Unit 02 Reasoning and Proofs

Content Area: **Mathematics**
Course(s):
Time Period: **Marking Period 1**
Length: **2 weeks**
Status: **Published**

Brief Summary of Unit

In this unit, students will use precise definitions and prove geometric theorems. Inductive and deductive reasoning are introduced as well as conditional statements. Students will determine if conditional statements are true or false; students should recognize that they have had many experiences with conditional statements, but perhaps the language was more formal.

Revision Date: July 2024

Standards

Students will analyze geometric designs which connects to various cultures. Embracing the diversity within society incorporates the following:

Amistad Commission

This unit also reflects the goals of the Department of Education and the Amistad Commission including the infusion of the history of Africans and African-Americans into the curriculum in order to provide an accurate, complete, and inclusive history regarding the importance of of African-Americans to the growth and development of American society in a global context.

Asian American and Pacific Islander History Law

This unit includes instructional materials that highlight the history and contributions of Asian Americans and Pacific Islanders in accordance with the New Jersey Student Learning Standards in Social Studies.

New Jersey Diversity and Inclusion Law

In accordance with New Jersey's Chapter 32 Diversity and Inclusion Law, this unit includes instructional materials that highlight and promote diversity, including:

economic diversity, equity, inclusion, tolerance, and belonging in connection with gender and

sexual orientation, race and ethnicity, disabilities, and religious tolerance.

1	Developing Responsibility for Learning: Cultivating independence, self-reflection, and responsibility for one's own learning.
2	Adapting Communication: Adapting communication in response to the varying demands of audience, task, purpose, and discipline.
3	Valuing Evidence in Argumentation: Constructing viable claims and evaluating, defending, challenging, and qualifying the arguments of others.
4	Building Knowledge: Building strong content knowledge and connecting ideas across disciplines using a variety of text resources and media.
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.
3.a	Identify complex, interdisciplinary, real-world problems that can be solved computationally.
3.b	Decompose complex real-world problems into manageable sub-problems that could integrate existing solutions or procedures.
G.CO.C.9	Prove theorems about lines and angles. Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.
G.CO.C.10	Prove theorems about triangles. Theorems 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.
G.CO.C.11	Prove theorems about parallelograms. Theorems 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.
G.SRT.B.4	Prove theorems about triangles. Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity.
TEC.K-12.8.1	All students will use computer applications to gather and organize information and to solve problems.
TEC.K-12.8.2	All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world as they relate to the individual society, and the environment.
WORK.K-12.9.1	All students will develop career awareness and planning, employability skills and foundational knowledge necessary for success in the workplace.
WORK.K-12.9.2	All students will develop career awareness and planning, employability skills and foundational knowledge necessary for success in the workplace.

Essential Questions

- How can algebraic proofs build the foundation of writing geometric proofs?
- How can we use important properties to write concise and accurate geometric proofs?
- What are the components of a credible mathematical argument?

Enduring Understandings

- Some mathematical relationships can be described using a variety of if-then statements.
- The converses of the parallel line postulates and theorems are used to prove lines parallel.
- The planning and writing of proofs is related to skills in logical thinking.
- There may be several ways to prove a statement, but the proof must be mathematically sound.

Students Will Know

- A bi-conditional is an if and only if statement.
- Definitions, algebraic properties, geometric postulates, and previously proven theorems are used as reasons in a formal statement/reason geometric proof.
- How to form a converse, inverse, and contrapositive when given a conditional statement.
- How to prove geometric relationships.
- How to prove statements about segments and angles.
- How to use properties of equality to solve problems.
- The difference between a hypothesis and a conclusion.

Students Will Be Skilled At

- Assessing the benefits of validity or invalidity in conditional statements and their converses, inverses, and contrapositives.
- Explaining the structure of a two-column proof.
- Identifying algebraic properties of equality.
- Identifying postulates represented by diagrams.
- Identifying properties of congruence.
- Interpreting a diagram.
- Sketching a diagram given a verbal description.
- Using a formal proof to provide reasons why two triangles are or are not congruent.
- Using algebraic properties of equality to solve equations.
- Using properties of equality to solve for geometric measures.
- Writing a two-column proof.
- Writing conditional and biconditional statements.

Evidence/Performance Tasks

Assessments

- Formative: Daily assessments using examples from class notes, NJSLA test bank problems, and/or

Albert/AP Classroom assessments

- Summative: Teacher-created assessments, NJSLA test bank problems, Big Ideas Math online platform problems, Albert/AP Classroom and/or Big Ideas Math unit assessments
- Benchmark: IXL or teacher created diagnostic assessments in addition to unit assessments from Big Ideas Math
- Alternative Assessments: Student-centered activities such as scavenger hunts, various projects involving real world applications, and differentiated learning tasks in Khan Academy, DeltaMath, and IXL

- Answer essential questions
- Class discussion of daily topic
- Classwork and homework that assess the essential questions
- Provide alternative means of assessments for certain students
- Teacher Observation
- Tests and quizzes that assess the essential questions
- Written assignments that assess the essential questions that involves providing explanations

Learning Plan

Unit 2: Chapter 2, Reasoning and Proofs (1-2 days per topic, 2 days review and practice, 2 days assessments for 10 days total)

- Conditional Statements 2.1
    - Write conditional statements
    - Write biconditional statements
- Postulates and Diagrams 2.3
    - Present postulates then identify postulate using a diagram
    - Interpret diagrams
- Algebraic Reasoning 2.4
    - Review algebraic properties; justify steps of algebraic equation using properties
    - Discuss distinction between substitution and transitive properties
- Proofs about Segments and Angles 2.5
    - For proofs, focus on meaningful shorter proofs rather than excessively long proofs. Mention flow proofs, but two column proofs should be the focus.
    - Discuss Properties of Congruence

Materials

Core instructional materials: Core Book List including Big Ideas Math Common Core Geometry

Supplemental materials: Khan Academy, Edia, DeltaMath

- District approved textbook and ancillary materials
- Online resources: Khan Academy, Delta Math, Edia, Geogebra
- Teacher created activiites
- Teacher created notes

Suggested Strategies for Modifications

Possible accomodations for Geometry CP