FCPS 2024-2025 Math Unit Framework

KY Math Standards

Unit 3 Title	Estimated Time Frame
3-D Figures, Quadrilaterals, Similarity, and Trigonometry	**40 days or 20 block days**

Big Idea (s)

The properties of polygons, lines, and angles can be used to understand circles.
Once an essential number of facts are known, figures can be found to be similar, which means that all corresponding sides are proportional and all corresponding angles are congruent.
Algebraic techniques and coordinate systems can be applied to solve problems with geometric figures.

Essential Question(s)

How are three-dimensional figures and polygons related?
How can I use volume to model and solve real-world problems?
How are the prism/cylinder and cone/pyramid formulas alike?
How does the volume of a sphere relate to the volumes of other solids?

What can I discover about the relationship between sides and angle sum in a convex polygon?
How are properties of parallelograms used to solve problems?
How are diagonals and angle measures related in kites and trapezoids?
How are diagonals and angle measures related in rectangles, rhombuses, and squares?

What is the relationship between the sides and angles of similar figures?
How can I use the properties of similar figures to find and solve algebraic and real-world problems?
How can I prove two triangles are similar?
How can I generalize the properties of similar triangles to solve problems involving parallel segments and angle bisectors?
How might the features of one figure be helpful when solving problems about other similar figures?
How much information is needed to determine that the two figures are similar?
In what ways can similarity be useful?

Standards for Mathematical Practice (MP.) - The practice standards in bold describe	**Kentucky Interdisciplinary Literacy Practices (KILP.) -** The practice standards in bold describe expertise to be intentionally developed in Mathematics.

expertise to be intentionally developed in this unit.	
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, 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 use previously learned definitions, theorems, postulates, and properties of lines, angles, and triangles to draw conclusions and to make inferences.
Students may need help with setting up the geometric mean. Point out to students that the geometric mean always appears twice in the proportion, once as the numerator and once as the denominator.

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.1, KILP.3, KILP.8** *Supporting Standard: KY.HS.G.7, KY.HS.G.21, KY.HS.G.22, KY.HS.G.23* ☐ 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 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.	We are 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. I am learning to prove and apply parallelogram theorems. ● I can show that consecutive angles of a parallelogram are supplementary and

		opposite angles are congruent. ● I can show that diagonals of a parallelogram bisect each other. ● I can use the properties of a parallelogram to find missing values and solve problems. I am learning to prove and apply the properties of special parallelograms: rhombuses, rectangles, and squares. ● I can prove that the diagonals of rhombuses are perpendicular bisectors of each other and angle bisectors of the angles of a rhombus. ● I can prove that the diagonals of a rectangle are congruent. ● I can solve problems involving the properties of rectangles, rhombuses. and squares. ● I can identify rhombuses, rectangles, and squares by the characteristics of diagonals of parallelograms.
Cluster: Use coordinates to prove simple geometric theorems algebraically.		
KY.HS.G.24 Use coordinates within the coordinate plane to calculate measurements of two dimensional figures. a. Compute the perimeters of various polygons. b. Compute the areas of triangles, rectangles and other quadrilaterals.★ **MP.2, MP.4** *Supporting Standard: KY.HS.G.7, KY.HS.G.21, KY.HS.G.22, KY.HS.G.23*	Students utilize the distance formula to find distances between points in order to find the area and/or perimeter of various geometric figures.	We are learning to apply properties of polygons. ● I can use theorems related to polygon sum to find the measure of interior and exterior angles (and sums). We are learning to connect Algebra and Geometry through coordinates. ● Identify coordinates of figure vertices on a plane. ● Calculate distances between points for perimeter. ● Apply formulas for polygon perimeters accurately. ● Apply triangle area formula correctly. ● Apply quadrilateral area formula accurately. ● Communicate reasoning clearly.
Cluster: Explain volume formulas and use them to solve problems.		

KY.HS.G.25 Analyze and determine the validity of arguments for the formulas for the various figures and shapes. b. Finding the volume of a sphere, prism, cylinder, pyramid and cone. **MP.3, MP.7, KILP.1, KILP.6, KILP.8** *Supporting Standard: KY.HS.G.26 (+), KY.HS.G.30* ☐ Conceptual ☐ Procedural ☐ Application	Students may use dissection arguments, Cavalieri's principle and informal limit arguments in order to find these values for these figures. ***Cavalieri's Principle is only in Adv. Geom - see Standard G.26 (+)**	We are learning to analyze and determine the validity of arguments for the formulas used to calculate measurements of various figures and shapes ● I can identify volume formulas of a sphere, prism, cylinder, pyramid and cone. ● I can analyze and critique the rationale behind the formula for finding the volume of a sphere, demonstrating an understanding of its connection to the formula for the volume of a cylinder.
KY.HS.G.27 Use volume formulas to solve problems for cylinders, pyramids, cones, spheres, prisms ★ **MP.4, MP.6, KILP.2, KILP.6, KILP.9** *Supporting Standard: KY.HS.G.28, KY.HS.G.29, KY.HS.G.30* ☐ Conceptual ☐ Procedural ☐ Application	General Prism: $V = Bh$ Right Circular Cylinder: $V = \pi r^2 h$ Pyramid: $V = \frac{1}{3}Bh$ Right Circular Cone: $V = \frac{1}{3}\pi r^2 h$ Sphere: $V = \frac{4}{3}\pi r^3$	We are learning to use volume formulas for cylinders, pyramids, cones, and spheres to solve problems. ● I can use the appropriate formula for volume based on the figure. ● I can use volume formulas for cylinders, pyramids, cones, and spheres to solve contextual problems.
Cluster: Understand similarity in terms of similarity transformations.		
KY.HS.G.10 Apply the properties of similarity transformations to establish the AA criterion for two triangles to be similar. **MP.3, MP.6, KILP.1, KILP.3, KILP.8** ☐ Conceptual ❑ Procedural ❑ Application	**The AA Similarity Theorem** If $\angle A \cong \angle D$, *and* $\angle B \cong \angle E$, then $\Delta ABC \sim \Delta DEF$.	We are learning to apply the properties of similarity transformations to establish the AA (angle-angle) criterion for determining similarity between two triangles. ● I can use dilations and rigid motions to prove triangles are similar. ● I can use properties of similar triangles to establish the Angle-Angle Similarity Theorem. ● I can use the AA criterion to determine whether two triangles are similar. ● I can
Cluster: Prove theorems involving similarity.		

KY.HS.G.11 Understand theorems about triangles.
a. Apply theorems about triangles.

☐ Conceptual ☐ Procedural ❑ Application

b. (+) Prove theorems about triangles.

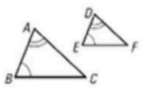
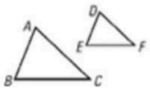
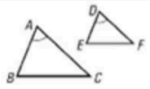
☐ Conceptual ☐ Procedural ❑ Application

c. Use similarity criteria for triangles to solve problems and to prove relationships in geometric figures.
MP.1, MP.3, KILP.1, KILP.3, KILP.8

☐ Conceptual ☐ Procedural ☐ Application

Supporting Standards: KY.HS.G. 5, KY.HS.G.7 KY.HS.G.10

Triangle Similarity Postulate and Theorems:

AA Similarity Postulate	SSS Similarity Theorem	SAS Similarity Theorem
		
Two triangles are similar if they have two pairs of congruent angles.	Two triangles are similar if they have three pairs of proportional sides.	Two triangles are similar if they have two pairs of proportional sides with a congruent included angle.

Theorems include the Pythagorean Theorem, “a line parallel to one side of a triangle divides the other two proportionally and conversely,” and “a segment joining midpoints of a triangle is parallel to the third side and and half the length.”

Students demonstrate the ability to copy a segment, copy an angle, bisect a segment, bisect an angle, construct perpendicular lines, which includes the perpendicular bisector of a line segment and construct a line parallel to a given line through a point not on the line.

We are learning to develop an understanding of theorems about triangles and their applications.

- I can apply theorems related to triangles, including the Pythagorean theorem, Triangle Sum theorem, Triangle Inequality theorem, and Triangle Similarity postulate/theorems.
- verify triangle similarity by using one of the following: SSS ~, SAS~, AA~.
- I can use triangle similarity criteria to solve problems of missing angle measures and lengths.

We are learning to use triangle theorems to solve problems.

- I can demonstrate the ability to copy a segment, copy an angle, bisect a segment, bisect an angle, construct perpendicular lines.

- I can use the similarity of triangles divided by a segment parallel to one side to divide the sides of triangles in proportion.
- I can use similarity to divide one side of a triangle in proportion to the other two sides.
- I can use the geometric mean to solve problems with right triangles.

Supporting Standards

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. 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**

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. (Advanced Geometry) **MP.6, MP.7**

KY.HS.G.21 Use coordinates to justify and prove simple geometric theorems algebraically. **MP.2, MP.6**

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**

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. **MP.2, MP.8**

KY.HS.G.26 (+) Give an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures. **MP.2, MP.5**

KY.HS.G.28 Identify the shapes of two-dimensional cross-sections of three-dimensional objects and identify three-dimensional objects generated by rotations of two-dimensional objects. **MP.5, 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.30 Apply concepts of density based on area and volume in modeling situations, using appropriate units of measurement. **MP.4, MP.6**

Essential Vocabulary, Theorems, and Postulates

Essential Vocabulary by Topic	Essential Theorems/Postulates by Topic
Quadrilateral **Vocabulary:**quadrilateral, pentagon, hexagon, heptagon, octagon, nonagon, decagon, dodecagon, n-gon, diagonal, parallelogram, isosceles trapezoid, kite, trapezoid, midsegment of a trapezoid, parallelogram, rectangle, rhombus, square, diagonal, consecutive angles	•**Polygons and Parallelograms:** •Polygon Interior & Exterior Angle-Sum Theorem •Opposite sides of a parallelogram are parallel •Opposite sides of a parallelogram are congruent •Opposite angles of a parallelogram are congruent •Consecutive angles of a parallelogram are supplementary •Diagonals of a parallelogram bisect each other All properties of parallelograms, rectangles, rhombuses, squares, trapezoids (including isosceles), and kites found on the Quadrilateral Family Tree •Conditions of Special Parallelograms found on p.291 of the textbook
Similarity Vocabulary: ratio, proportion, reflection, rotation, translation, dilation, similar, scale factor, proportionality statement, similarity statement, transversal, angle bisector, cross-product property, extended proportion, geometric mean, golden ratio, indirect measurement, proportion, scale factor, similar figures, Side-Splitter Theorem, Angle Bisector Theorem	•Corresponding angles in ~ figures are equal •Corresponding sides in ~ figures are proportional •Ratio of perimeters in ~ figures = scale factor •Ratio of areas in ~ figures = square of scale factor •AA~ Similarity Theorem •SAS~ Similarity Theorem •SSS~ Similarity Theorem •Side–Splitter Theorem •Corollary to Side–Splitter Theorem •Triangle Angle–Bisector Theorem •Triangle Midsegment Theorem

3-D Vocabulary: cylinder, prism, pyramid, cone, sphere, hemisphere, area, volume, slant height, edge, vertex, side, altitude, cross-section	•Euler's Formula •Volume of the prism, cylinder, pyramid, cone, and sphere

Benchmark Assessment #2

Anchor Resources

enVision Topic 11 3-D	**enVision Topic 6 - Quadrilaterals and Other Polygons**	**enVision Topic 7 - Similarity**
MILC - **MILC Topic resources for 3-D figures** **3-ACT Math Task** - "Box 'em Up" **Stations Assessment** - •**Topic #11 Performance Task** (use as a mini-test grade) Students can work collaboratively in groups to find the volume of real-life items (coffee can, tissue box, tennis or beach ball, etc)	**MILC -** MILC Topic 6 resources **Topic 6** continued -Quadrilaterals and Other Polygons **FAL** (one per semester)**-** Describing and Defining Quadrilaterals **3 Act Math Task** - Optional: Assign a self-guided review over proportions and skip Day 10	**MILC -** MILC Topic Similarity (11 days) resources Review proportions. Review or Teach 7-1 from the Transformations unit. Only teach dilations from the origin. **3-ACT Math Task** - Make It Right (baseball diamond connections) (after Lesson 7-4) **FAL -** Identifying Similar Triangles / Floodlight Shadows

*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 throughout each unit, depending on the explored tasks.
*** Modeling Standards: Modeling is best interpreted not as a collection of isolated topics but rather in relation to other standards. Making mathematical models is a Standard for Mathematical Practice, and specific modeling standards appear throughout the high school standards indicated by a star symbol (★). The star symbol sometimes appears on the heading for a group of standards; in that case, it should be understood to apply to *all* standards in that group.