Unit 6: Inequalities in Geometry

Content Area: **Mathematics**
Course(s): **English I, Geometry, Honors Geometry**
Time Period: **January**
Length: **1.5 weeks**
Status: **Published**

Unit Overview

- Apply properties of inequality to find lengths of segments and measures of angles.
- State and apply the inequality theorems and corollaries for one or two triangles in proofs.
- State and use the Exterior Angle Inequality Theorem in proofs.
- State the contrapositive and inverse of an if-then statement and evaluate its truth value.
- Understand the logic behind indirect proofs and write them (optional).

Enduring Understandings

- Algebra is used with geometric formulas and properties to find unknown values.
- Relationships between geometric figures can be illustrated verbally, visually, and symbolically.
- Valid argument and presentation of clearly conclusive evidence is essential to writing a proof.

Essential Questions

- How are relationships between geometric figures used in proofs?
- How can an unknown length or angle measurement be found?
- What are possible proof formats?
- Where are the skills used to write proofs used outside of geometry?
- Why do we learn algebra before geometry?

Lesson Titles/Objectives

- To apply properties of inequality to positive numbers, lengths of segments, and measures of angles
- To draw correct conclusions from given statements
- To state and apply the inequality theorems and corollaries for one triangle
- To state and apply the inequality theorems for two triangles
- To state the contrapositive and inverse of an if-then statement
- To understand the relationship between logically equivalent statements
- To write indirect proofs in paragraph form

Standards

Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

MA.G-GPE.B	Use coordinates to prove simple geometric theorems algebraically
MA.G-GMD.B	Visualize relationships between two-dimensional and three-dimensional objects

Connections to Equations.

Geometry

Indicators

MA.G-CO.C.10	Prove theorems about triangles.
MA.G-SRT.B.5	Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.
MA.G-GPE.B.4	Use coordinates to prove simple geometric theorems algebraically.
MA.G-GPE.B.7	Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.
MA.G-MG.A.1	Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).

The correspondence between numerical coordinates and geometric points allows methods from algebra to be applied to geometry and vice versa. The solution set of an equation becomes a geometric curve, making visualization a tool for doing and understanding algebra. Geometric shapes can be described by equations, making algebraic manipulation into a tool for geometric understanding, modeling, and proof.

Analytic geometry connects algebra and geometry, resulting in powerful methods of analysis and problem solving. Just as the number line associates numbers with locations in one dimension, a pair of perpendicular axes associates pairs of numbers with locations in two dimensions. This correspondence between numerical coordinates and geometric points allows methods from algebra to be applied to geometry and vice versa. The

solution set of an equation becomes a geometric curve, making visualization a tool for doing and understanding algebra. Geometric shapes can be described by equations, making algebraic manipulation into a tool for geometric understanding, modeling, and proof. Geometric transformations of the graphs of equations correspond to algebraic changes in their equations.

The concepts of congruence, similarity, and symmetry can be understood from the perspective of geometric transformation. Fundamental are the rigid motions: translations, rotations, reflections, and combinations of these, all of which are here assumed to preserve distance and angles (and therefore shapes generally). Reflections and rotations each explain a particular type of symmetry, and the symmetries of an object offer insight into its attributes—as when the reflective symmetry of an isosceles triangle assures that its base angles are congruent.

21st Century Skills and Career Ready Practices

CRP.K-12.CRP2.1	Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation.
CRP.K-12.CRP6.1	Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices, and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization.
CRP.K-12.CRP8.1	Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur and take action quickly to address the problem; they thoughtfully investigate the root cause of the problem prior to introducing solutions. They carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others.
CRP.K-12.CRP12.1	Career-ready individuals positively contribute to every team, whether formal or informal. They apply an awareness of cultural difference to avoid barriers to productive and positive interaction. They find ways to increase the engagement and contribution of all team members. They plan and facilitate effective team meetings.

Inter-Disciplinary Connections

LA.RI.11-12.7	Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem.
LA.L.11-12.6	Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression.
ARCH.9-12.9.4.12.B.4	Perform math operations, such as estimating and distributing materials and supplies, to complete classroom/workplace tasks.

Instructional Strategies. Learning Activities. and Levels of Blooms/DOK:

- Intro. contrapositive statements
- Intro. how to write an indirect proof
- Intro. Indirect proofs
- Intro. inequalities for two triangles
- Intro. inequalities in one triangle
- Intro. Inverse statements
- Intro. logically equivalent statements
- Intro. properties of inequalities for angles of a triangle
- Intro. SAS inequality theorem
- Intro. the exterior angle inequality theorem
- Intro. the SSS inequality theorem
- Intro. the triangle inequality theorem
- Intro. venn diagrams
- Review anticipatory Set
- Review Homework
- Review HSPA warmup
- Review Quiz
- Students will take a quiz on 6.1-6.3
- Students will take a quiz on 6.4-6.5
- Students will take the chapter 6 test

Modifications:

ELLs Modifications

- 1:1 testing
- Offer alternate/or modify assessments
- Utilize explicit learning strategies that are well planned in advance (intentional planning)

IEP & 504 Modifications

- math tests could have formula’s available on the test and/or sample problems
- modeling and showing lots of examples
- scaffolded notes

G&T Modifications

- Encourage students to explore concepts in depth and encourage independent studies or investigations
- Inquiry based learning
- Refrain from having them complete more work in the same manner.

Formative Assessment

- closure compare sides and angles of two or more triangles
- closure finding the range of missing side triangle
- journal write
- pass out of class
- think-pair-share
- warm up do segments form a triangle
- warm up listing sides and angles according to size

Summative Assessment

- Test inequality in one triangle and two triangles.
- test median, altitude, perpendicular bisector in triangles

Resources & Technology

Resources and Materials

- Geometry Text Book- McDougal – Littell
- Manipulatives
- Protractors
- Ruler
- Study Guide and Practice Sheet – Glencoe/McGraw Hill
- Teacher Created worksheets
- Teacher Generated worksheets

Technology

- Geometer sketchpad

- Mathxl
- Smart Board
- Ti-84 calculator
- Videos

TECH.8.1.12	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.8.1.12.A.CS2	Select and use applications effectively and productively.
TECH.8.1.12.B.CS1	Apply existing knowledge to generate new ideas, products, or processes.