Theme

How can citizens innovate, manage, and use technology in ways that are socially responsible?

STEM Innovation Academy Unit 3

Subject: Geometry Unit Title: Justification and Similarity Grade: 9	Teacher: Mellina Truncale Duration: 6 weeks

Summary of Unit

This unit is designed for students to learn:

- How to support a mathematical statement using flowcharts and conditional statements
- About the special relationships between shapes that are similar or congruent.
- How to determine if triangles are similar or congruent.

Section 3.1 Through an exploration, students will generate similar figures, which will launch a focus on similarity. During these lessons, students will determine the common qualities that similar figures have.

Section 3.2 As students discover the conditions that cause triangles to be similar or congruent, they will learn about using a flowchart to organize facts and support their conclusions.

Stage 1 – Desired Results

Essential Questions:

- Can I apply the mathematics that I know to problems in everyday life?

Objectives:

- Students will learn about the concept of dilation and will investigate the characteristics that figures share if they have the same shape. Students will determine that dilations have equal angles and proportional corresponding side lengths.
- Students will learn that figures that can be related through a sequence of transformations that include a dilation are similar and will determine that multiplying (and dividing) lengths of figures by a common number (zoom factor) produces a similar figure. Students will use the equivalent ratios to find missing lengths in similar figures and will learn that congruent figures are similar and have a side ratio of 1.
- As students continue to become familiar with similarity, they will examine the ratio of the perimeters of similar figures and will practice setting up and solving equations to solve proportional problems.
- Students will apply proportional reasoning and will learn how to write similarity statements.
- Students will learn the SAS ~ and AA ~ conditions for determining triangle similarity.
- Students will learn how to use flowcharts to organize their arguments for triangle similarity and will continue to practice applying the AA ~ and SAS ~ conditions.
- Students practice making and using flowcharts in more challenging reasoning contexts. Students also further investigate the fact that if two triangles are similar and the common ratio between the lengths of their corresponding sides is 1, then the triangles must be congruent.
- Students will complete their list of triangle similarity conditions involving sides and angles, learning about the SSS ~ condition in the process.
- Students will practice using the three triangle similarity conditions (AA ~, SAS ~, and SSS ~) and organizing their reasoning in a flowchart. Students will also use a flowchart to diagram a multi-step argument.
- Students will apply their knowledge of similar triangles to multiple contexts.

Standards/Outcomes:

- G-CO.2: Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch).
- G-CO.6: 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.
- G-SRT.1a: A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged.
- G-SRT.1b: The dilation of a line segment is longer or shorter in the ratio given by the scale factor.
- G-SRT.2: Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.
- G-SRT.3: Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.
- G-SRT.5: Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.
- G-C.1: Prove that all circles are similar.

Unit Math Practice Standards:

- MP.1
- MP.2
- MP.4
- MP.5
- MP.6
- MP.7

Stage 2 – Assessment Evidence

Performance Task(s):

- November ECR
- December ECR
- Triangle Congruence Reasoning Task

Authentic Experiences:

- Similarity Exploration (hands-on dilations)
- Family Tree (justification and proofs)
- Road Trip (distance and midpoint)

Benchmark Assessment:

- Unit 3 Test
- Quarterly Assessment (Edulastic)
- NWEA MAP Winter Assessment

Unit Pre-Assessment:

- Formative assessments
- NWEA Diagnostic

Presentation:

- Triangle Similarity and Congruence Proofs

Extensions (Tier I):

- Scaled dilations to create a floor plan

Differentiation (Tiers 2 and 3):

- Selective grouping
- Extended time
- Small groups / Individual instruction

Stage 3 – Learning Plan

Objectives:

- Triangle Inequality (CPM 2.3.1)
    - spaghetti triangles activity - exploration
- Pythagorean Theorem (CPM 2.3.2)
    - scavenger hunt
- Dilations (CPM 3.1.1)
    - scale drawings activity
- Similarity (CPM 3.1.2)
    - eTool activity investigation
- Using Ratios of Similarity (CPM 3.1.3)
    - team poster rotations
- Applications and Notation (CPM 3.1.4)
    - numbered heads together activity
- Conditions for Triangle Similarity (CPM 3.2.1)
    - quiz-quiz-trade activity
- Creating a Flowchart (CPM 3.2.2)
    - group posters activity
- Triangle Similarity and Congruence (CPM 3.2.3)
    - partner investigation
- More Conditions for Triangle Similarity (CPM 3.2.4)
    - partner investigation
- Determining Similarity (CPM 3.2.5)
    - find someone who
- Applying Similarity (CPM 3.2.6)
    - application problems

Vocabulary

- AA ~
- Angle
- Conditional statement
- Congruent
- Corresponding sides
- Dilation
- Enlarge
- Flowchart
- Hypotenuse
- Logical argument
- Original
- Perimeter
- Proportional equation
- Ratio
- Relationship
- SAS ~
- Sides
- Similar figures
- Similarity statement
- Similarity transformations
- SSS ~
- Translation
- Vertex
- Zoom factor

Expert / Field Experiences:

- Architectural design using triangles for structural support
- Modeling real life shapes by scale drawing
- Professional experience: architecture

Literacy Connections / Research / Extensions:

- Applying proportions to scale drawings to models
- Applying knowledge of angle relationships to triangle situations
- Prove triangle similarity using logical reasoning and proof by contradiction
- Evaluating differences between triangle similarity and congruence and their conditions
- Writing a coherent, logical proof