CARNEGIE LEARNING

1	Tools of Geometry								
MATHia Unit	**MATHia Workspace**	**Overview**	**CCSS**	**Problem Solving**	**Animation**	**Worked Examples**	**Classification Tools**	**Explore**
Lines, Rays, Segments, and Angles	Naming Lines, Rays, Segments, and Angles	Students practice identifying geometric entities from their names, writing names for various geometric entities, and identifying when an entity has multiple possible names.	G.CO.A.1	●				
	Working with Measures of Segments and Angles	Students practice writing measure statements for segments and angles using appropriate notation.	G.CO.A.1	●				
Distances on the Coordinate Plane	Deriving the Distance Formula	Students answer questions related to an animation demonstrating how the Distance Formula is derived using the Pythagorean Theorem. Students then use interactive Explore Tools and the Distance Formula to solve mathematical problems about the distances between two points on the coordinate plane.	G.GPE.B.7		●			●
	Calculating Distances using the Distance Formula	Students use the distance formula to determine distances between points.	G.GPE.B.7	●				
	Partitioning Segments Proportionately	Students determine the coordinates of points that partition given line segments into different ratios.	G.GPE.B.6	●				
	Calculating Perimeter and Area using the Distributive Property	Students use the distance formula to determine perimeters and areas of different shapes.	G.GPE.B.7	●				
Parallel and Perpendicular Lines	Introduction to Parallel and Perpendicular Lines	Students answer questions related to an animation demonstrating that the rotation of a point (x, y) 90 degrees counterclockwise on the coordinate plane is given by the coordinates (-y, x). Students answer questions to discover that the slopes of perpendicular lines are negative reciprocals of each other. Students then use graphs of functions to understand that the slopes of parallel lines are equal. Finally, students use their knowledge of parallel and perpendicular lines as graphs of functions to solve problems in a real-world context.	G.GPE.B.5		●			
	Modeling Parallel and Perpendicular Lines	Students determine the equations of lines parallel or perpendicular to given lines.	G.GPE.B.5	●				
Angle Properties	Calculating and Justifying Angle Measures	Calculate the measure of the sought angle by following a prescribed path of angle measures.	G.CO.C.9	●				
	Calculating Angle Measures	Calculate the measure of the sought angle by following an open solution path.	G.CP.C.9	●				

2 Segments, Angles, and Lines

MATHia Unit	MATHia Workspace	Overview	CCSS	Problem Solving	Animation	Worked Examples	Classification Tools	Explore
Introduction to Proofs with Segments and Angles	Introduction to Proofs	Students are introduced to proof by answering questions related to two animations demonstrating the Triangle Sum Theorem and the Vertical Angle Theorem.	G.CO.A.1		●			
	Completing Measure Proofs	Students complete the steps in a scaffolded proof, supplying appropriate statements and reasons to prove a variety of fundamental angle and segment theorems.	G.CO.C	●				
	Connecting Steps in Angle Proofs	Students arrange the steps of more complex proofs into logical order.	G.CO.C.9	●				
	Using Angle Theorems	Students use a wide variety of postulates, properties, and theorems to solve mathematical problems related to angles in geometrical figures and diagrams. The Congruent Complements Theorem, Congruent Supplements Theorem, Angle Addition Postulate, angle bisection, Vertical Angle Theorem, and the Transitive Property are all discussed.	G.CO.C.9			●		
Lines Cut by a Transversal	Classifying Angles Formed by Transversals	Students follow worked examples and complete sorting activities as they learn to identify angles and angle pairs formed by lines cut by a transversal.	G.CO.C.9			●	●	
	Calculating Angle Measures Formed by Transversals	Calculate the measure of the sought angle by using angle relationships formed by two lines cut by a single transversal.	G.CO.C.9	●				
	Calculating Angles Formed by Multiple Transversals	Calculate the measure of the sought angle by using angle relationships formed by three parallel lines cut by a single transversal or two parallel lines cut by two transversals.	G.CO.C.9	●				
Parallel Lines Theorems	Proving Parallel Lines Theorems	Students apply basic angle theorems to prove the alternate interior, alternate exterior, same side interior, and side side exterior parallel line theorems.	G.CO.C.9	●				
	Proving the Converses of Parallel Lines Theorems	Students apply basic angle theorems to prove the alternate interior converse, alternate exterior converse, same side interior converse, and side side exterior converse parallel line theorems.	G.CO.C.9	●				
	Using Parallel Lines Theorems	Students apply parallel line theorems to prove relationships between elements in more complex diagrams.	G.CO.C.9	●				

3	Three-Dimensional Objects							
MATHia Unit	**MATHia Workspace**	**Overview**	**CCSS**	**Problem Solving**	**Animation**	**Worked Examples**	**Classification Tools**	**Explore**
Three-Dimensional Shapes	Visualizing Cross Sections of Three-Dimensional Shapes	Students watch an animation showing two different intersections of a plane and a solid. They then describe cross-sections of different solids given the intersection of a plane. Finally, students identify the solid from a given cross-section.	G.GMD.B.4		●			
	Creating Three-Dimensional Shapes from Two-Dimensional Figures	Students rotate two-dimensional figures about an axis to create three-dimensional shapes and relate the dimensions of the plane figure to the solid. They then identify vocabulary highlighting the difference between right and oblique solids. Finally students create solids by stacking congruent or similar shapes.	G.GMD.B.4			●		
Volume	Calculating Volume of Cylinders	Students will use mathematical and real-world objects to determine the volume of cylinders.	G.GMD.A.3	●				
	Calculating Volume of Pyramids	Students calculate the volume of pyramids in mathematical and real-world contexts using given measurements.	G.GMD.A.3	●				
	Calculating Volume of Cones	Students will use mathematical and real-world objects to determine the volume of cones.	G.GMD.A.3	●				
	Calculating Volume of Spheres	Students will use mathematical and real-world objects to determine the volume of spheres.	G.GMD.A.3	●				

4 Congruence

MATHia Unit	MATHia Workspace	Overview	CCSS	Problem Solving	Animation	Worked Examples	Classification Tools	Explore
Rigid Motion	Developing Definitions of Rigid Motions	Students learn the formal definitions for translation, reflection, and rotation as rigid motions. Students then apply these formal definitions to other situations involving mathematical transformations.	G.CO.A.4			●		
	Rotations and Reflections on the Plane	Students apply the formal definitions of reflection and rotation to identify rigid motions that carry rectangles, non-rectangular parallelograms, trapezoids, and regular polygons onto themselves. Students learn that figures which can be reflected or rotated onto themselves have reflectional or rotational symmetry.	G.CO.A.3			●		
	Specifying a Sequence of Transformations	Students will select multiple transformations from translation, rotation, dilation, and reflection about any line to match a pre-image to a target image, given a reference point.	G.CO.A.5	●				
Triangle Congruence	Introduction to Triangle Congruence	Students practice writing and identifying triangle congruency statements, as well as corresponding sides and angles, given a diagram of congruent triangles or a triangle congruency statement. They then watch a video that introduces the four theorems of triangle congruence--SAS, SSS, AAS, and ASA. Finally, students use a sorting tool to match images of pairs of triangles with congruency markings to the theorem by which they are proven congruent.	G.CO.B.7 G.CO.B8		●	●	●	
	Proving Triangles Congruent using SAS and SSS	Students prove triangles congruent using the side-angle-side and side-side-side congruence theorems in a variety of diagrams.	G.CO.C.10	●				
	Proving Triangles Congruent using AAS and ASA	Students prove triangles congruent using the angle-angle-side and angle-side-angle congruence theorems in a variety of diagrams.	G.CO.C.10	●				
	Proving Triangles Congruent using HL and HA	Students prove triangles congruent using the hypotenuse-leg and hypotenuse-angle congruence theorems in a variety of diagrams.	G.CO.C.10	●				
	Using Triangle Congruence	Students use SSS, SAS, AAS, and ASA congruence theorems to determine whether two triangles are congruent. They then prove two triangle are congruent by the same group of theorems when given statements about the geometric figures shown. Finally, students complete a two-column proof to identify the reasons for given congruency statements.	G.CO.C.10			●		
	Proving Theorems using Congruent Triangles	Students using congruent triangle theorems to prove the perpendicular bisector theorem, isosceles triangle base angle theorem and its converse, and the angle bisector theorem.	G.CO.C.10	●				
Triangle Theorems	Proving Triangle Theorems	Students apply previously proved theorems to prove the triangle sum and exterior angle theorems.	G.CO.C.10	●				
	Using Triangle Theorems	Students apply angle, parallel line, and triangle theorems to prove relationships between elements in more complex diagrams.	G.CO.C.10	●				

5	Similarity, Right Triangles, and Trigonometry			Problem Solving	Animation	Worked Examples	Classification Tools	Explore
MATHia Unit	**MATHia Workspace**	**Overview**	**CCSS**					
Similar Triangles	Understanding Similarity	Students watch an animation which demonstrates that when figures are similar, a series of rigid motions and dilations can transform one figure on top of the other to match exactly. Students recall that similar figures have corresponding side lengths that are proportional and congruent corresponding angles. Students identify similar figures and determine corresponding side lengths and corresponding angle measures, given similar figures.	G.SRT.A.2		●	●		
	Calculating Corresponding Parts of Similar Triangles	Students calculate corresponding parts of similar triangles, both in context and out of context.	G.SRT.B.5	●				
	Proofs using Similar Triangles	Students use the AA similarity postulate, SSS similarity theorem, and SAS similarity theorem in order to prove the parallel segment proportionality theorem and triangle midsegment theorem.	G.SRT.B.4	●				
Special Right Triangles	Introduction to Special Right Triangles		G.SRT.B.4			●		
	Calculating the Lengths of Sides of Special Right Triangles	For a 30-60-90 or 45-45-90 degree triangle with an expression for one leg given as x and the measure of one side given, determine expressions and measures for each side.	G.SRT.B.4 G.SRT.B.5	●				
Trigonometric Ratios	Introduction to Trigonometric Ratios	Students use similar triangles to define and understand the trigonometric ratios sine, cosine, and tangent. Students then explore the sine, cosine, and tangent and estimating these ratios using an interactive Explore Tool with a unit circle, including describing the ratios as percents of different lengths. Students solve problems in various contexts using the trigonometric ratios and the Explore Tool.	G.SRT.C.6			●		●
	Relating Sines and Cosines of Complementary Angles	Students use the interactive unit circle trig ratio Explore Tool to explore complementary angles and to see that the sine of an angle is equal to the cosine of its complement, and vice versa.	G.SRT.C.7					●
Right Triangles and Trigonometric Ratios	Using One Trigonometric Ratio to Solve Problems	Students calculate the measures of sides and angles of a right triangle using the trigonometric ratios, the Pythagorean Theorem, and/or the Triangle Sum Theorem in both contextual and abstract problems.	G.SRT.C.8	●				
	Using Multiple Trigonometric Ratios to Solve Problems	Students calculate the measures of sides and angles of two right triangles that share a side using trigonometric ratios, the Pythagorean Theorem, and/or the Triangle Sum Theorem in both contextual and abstract problems.	G.SRT.C.8	●				

6	Parallelograms			Problem Solving	Animation	Worked Examples	Classification Tools	Explore
MATHia Unit	**MATHia Workspace**	**Overview**	**CCSS**					
Properties of Parallelograms	Understanding Parallelograms	Students are given the properties of parallelograms and use the information to determine the side parallel to a given side of a parallelogram as well as the sides or angles that are congruent to a given side or angle of a parallelogram. They then determine a missing statement to prove a quadrilateral is a parallelogram using the Parallelogram/Congruent-Parallel Side Theorem. Finally, students identify quadrilaterals by properties of their sides, angles, and diagonals.	G.CO.C.11			●		
	Properties of Parallelograms	Students will be given a diagram of a parallelogram with the measures of some sides, diagonals and/or angles given, and asked to determine the measures of the remaining sides/diagonals/angles.	G.CO.C.11	●				
Parallelogram Proofs	Proofs about Parallelograms	Students will be given a diagram of a parallelogram with the measures of some sides, diagonals and/or angles given, and asked to determine the measures of the remaining sides/diagonals/angles.	G.CO.C.11	●				

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7	Circles			Problem Solving	Animation	Worked Examples	Classification Tools	Explore
MATHia Unit	**MATHia Workspace**	**Overview**	**CCSS**					
Properties of Circles	Introduction to Circles	Students watch an animation defining some of the terminology of circle parts. They then identify chords, tangents, points of tangency, and secants of circles. Next, students sort inscribed and central angles. Finally, they classify minor and major arcs as well as semicircles.	G.C.A.1 G.C.A.2		●			
Angles in Circles	Determining Central and Inscribed Angles in Circles	Students will calculate the measure of an arc or an angle using the definition of a central angle, the Arc Addition Postulate, or the Inscribed Angle Theorem.	G.C.A.2	●				
	Determining Chords in Circles	Students will calculate the length of an arc using the radius or diameter, the circumference, and the arc-to-circle ratio.	G.C.A.2	●				
	Determining Interior and Exterior Angles in Circles	Students will calculate the measure of an arc or an angle using Interior Angles of a Circle Theorem and Exterior Angles of a Circle Theorem.	G.C.A.2	●				
	Angles of an Inscribed Quadrilateral	Students are shown an inscribed quadrilateral and prove the Inscribed Quadrilateral-Opposite Angles Conjecture. They then use the theorem to determine the measure of an angle in an inscribed quadrilateral given the measure of the opposite angle.	G.C.A.3			●		
Arc Length	Relating Arch Length and Radius	Students explore the difference between the degree measure of an arc and the length of an arc. They then practice calculating the fraction of a circle's circumference that an arc occupies and writing an expression that can be used to calculate an arc's length. Students then calculate the arc length given the radius or diameter of the circle. Next, they relate the arc length to the circle's radius and are introduced to the units radians and the theta symbol. Finally, students practice determining different measurements of a circle using the formula theta = s/r.	G.C.B.5			●		●
	Calculating the Area of a Sector	Students are given the definition of a sector of a circle and practice identifying sectors. They then work through an example that develops the formula for determining the area of a sector of a circle before using the formula to find areas of different sectors of circles.	G.C.B.5			●		

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8	Conics			Problem Solving	Animation	Worked Examples	Classification Tools	Explore
MATHia Unit	**MATHia Workspace**	**Overview**	**CCSS**					
Equation of a Circle	Deriving the Equation of a Circle	Students are given a circle on the coordinate plane with a defined center. They use the Pythagorean Theorem to derive the standard form for the equation of a circle.	G.GPE.A.1			●		
	Determining the Radius and Center of a Circle	Students are given an equation for a circle. They then rewrite the equation if necessary in standard form to identify the radius and center of the circle.	G.GPE.A.1			●		

9	Probability								
MATHia Unit	**MATHia Workspace**	**Overview**	**CCSS**	**Problem Solving**	**Animation**	**Worked Examples**	**Classification Tools**	**Explore**
Independence and Conditional Probability	Independent Events	Students define "independent events." They investigate different scenarios to determine whether the events given are independent or not independent. Students then investigate compound probability with "and" and use the equation P(A and B) = P(A) x P(B) to verify whether two events are independent or not.	S.CP.A.2			●		
	Conditional Probability	Students use an interactive Explore Tool to explore probability using area and random points. Students then explore the idea of conditional probability, using the interactive tool to visualize the conditional probability formula P(A | B) = P(A and B) / P(B). Students apply what they know about conditional probability to make predictions and check for independence of events using the Explore Tool.	S.CP.A.3 S.CP.B.6					●
	Understanding Frequency Tables	Students review how to read a two-way frequency table and construct a relative frequency table. Students then use two-way frequency tables to determine probabilities, including conditional and other compound probabilities, and they use information from frequency tables to check for the independence of events.	S.CP.A.4			●		
	Recognizing Concepts of Conditional Probability	Students investigate conditional probabilities using two-way frequency tables. They apply the concept of conditional probability in a variety of different situations involving a change in the sample space as a result of an event occurring.	S.CP.A.5			●		
	Calculating Compound Probabilities	Students determine probabilities of compound events from two-way frequency tables via the Addition Rule.	S.CP.B.7	●				