plan

Unit 9 Surface Area & Volume

Brief Summary of Unit
Students apply surface area and volume formulas for prisms, cylinders, pyramids, cones and spheres.

Stage One—Desired Results	
Established Goals: (Standards of Learning, Content Standards) 1. Identify the parts on a polyhedron 2. Find unknown number of faces, edges, or vertices using Euler's Formula 3. Find the surface area and volume of prisms, cylinders, pyramids, cones, and spheres 4. Find the volume of composite figures 5. Find the slant height or height in pyramids and cones using the Pythagorean Theorem	
Understandings: 1. **Surface area and volume of three-dimensional objects can be used to solve complex problems.** 2. **A three-dimensional figure can be analyzed by describing the**	**Essential Questions:** 1. How can you determine the intersection of solid and a plane? 2. How do you find the surface area and volume of a solid?

relationships among its vertices, edges, and faces. **3. The surface area of a three-dimensional figure is equal to the sum of the areas of each surface of the figure.** **4. The volume of a pyramid is related to the volume of a prism with the same base and height.** **5. Ratios can be used to compare the areas and volumes of similar solids.**	**3.** How do the surface areas and volumes of similar solids compare?
Stage Two—Assessment Evidence	
Performance Tasks:	
Other Evidence: :(quizzes, tests and so on)	
Stage Three—Learning Plan	

Unit 10 Circles

Brief Summary of Unit	
Students will build on their knowledge of circles by studying properties of tangents, secants, chords, and arcs. They will study angles formed by chords, tangents, and secants, their relationships to intercepted arcs, and the relationship among segments of intersecting chords, tangents and secants.	
Stage One—Desired Results	
Established Goals: (Standards of Learning, Content Standards) 1. Tangent Theorem and its converse 2. Find the missing lengths of a triangle that is circumscribed about the circle 3. Find the distance from the center of the circle to the chord or the length of a chord using the theorems 4. Find missing angle and arc measures using the inscribed angle theorem 5. Find missing segment lengths using the theorem about segments in circles	
Understandings: **1. Missing angle measures, arc measures, and segment lengths can be found using the various theorems.** **2. A radius of a circle and the tangent that intersects the endpoint of the radius on the circle have a special relationship.** **3. Information about congruent parts of a circle (or congruent**	**Essential Questions:** **1.** How can you prove relationships between angles and arcs in a circle? **2.** When lines intersect a circle, or within a circle, how do you find the measures of resulting angles, arcs, and segments? **3.** How do you find the equation of a circle in the coordinate plane?

circles) can be used to find information about other parts of the circle (or circles). **4. The information of the equation of a circle allows the circle to be graphed. The equation of a circle can be written if its center and radius are known.**	
Stage Two—Assessment Evidence	
Performance Tasks:	
Other Evidence: :(quizzes, tests and so on)	
Stage Three—Learning Plan	