01 Constructions & Transformations

Content Area: **Math**
Course(s):
Time Period: **Full Year**
Length: **4 weeks**
Status: **Published**

General Overview, Course Description or Course Philosophy

NJSLS Geometry Curriculum Overview

During this unit students will we build upon previous understandings of transformations to develop a transformation-based definition of congruence. Through the work in this unit students will develop definitions for specific Geometric terms and ideas. To perform and analyze the transformations in this unit students will need to use both the coordinate and analytic planes as well as formal geometric construction techniques.

OBJECTIVES, ESSENTIAL QUESTIONS, ENDURING UNDERSTANDINGS

Objectives:

In this unit, students first informally explore geometric properties using straightedge and compass constructions. This allows them to build conjectures and observations before formally defining rotations, reflections, and translations. In middle school, students studied transformations of figures in the coordinate plane. In this unit, they transition to more formal definitions that don't rely on the coordinate plane, and the focus shifts from transforming whole figures towards a more point-by-point analysis. Students then begin to use the rigorous definitions they developed to prove statements involving angles and distances, preparing them for congruence proofs in the next unit. (IM)

Essential Questions:

- Why are point and line considered undefined terms?
- How are the concepts of rigid motions and congruence related?
- How can you determine if two figures are congruent to one another?
- What constitutes a "geometric construction"?

Enduring Understandings:

- The structure of Geometry is based on a set of undefined terms and well defined manipulations of points, lines, and planes
- The notion of congruence can be based on concept of rigid motions/transformations
- Formal constructions can be used to study and analyze properties of figures and relationships among

figures.

CONTENT AREA STANDARDS

G.C

A. Understand and apply theorems about circles

B. Find arc lengths and areas of sectors of circles

G.CO

A. Experiment with transformations in the plane

B. Understand Congruence in terms of rigid motions

C. Prove geometric theorems

D. Make geometric constructions

G.GMD

A. Explain volume formulas and use them to solve problems

B. Visualize relationships between two-dimensional and three-dimensional objects

G.GPE

A. Translate between the geometric description and the equation for a conic section

B. Use coordinates to prove simple geometric theorems algebraically

G.MG

A. Apply geometric concepts in modeling situations

G.SRT

A. Understand similarity in terms of similarity transformations

B. Prove theorems involving similarity

C. Define trigonometric ratios and solve problems involving right triangles

D. Apply trigonometry to general triangles

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.G-CO.A.1	Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.
MA.G-CO.A.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).
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.G-CO.A.3	Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.
MA.G-CO.A.4	Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.
MA.G-CO.A.5	Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.
MA.G-CO.B.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.
MA.G-CO.B.7	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.
MA.G-CO.D.12	Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.).

RELATED STANDARDS (Technology, 21st Century Life & Careers, ELA Companion Standards are Required)

9.1.12.CDM.1: Identify the purposes, advantages, and disadvantages of debt. • 9.1.12.CDM.2: Compare and contrast the advantages and disadvantages of various types of mortgages

LA.RH.9-10.4	Determine the meaning of words and phrases as they are used in a text, including vocabulary describing political, social, or economic aspects of history and the social sciences; analyze the cumulative impact of specific word choices on meaning and tone.
LA.RH.9-10.5	Analyze how a text uses structure to emphasize key points or advance an explanation or analysis.
LA.RH.9-10.7	Integrate quantitative or technical analysis (e.g., charts, research data) with qualitative analysis in print or digital text, to analyze information presented via different mediums.
LA.RST.9-10.2	Determine the central ideas, themes, or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.
LA.RST.9-10.3	Follow precisely a complex multistep procedure when carrying out experiments, taking

	measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
LA.RST.9-10.4	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.
LA.RST.9-10.5	Analyze the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).
LA.RST.9-10.6	Determine the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address.
CS.K-12.1.a	Include the unique perspectives of others and reflect on one's own perspectives when designing and developing computational products.
CS.K-12.2.b	Create team norms, expectations, and equitable workloads to increase efficiency and effectiveness.
CS.K-12.2.c	Solicit and incorporate feedback from, and provide constructive feedback to, team members and other stakeholders.
CS.K-12.2.d	Evaluate and select technological tools that can be used to collaborate on a project.
CS.K-12.3.a	Identify complex, interdisciplinary, real-world problems that can be solved computationally.
CS.K-12.3.b	Decompose complex real-world problems into manageable sub-problems that could integrate existing solutions or procedures.
CS.K-12.3.c	Evaluate whether it is appropriate and feasible to solve a problem computationally.
WRK.K-12.P.4	Demonstrate creativity and innovation.
WRK.K-12.P.5	Utilize critical thinking to make sense of problems and persevere in solving them.
WRK.K-12.P.8	Use technology to enhance productivity increase collaboration and communicate effectively.

STUDENT LEARNING TARGETS

Declarative Knowledge

Students will understand that:

- Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment

Procedural Knowledge

Students will be able to:

- Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure.
- Represent transformations in a plane.
- Develop definitions of rotations, reflections, and translations.
- Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotation and reflections

that carry it onto itself.
- Specify a sequence of transformations that will carry a given figure onto another.
- Given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.
- 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.
- Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure.

EVIDENCE OF LEARNING

Benchmark Assessments

Benchmark Assessments conducted three times per year, using Pear Assessment (Standards Based Assessments)

Alternate Assessments

- Portfolios
- Verbal Assessment (instead of written)
- Multiple choice
- Modified Rubrics
- Performance Based Assessments

Formative Assessments

- Student feedback/questioning/observation
- Exit Ticket
- Error analysis
- Specific skill assessment/questions

- Survey/polling
- Reflection questions
- Scored/evaluated class work or homework
- Task completion

Summative Assessments

Lesson Quizzes
Unit Test
Performance Tasks

RESOURCES (Instructional, Supplemental, Intervention Materials)

Core Instructional Materials

Envisions Geometry

Kuta Software

Supplemental Materials

NJ DOE Model Curriculum unit: Congruence, Proof & Constructions

Illustrative Mathematics unit: Constructions and Rigid Transformations

Khan Academy Unit: Performing Transformations

NJCTL Unit: Transformations ; Points, Lines, and Planes ;

Constructions tutorials: https://mathopenref.com/tocs/constructionstoc.html

INTERDISCIPLINARY CONNECTIONS

Interdisciplinary connections are frequently addressed through modeling and application problems whereby students solve and analyze situations taken from business, physics, engineering, biology, statistics, geography, and numerous other fields. Examples can be found in topic specific textbook problems and digital resources.

ACCOMMODATIONS & MODIFICATIONS FOR SUBGROUPS

See link to Accommodations & Modifications document in course folder.