Unit #1: Geometry: Transformations

Content Area: **Mathematics**
Course(s): **English I**
Time Period: **September**
Length: **1**
Status: **Published**

Unit Overview

This unit will help students to refine their knowledge of symmetry and use it to make mathematical arguments. Students explore transformations (reflections, rotations, and translations) that preserve angle and side length relationships of figures in the plane. Students also explore enlarging geometric figures to create similar geometric figures. Students will also investigate angle relationships that are created by parallel lines and intersecting lines. Students will investigate angle relationships in triangles.

Geometric sense allows students to comprehend space and shape. Students analyze the characteristics and relationships of shapes and structures, engage in logical reasoning, and use tools and techniques to determine measurement. Students learn that geometry and measurement are useful in representing and solving problems in the real world as well as in mathematics.

Enduring Understandings

- • Coordinate geometry can be used to represent and verify geometric/algebraic relationships
- • Geometric properties can be used to construct geometric figures.
- • Measurements can be used to describe, compare, and make sense of phenomena.
- • Reasoning/Proof can be used to verify or refute conjectures of theorems in geometry.
- Shape and area can be conserved during mathematical transformations.

Essential Questions

- How can I use symmetry to describe the shapes and properties of figures in a design or a problem?
- What parts of a figure will be matched by a congruence transformation?
- Which figures in a pattern are congruent?

Standards/Indicators

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.7	Look for and make use of structure.
MA.8.G	Geometry

MA.8.G.A	Understand congruence and similarity using physical models, transparencies, or geometry software.
MA.8.G.A.1	Verify experimentally the properties of rotations, reflections, and translations:
MA.8.G.A.1a	Lines are transformed to lines, and line segments to line segments of the same length.
MA.8.G.A.1b	Angles are transformed to angles of the same measure.
MA.8.G.A.1c	Parallel lines are transformed to parallel lines.
MA.8.G.A.2	Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.
MA.8.G.A.3	Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.
MA.8.G.A.4	Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.
MA.8.G.A.5	Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles.

Lesson Titles

- Symmetry Transformations
- Classifying Angles
- Determining Similar Triangles
- Dilations
- Investigation: Interior angles of a triangle
- Parallel Lines cut by a transversal
- Reflection Symmetry
- Rotation Symmetry
- Symmetry in Kaleidoscopes
- Transforming Coordinates
- Translation Symmetry

21st Century Skills and Career Ready Practices

CAEP.9.2.8.B.1	Research careers within the 16 Career Clusters ® and determine attributes of career success.
CAEP.9.2.8.B.2	Develop a Personalized Student Learning Plan with the assistance of an adult mentor that includes information about career areas of interest, goals and an educational plan.
CAEP.9.2.8.B.3	Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.
CAEP.9.2.8.B.4	Evaluate how traditional and nontraditional careers have evolved regionally, nationally, and globally.

CAEP.9.2.8.B.5	Analyze labor market trends using state and federal labor market information and other resources available online.
CAEP.9.2.8.B.6	Demonstrate understanding of the necessary preparation and legal requirements to enter the workforce.
CAEP.9.2.8.B.7	Evaluate the impact of online activities and social media on employer decisions.

Inter-Disciplinary Connections

- Architecture
- Art - Name Kaliedoscope
- History - Symmetry in Architecture
- LAL - Vocabulary

LA.L.8.4.D	Verify the preliminary determination of the meaning of a word or phrase (e.g., by checking the inferred meaning in context or in a dictionary).
VPA.1.1.8.D.CS1	Art is a universal language. Visual communication through art crosses cultural and language barriers throughout time.
VPA.1.2.8.A.CS3	The arts reflect cultural morays and personal aesthetics throughout the ages.

Anticipatory Set

- Current Events
- Mathematics History
- Relate to prior knowledge
- Video clips

Instructional Strategies, Learning Activities, and Levels of Blooms/DOK

- Students will analyze the vertices of a figure in the coordinate plane and its image under a size and shape preserving transformation and specify the coordinates of the original and the image.
- Students will design shapes that have specified symmetries.
- Students will develop ability to match corresponding parts of congruent figures and to express those correspondences in standard notation.
- Students will develop basic ability to use triangle congruence principles to prove properties of familiar quadrilaterals.
- Students will develop the insight and ability to use triangle congruence conditions to deduce unknown side and angle lengths in figures.
- Students will discover conditions that create equivalent angles; such as vertical angles and alternate interior angles.
- Students will discover minimal conditions about corresponding sides and angles of triangles from which one can infer congruence of the two figures—SAS, ASA, SSS.
- Students will discover that same side interior angles are supplementary.
- Students will draw conclusions about a figure, such as measures of sides and angles, lengths of

diagonals, or intersection points of diagonals, based on what symmetry or symmetries the figure has.

- Students will find lines of reflection, magnitudes and directions of translations, and centers and angles of rotation.
- Students will give precise mathematical directions for performing reflections, rotations, and translations in terms of the transformation on points of the original figure.
- Students will identify a basic design element that can be used to replicate a design.
- Students will recognize and describe reflection, rotation, and translation symmetry informally.
- Students will recognize that a transformation of the form (x, y) S (x + a, y + b) is a translation of point (x, y) a units in the x direction and b units in the y direction.
- Students will specify coordinate rules for reflections in the x-axis, the y-axis, and the line y = x.
- Students will specify coordinate rules for rotations of 90 degrees, 180 degrees, 270 degrees, and 360 degrees.
- Students will understand important properties of symmetry.
- Students will use coordinates to write directions for drawing figures composed of line segments.
- Students will use reasoning about symmetry transformations and congruence conditions for triangles, to deduce further information about given figures.
- Students will use the properties of reflections, translations, and rotations to perform transformations.
- Students will use tools, such as mirrors, to analyze designs to determine symmetries.

Modifications

ELL Modifications

Content specific:

Vocabulary important for ELL students to understand include: angle, right angle, straight angle, parallel, interior, exterior, triangle, sum, quadrilateral, pentagon, hexagon, heptagon, octagon, nonagon, decagon, slide, turn, flip, shrink, expand, figure, congruent, similar, prism, pyramid, cylinder, cone, sphere, volume, area, base, right triangle, hypotenuse

- Collaboration with ELL Teacher
- Frontload information in native language
- Graphic organizers
- Modification plan
- Strategy groups
- Teacher conferences
- using videos, illustrations, pictures, and drawings to explain or clarification

IEP & 504 Modifications

- Anticipate where needs will be
- Assign a peer to help keep student on task
- Break tests down in smaller increments
- Increase one-to-one time
- Modifications & accommodations as listed in the student's IEP
- Modified or reduced assignments
- personal handout for integer rules
- Position student near helping peer or have quick access to teacher
- Prioritize tasks
- Provide completed problems for practice work and homework
- Provide coordinate planes in which the x and y-axis go from -5 to 5 rather than -10 to 10 for transformations
- Provide graphic organizer for angle relationships
- Provide personal handout with names and examples of each solid figure to assist in identifying a solid
- Provide students with a formula sheet with one type of problem for each formula worked out for them already.
- Reduce length of assignment for different mode of delivery
- Think in concrete terms and provide hands-on-tasks
- Working contract between you and student at risk

G&T Modifications

- For angle relationship and triangle problems, provide expressions containing rational numbers.
- For transformations, give coordinates of image and list of multiple transformations completed and ask students to find the coordinates of the pre-image.
- For volume, find the volume of complex figures (i.e. find the volume of a castle made completely of solid figures).
- Write equations for word problems that require variables to be on both sides of the equal sign.

Formative Assessment

- Exit Questions - Angle relationships
- Exit Questions - Volume Cone, Sphere, Cylinder
- Exit Ticket - transformations
- Graphic Organizer
- Group Work
- Guided Practice

- Hand Signals
- Independent Practice
- Math Puzzles - Crossmatic
- Observation
- Oral Questioning
- PARCC questions - transformations
- PARCC Questions - Volume
- PARCC questions -angle relationships
- Quick Quizzes - Previous days material
- Quiz - Reflections
- Quiz - Translations
- Senteo
- Think-Pair-Share
- Written Work

Summative Assessment

- Marking Period Assessment
- Project - Tesselation
- Project Based Assessment - Design a Town (Intersecting Lines)
- Project Based Assessment - Name Kaliedoscope
- Quiz - Angle Relationships
- Quiz - Rotations
- Quiz - Translations
- Self-Assessment
- Test - Transformations
- Tests - Angle Relationships

Resources & Materials

- Connected Math: Kaleidoscopes, Hubcaps, Mirrors
- Glencoe Pre-Algebra - Chapter 6 and 11
- Graph paper
- Mirrors

Technology

- Calculator
- Chromebook

- Geometer's Sketchpad
- Khan Academy - Transformations Video https://www.youtube.com/watch?v=XiAoUDfrar0
- PMI - Angle Relationships
- PMI - Transformations Unit
- SmartBoard
- Transformations Song https://www.youtube.com/watch?v=0Z1aUhGCZs0

TECH.8.1.8	Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.
TECH.8.2.8	Technology Education, Engineering, Design, and Computational Thinking - Programming: All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.