FCPS 2024-2025 Math Unit Framework

KY Math Standards

Unit 2 Title	**Estimated Time Frame**
Relationships in Triangles and Transformations	**40 days or 20 block days**

Big Idea (s)

Geometric figures are named precisely, based on their properties.
Congruent figures have identical properties but lie in different positions or orientations.
Once an essential number of facts are known, figures can be found to be congruent, which means that all corresponding sides and angles are congruent.
Proving and applying congruence in triangles provides a basis for modeling more complex problems geometrically.

Essential Question(s)

In what ways can congruence be useful?
How can relationships between angles be used to solve problems?
How can I use rigid motion to prove figures congruent?
How can I use the properties of isosceles and equilateral triangles to solve for missing values?
How can I determine whether or not 3 side lengths can form a triangle?
How can I prove a line is a perpendicular bisector?
How can I prove a ray is an angle bisector?

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 and expressive language arts to better understand self, others, and 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 difficulty expressing their thinking in more formal ways. The teacher needs to encourage precision in oral and written communication. Classroom dialogue can also help students see the limitations of their thinking.

Make sure to review the Pythagorean Theorem with Perpendicular Bisector problems.

Some students may find it easier to identify the longest side in a triangle by ordering the angles from smallest to largest and using that list to order the sides.

Prerequisites:
- Use reflections, rotations, and translations to determine if an image can be a transformation of a preimage.

Grade Level Skills:
- Show triangles are congruent by mapping one triangle onto another.
- Determine if two triangles are congruent by showing corresponding pairs of sides and if corresponding pairs of angles are congruent.
- Use SSS, SAS, and ASA to determine if two triangles are congruent.
- Use SSS, SAS, and ASA to solve problems with congruent triangles
- Use the definition of congruence in rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.
- Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.

KAS Standards	Considerations	Samples of Learning Intentions and Success 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.1, KY.HS.G.7, KY.HS.G.22, KY.HS.G.29, KY.HS.G.31* ☐ 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 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.	We are learning to use parts of a triangle to solve problems. ● I can use the Angle Bisector Theorem to find missing values in triangles. ● I can use the Perpendicular Bisector Theorem to find missing values in triangles. ● I can define the median and altitude of a triangle. ● I can sketch and identify the median and altitude of a triangle. I am learning to apply properties of polygons. ● I can use theorems related to polygon sum to find the measure of interior and exterior

	****Begin polygons and quadrilaterals after transformations.*** **Theorems for parallelograms 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.	angles (and sums). ● I am learning to apply properties of kites and trapezoids. ● I can use properties of the diagonals of a kite to prove relationships and solve problems. ● I can use the properties of an isosceles trapezoid to solve problems. ● I can use the relationship between the lengths of the bases and midsegment of a trapezoid to solve problems.
Cluster: Experiment with transformations in the plane.		
KY.HS.G.2 Representing transformations in the plane. a. **Describe** transformations as functions that take points in the plane as inputs and give other points as outputs. ☐ Conceptual ❑ Procedural ❑ Application b. **Compare** transformations that preserve distance and angle measures to those that do not. ☐ Conceptual ❑ Procedural ❑ Application c. Given a rectangle, parallelogram, trapezoid, or regular polygon, formally **describe** the rotations and reflections that carry it onto itself, using properties of these figures. **MP.5, MP.7, KILP.7, KILP.8** *Supporting Standards: KY.HS.G.3 (+), KY.HS.N.5*	Software, transparencies, etc. may be used to accurately represent congruence transformations in the plane. a. Students understand any point (a,b) can be thought of as an input and any image of point (a,b) can be thought of as the output of a specific transformation function. b. Students make connections between which transformations are a rigid motion (isometry) and which transformations do not have that characteristic. c. Students practice and understand the procedures needed to carry out multiple transformations that carry the figure onto itself, recognizing the important properties of these figures. **Mathematical Practices Considerations:** ● Demonstrate knowledge of congruence and	I am learning to represent transformations in the plane and describe transformations as functions. ● I can **describe** transformations as functions that take points in the plane as inputs and give other points as outputs, using appropriate mathematical language and notation. I am learning to compare transformations that preserve distance and angle measures to those that do not. ● I can define a rigid transformation. ● I can **compare** and contrast transformations that preserve distance and angle measures to those that do not, using appropriate mathematical language and notation. (i.e., rigid vs. non-rigid) ● I can model transformations as functions and describe points in the plane as inputs and outputs. I am learning to use properties of geometric figures to describe rotations and reflections. ● I can define rotation, reflection, translation, and parts of polygons such as vertices, angles, and line segments. ● I can **describe** the rotations and reflections

☐ Conceptual ❑ Procedural ❑ Application	symmetry through transformations.	that carry a regular polygon onto itself using appropriate mathematical language and notation.
KY.HS.G.4 Understand the effects of transformations of geometric figures. a. Given a geometric figure and a rotation, reflection, or translation, **draw** the transformed figure. b. **Specify** a sequence of transformations that will carry a given figure onto another. c. **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. **MP.2, MP.8** *Supporting Standards: KY.HS.G.3 (+), KY.HS.G.2, KY.HS.G.29, KY.HS.G.21* ☐ Conceptual ❑ Procedural ❑ Application	Students understand a figure, called a pre-image, is congruent to another figure, called the image, if that second figure can be obtained by a sequence of congruence transformations performed on the first figure. Students can draw the image of a transformed pre-image using a variety of tools, including but not limited to: • graph paper • manipulatives • tracing paper • computer programs Students perform such sequences and describe the sequence of congruence transformations necessary to transform one figure to a congruent second figure. **Mathematical Practices Considerations:** ● Apply these concepts to analyze and solve problems involving transformations of geometric figures effectively.	I am learning to understand the effects of transformations on geometric figures and ● I can identify and describe the effects of rotations, reflections, and translations on geometric figures. ● I can **draw** the transformed figure when given a geometric figure and a specified rotation, reflection, or translation. ● I can **specify** a sequence of transformations needed to **carry one** given figure onto another. I am learning to apply geometric descriptions of rigid motions to predict and draw transformed figures. ● I can **use** geometric descriptions of rigid motions to predict the effect of a given rigid motion on a given figure. ● I can use the definition of congruence in terms of rigid motions to determine if two figures are congruent.
Cluster: Understand similarity in terms of similarity transformations.		
KY.HS.G.9 Understand properties of dilations. a. Verify the properties that result from that dilations given by a center and a scale factor. b. Verify that a dilation produces an image that is similar to the pre-image. **MP.5, MP.7, KILP.1, KILP.8** *Supporting Standards: KY.HS.N.5, KY.HS.G.2, KY.HS.G.4*	Methods to verify properties could include, but not limited to: scale models, moving an object closer to a light source and examining changes, changing the scale factor on a copier. • Students explain the effect of dilations on objects that pass through the center verses those that do not pass through the center of a figure.	I am learning to understand the properties of dilations. ● I can dilate a figure by a scale factor with a fixed center called the center of dilation. ● I can identify similar parts of figures after a dilation using pairs of angles. ● I can find the scale factor of similar figures using the ratio of side lengths of the image to the corresponding side lengths of the preimage. ● I can use a scale factor and center to **verify**

☐ Conceptual ❑ Procedural ❑ Application	• Students understand within this standard, the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides is a result that occurs because two objects are similar.	a dilation of similar figures. We are learning to use the properties of dilations to solve problems. ● I can explain the effects of dilation on objects that do not pass through the center of a figure. ● I can use the coordinates of an image under a similarity transformation to **verify** a dilation.

Supporting Standards

KY.HS.N.5 Define appropriate units in context for the purpose of descriptive modeling. ★ **MP.1, MP.6**

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**

KY.HS.G.3 (+) Develop formal definitions of rotations, reflections and translations in terms of angles, circles, perpendicular lines, parallel lines and line segments. **MP.6, MP.7**

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 - Triangles
acute, obtuse, right, equiangular, equilateral, isosceles, scalene, congruence statement, legs of isosceles triangle, base angles, vertex angle, included angle, included side, non-included side, hypotenuse, legs of right triangle, median, altitude, perpendicular bisector, angle bisector, acute triangle, right triangle, obtuse triangle, equilateral, equiangular, scalene, isosceles, exterior angle of a triangle, interior angle of a triangle, legs of an isosceles triangle, base angles, vertex angle of an isosceles triangle, mid-segment, median, altitude, interior angle, exterior angle, triangle	•Reflexive Property •Isosceles Triangle Theorem •Converse of Isosceles Triangle Theorem •Side–Side–Side (SSS) •Side–Angle–Side (SAS) •Angle–Side–Angle (ASA) •Angle–Angle–Side (AAS) •Corresponding Parts of Congruent Triangles are Congruent (CPCTC) •Hypotenuse–Leg Theorem (HL)

	•Perpendicular Bisector Theorem •Pythagorean Theorem

Benchmark Assessment #1

Anchor Resources

enVision Topic 4 - Triangle Congruence	**enVision Topic 5 - Relationships in Triangles (11 days)**
MILC - MILC Topic 4 resources **FAL** (one per semester): Evaluating Conditions for Congruency **3 Act Math Task** - 3 Act: Best Triangle	**MILC -** MILC Topic 5 resources **3 Act -** 3 Act: Best Triangle

*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.