KY Math Standards

Unit 1 Title	**Estimated Time Frame**
Foundations of Geometry, Parallel and Perpendicular Lines, and **Triangle Congruence**	**40 days or 20 blocks**

Big Idea (s)

Geometric figures are named precisely, based on their properties.
Algebra and the coordinate plane can be used to solve problems involving geometric concepts.

Essential Question(s)

How can properties of polygons, lines, and angles be used to solve problems?
How can algebraic ideas be used when expressing geometric properties?

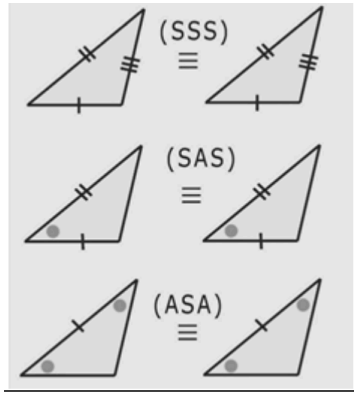
Standards for Mathematical Practice (MP.) - The practice standards in bold describe expertise to be intentionally developed in this unit.	**Kentucky Interdisciplinary Literacy Practices (KILP.) -** The practice standards in bold describe expertise to be intentionally developed in Mathematics.
MP.1. Make sense of problems and persevere in solving them. **MP.2. Reason abstractly and quantitatively.** **MP.3. Construct viable arguments and critique the reasoning of others.** **MP.4. Model with mathematics.** **MP.5. Use appropriate tools strategically.** MP.6. Attend to precision. **MP.7. Look for and make use of structure.** **MP.8. Look for and express regularity in repeated reasoning.**	KILP.1 Recognize that text is anything that communicates a message. KLIP.2 Employ, develop, and refine schema to understand and create text. KILP.3 View literacy experiences as transactional, interdisciplinary and transformational. KILP.4 Utilize receptive & expressive language arts to better understand self, others, & the world. KILP.5 Apply strategic practices, with scaffolding & then independently, to approach new literacy tasks. **KILP.6 Collaborate with others to create new meaning.** **KILP.7 Utilize digital resources to learn and share with others.** **KILP.8 Engage in specialized, discipline specific literacy practices.** **KILP.9 Apply high level cognitive processes to think deeply and critically about text.** KILP.10.Develop a literacy identity that promotes lifelong learning.

Common Preconceptions/Misconceptions

- Students may have intuitive but limited ideas of basic geometric terms. For example, they may consider a point a “dot.” Teachers should challenge these notions. Students should recognize that the dot is just a representation of a point, and the point is an exact location.
- Make sure students understand the definition of parallel lines as “two coplanar lines that never intersect.”
- Emphasize that opposite reciprocals multiply to = –1. (also the definition of perpendicular slope)
- Remind students that rotations are always counterclockwise, the way of the quadrants.
- Students connect prior knowledge of the Pythagorean Theorem (Gr 8) to develop the distance and midpoint formulas.
- Students often view transformations as a “motion.” Encourage students to think of a transformation as *a function*. That is, it is a rule that could be applied to any point in the plane, not just a given figure.

KAS Standards	Considerations	Samples of Learning Intentions and Success Criteria
Cluster: Experiment with transformations in the plane.		
KY.HS.G.1 Know and apply precise definitions of the language of Geometry: a. **Understand** properties of line segments, angles, and circles. b. **Understand** the properties of and differences between perpendicular and parallel lines. **MP.3, MP.6, KILP.3, KILP.5** *Supporting Standard: KY.HS.G.8, KY.HS.G.22, KY.HS.N.5, KY.HS.N.6* ☐ Conceptual ❑ Procedural ❑ Application	Students in high school start to formalize the intuitive geometric notions they developed in grades 6–8 and give specificity to geometric concepts that can serve as a good basis for developing precise definitions and arguments. a. Students understand a more formal knowledge of postulates, theorems and various properties relating to line segments, angles and circles. This knowledge is based on the undefined notions of point, line, distance along a line and distance around a circular arc. b. Students understand important properties of both parallel and perpendicular lines, prior to making the connections between these types of lines and how they relate to their calculated or given slope.	I am learning to apply definitions in the language of Geometry. ● I can define point, line, and plane definitions. ● I can apply the Ruler and Segment Addition Postulate ● I can apply the Protractor and Angle Addition Postulate ● I can identify and apply properties of line segments, angles, and circles. ● I can demonstrate **understanding** by applying properties of points, lines, and planes to segments, angles, and circles to solve problems. I am learning to describe the properties of perpendicular and parallel lines. ● I can define parallel and perpendicular lines. ● I can describe properties of parallel and perpendicular lines.
Cluster: Use coordinates to prove simple geometric theorems algebraically.		
KY. HS.G.23 Find measurements among points within the coordinate plane. a. **Use** points from the coordinate plane to find the coordinates of a midpoint of a line segment and the distance between the endpoints of a line segment. b. **Find** the point on a directed line segment between two given points that partitions the segment in a given ratio.	$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ $M = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$	I am learning to find measurements among points in the coordinate plane by using the midpoint and distance formula. ● I can locate points on the coordinate plane and understand the concept of a line segment. ● I can calculate the midpoint of a line segment **using** points from the coordinate plane. ● I can calculate the distance between the endpoints of a line segment **using** the distance formula.

MP.2, MP.8, KILP.6, KILP.7, KILP. 9 *Supporting Standards: KY.HS.G.7, KY.HS.G.31* ☐ Conceptual ☐ Procedural ❑ Application		I am learning to find the point on a directed line segment between two given points that partition the segment in a given ratio. ● I can use the distance formula and ratios to partition a segment to **find** a point.
KY.HS.G.22 Justify and apply the slope criteria for parallel and perpendicular lines and use them to solve geometric problems. **MP.3, MP.7** *Supporting Standard: KY.HS.G.1, KY.HS.G.31* ☐ Conceptual ❑ Procedural ❑ Application	Students understand the relationship between slope and how it relates to both parallel and perpendicular lines. Within this standard, students also understand how to find the equation of a line parallel or perpendicular to a given line that passes through a given point.	I am learning to apply the slope criteria for parallel and perpendicular lines. ● I can define parallel lines and identify the slope criteria for parallel lines. ● I can define perpendicular lines and identify the slope criteria for perpendicular lines. ● I can determine whether two lines are parallel or perpendicular based on their slopes. ● I can **apply** the slope criteria to determine the equations of parallel or perpendicular lines. ● I can solve geometric problems involving parallel and perpendicular lines using the slope criteria. ● I can **justify** my reasoning when determining whether lines are parallel or perpendicular using the slope criteria.
Cluster: Prove geometric theorems.		
KY.HS.G.6 Apply theorems for lines, angles, triangles, parallelograms. **MP.2, MP.3, KILP.6, KILP.9** *Supporting Standards: KY.HS.G.7, KY.HS.G.11, KY.HS.G.22, KY.HS.G.29* ☐ Conceptual ☐ Procedural ❑ Application	Students use previously learned definitions, theorems, postulates and properties of lines, angles, triangles and parallelograms to draw conclusions and to make inferences. **Theorems for lines and angles 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.	I am learning to apply previously learned definitions, theorems, postulates, and properties of lines, angles, and triangles, to draw conclusions and make inferences. ● I can write congruence statements identifying corresponding parts of congruent figures. ● I can use properties when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent ● I can use the properties of isosceles triangles to find missing sides and angles.

	Theorems for triangles 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. * Parallelograms in Topic 6	• I can use properties of equilateral triangles to find missing sides and angles • I can prove that two triangles are congruent. • I can determine if three segments can form a triangle.
Cluster: Understand congruence in terms of rigid motions.		
KY.HS.G.5 Know and apply the concepts of triangle congruence: a. 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. □ Conceptual ❑ Procedural ❑ Application b. Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions. **MP.3, MP.6, KILP.2, KILP.5, KILP.6** □ Conceptual ❑ Procedural ❑ Application	 Students will use SSS, SAS, and ASA to not only show congruence but also find measures of triangle parts.	We are learning to use and explain triangle congruence (ASA, SAS, and SSS). • I can relate congruence to rigid motions. • I can demonstrate that two figures are congruent by using one or more rigid motions to map one onto the other. • I can prove triangle congruence by AAS, SAS, ASA, and SSS criteria. Include HL. We are learning to intentionally select and/or calculate measures when determining criteria for triangle congruence. • I can use triangle congruence to solve problems.
Supporting Standards		
Emphasis is on congruence transformations that preserve corresponding congruent lines, segments, and angles. **KY.HS.N.5** Define appropriate units in context for the purpose of descriptive modeling. ★ **MP.1, MP.6** **KY.HS.N.6** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities**.** ★ **MP.2, MP.6** **KY.HS.G.7** Prove theorems about geometric figures.		

a. Construct formal proofs to justify theorems for lines, angles and triangles.
b. (+) Construct formal proofs to justify theorems for parallelograms. **MP.6, MP.7**

KY.HS.G.8 Create and apply geometric constructions.
a. Make formal geometric constructions with a variety of tools and methods.
b. Apply basic construction procedures to construct more complex figures.

KY.HS.G.11 Understand theorems about triangles.
a. Apply theorems about triangles. **MP.1, MP.3**

KY.HS.G.29 Use geometric shapes, their measures and their properties to describe objects in real world settings. **MP.1, MP.4**

KY.HS.G.31 Apply geometric methods to solve design problems. ★ **MP.1, MP.4**

Essential Vocabulary, Theorems, and Postulates

Essential Vocabulary by Topic	Essential Theorems/Postulates by Topic
Foundational: congruent, collinear points, coplanar points, line, segment, angle, ray, point, Postulate, Theorem, midpoint, perpendicular, bisect, angle bisector, perpendicular bisector, conditional statement, hypothesis, conclusion, vertical angles, linear pair, complementary, supplementary,	Segment Addition Postulate Angle Addition Postulate Vertical Angle Theorem Linear Pair Theorem

right angle, acute angle, obtuse angle	
Lines: parallel, coplanar, transversal, corresponding angles, alternate exterior angles, alternate interior angles, same–side interior angles	Same-Side Interior Angles Postulate Alternate Interior Angles Theorem Corresponding Angles Theorem Alternate Exterior Angles Theorem Parallel lines have equal slopes Perpendicular lines have opposite reciprocal slopes (in other words, the product of slopes equals –1)
Transformation: rigid motion, preimage, image, reflection, rotation, translation, vector, component form, composition of transformations, glide reflection, dilation, scale factor, line of symmetry, rotational symmetry, point symmetry	Reflection in x–axis Reflection in y–axis Reflection in y = x Rotation 90° counterclockwise about origin Rotation 270° counterclockwise about origin Rotation 180° about origin Translations (left/right/up/down) Compositions of transformations (including glide reflection) Dilations (enlarge/reduce

Benchmark Assessment #1

Anchor Resources

enVision Topic 1 - Foundations of Geometry	**enVision Topic 2** - Parallel & Perpendicular Lines	**enVision Topic 3** - Transformations
MILC Resources - MILC - Foundations of Geometry Topic Resources	**MILC** Resources **-** MILC - Parallel and Perpendicular Topic Resources	**MILC** Resources - MILC - Transformation Topic Resources

3 ACT Math Task (one per unit) The Mystery Spokes (use with review or as "anytime" activity after 1-3) Note: ● Include noncollinear and noncoplanar points ● Review supplements and complements with properties of vertical angles (1-7) ● Include angle bisector problems with midpoint and distance problems (section 1-3) (used briefly in 1–2 but will need to supplement)	**3 ACT Math Task (one per unit) -** Parallel Paving Company (after 2-4) **STEM (one per semester)** "Build a Roof" (construction/pitch…) recommended (include 2 minute NBC video) Note: ● Given a diagram students will justify their reasoning as to whether or not the lines are parallel ● Supplement classifying triangles by sides and angles ● Make sure to emphasize that opposite reciprocals multiply to = –1	**3 ACT Math Task (one per unit)** The Perplexing Polygon (use with review or as "anytime" activity Note: ● Remember rotations are always counterclockwise. ● Remember to complete the transformations in reverse order from the notation. ● *If pressed for time, 7-1 can be taught 2nd semester with Topic 7. ● Only use dilations from the origin. ● Software, transparencies, etc., may be used to accurately represent congruence transformations in the plane. **Formative Assessment Lesson (FAL) -** (one per semester as a minimum) **FAL - FAL: Representing and Combining Transformations**

*For teachers wanting to use a cumulative review throughout the year for Algebra I skills - the following Formative Assessment Lessons (FALs) are recommended:
Formative Assessment Lesson (FAL) - (one per semester as a minimum) examples to include:
FAL - Interpreting Algebraic Expressions
FAL - Solving Linear Equations in One Variable — Solving Linear Equations in One Variable
FAL - Solving Linear Equations in Two Variables

***Disclaimer: Success Criteria is the evidence students must produce to demonstrate learning. This example is not comprehensive.
** Mathematical Practices (A.MP.1- 8) should be evidenced at some point throughout each unit, depending on the explored tasks. It is important to note that MP. 2 should support learning in every lesson.
*** Modeling Standards: Modeling is best interpreted not as a collection of isolated topics but rather in relation to other standards.