Unit 4: Congruent Triangles

Content Area: **Mathematics**
Course(s): **English I, Geometry, Honors Geometry**
Time Period: **November**
Length: **3 weeks**
Status: **Published**

Unit Overview

- Identify the requirements for congruence.
- Prove triangles are congruent using triangle congruence postulates and theorems.
- Understand and use theorems involving angle bisectors and perpendicular bisectors in proofs and problems involving distance.
- Use congruent triangles to prove other geometric figures are congruent.
- Use definitions of medians, altitudes, and perpendicular bisectors and theorems pertaining to them in proofs.
- Use the definition, theorems, and corollaries pertaining to isosceles triangles in proofs.

Enduring Understandings

- Relationships between geometric figures can be illustrated verbally, visually, and symbolically
- Technology can be used to construct and measure parts of geometric figures.
- 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 computer programs be used in geometry?
- What are valid justifications in proofs and why are they necessary?
- What tools can be used to create and measure geometric figures if technology is inaccessible?

Lesson Titles/Objectives

- Prove that two overlapping triangles are congruent
- To apply the definitions of median and altitude of a tirangle and the perpendicular bisector of a segment
- To apply the theorems and corollaries about isosceles triangles
- To deduce information about segments and angles after proving that two triangles are congruent
- To identify the corresponding parts of congruent figures
- To prove two triangles congruent by first proving two other triangles congruent
- To prove two triangles congruent by using the SSS postulate, the SAS postulate, and the ASA postulate
- To sate and apply the theorem about a point on the bisector of an angle and the converse

- To state and apply the theorem about a point on the perpendicular bisector of a segment and the converse
- To use the AAS theorem to prove two triangles congruent
- To use the HL theorem to prove two right triangles congruent

Standards

	Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.
MA.G-CO.B	Understand congruence in terms of rigid motions
MA.G-CO.C	Prove geometric theorems
	Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.
	Geometry

Indicators

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.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.B.8	Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.
MA.G-CO.C.10	Prove theorems about triangles.

Although there are many types of geometry, school mathematics is devoted primarily to plane Euclidean geometry, studied both synthetically (without coordinates) and analytically (with coordinates). Euclidean geometry is characterized most importantly by the Parallel Postulate, that through a point not on a given line there is exactly one parallel line. (Spherical geometry, in contrast, has no parallel lines.)

During high school, students begin to formalize their geometry experiences from elementary and middle school, using more precise definitions and developing careful proofs. Later in college some students develop Euclidean and other geometries carefully from a small set of axioms.

In the approach taken here, two geometric figures are defined to be congruent if there is a sequence of rigid motions that carries one onto the other. This is the principle of superposition. For triangles, congruence means the equality of all corresponding pairs of sides and all corresponding pairs of angles. During the middle grades, through experiences drawing triangles from given conditions, students notice ways to specify enough measures in a triangle to ensure that all triangles drawn with those measures are congruent. Once these triangle congruence criteria (ASA, SAS, and SSS) are established using rigid motions, they can be used to prove theorems about triangles, quadrilaterals, and other geometric figures.

21st Century Skills and Career Ready Practices

CRP.K-12.CRP1.1	Career-ready individuals understand the obligations and responsibilities of being a member of a community, and they demonstrate this understanding every day through their interactions with others. They are conscientious of the impacts of their decisions on others and the environment around them. They think about the near-term and long-term consequences of their actions and seek to act in ways that contribute to the betterment of their teams, families, community and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good.
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.CRP4.1	Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.
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.RL.11-12.7	Analyze multiple interpretations of a story, drama, or poem (e.g., recorded or live production of a play or recorded novel or poetry), evaluating how each version interprets the source text. (e.g., Shakespeare and other authors.)
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.
MANU.9-12.9.4.12.M.5	Demonstrate use of the concepts, strategies, and systems for obtaining and conveying ideas and information to enhance communication.

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

- chapter 4 test
- Have students summarize all the ways to prove two triangles congruent
- intro. AAS theorem
- Intro. altitude of a triangle
- Intro. ASA postulate
- Intro. Congruency
- Intro. congruent triangles
- Intro. congruent triangles to prove two segments congruent
- Intro. corollaries associated with isosceles triangles
- Intro. corresponding angles
- Intro. corresponding sides
- Intro. HL theorem
- Intro. median of a triangle
- Intro. other methods of proving triangles congruent
- Intro. paragraph proofs
- Intro. perpendicular bisectors
- Intro. SAS postulate
- Intro. SSS postulate
- Intro. the converse of the isosceles triangle theorem
- Intro. the isosceles triangle theorem
- Intro. using congruent triangles to prove two angles congruent

- Intro. using more than one pair of congruent triangles
- Review anticipatory Set
- Review Homework
- Review HSPA warmup
- Review Quiz
- Students will take a quiz on 4. 6-4.7
- Students will take a quiz on 4.4-4.5
- Students will take quiz 4.1-4.3

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

- providing study guides that don't lead the student to study too much extraneous information (less unnecessary details)/scaffolded study guides
- allowing student to take notes in class for reinforcement but also providing a copy of completed/correct notes to study from
- math tests could have formula's available on the test and/or sample problems

G&T Modifications

- Ask students' higher level questions that require students to look into causes, experiences, and facts to draw a conclusion or make connections to other areas of learning.
- Math- provide additional rigorous challenge problems for advanced students
- Modeling

Formative Assessment

- closure prove triangles are congruent
- closure use sum of interior and exterior angles of triangle
- journal write
- pass out of class

- think-pair-share
- warm up classify triangles by angles and sides
- warm up find angle measures of triangles

Summative Assessment

- Test classify triangles, complementary, supplementary, vertical, sum of interior and exterior angles.
- Test isosceles triangles, congruent 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.