Unit 4: Congruent Triangles

Content Area: **Mathematics**
Course(s): **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.

Career Readiness, Life Literacies & Key Skills

WRK.9.2.12.CAP.3	Investigate how continuing education contributes to one's career and personal growth.
TECH.9.4.2.CI.1	Demonstrate openness to new ideas and perspectives (e.g., 1.1.2.CR1a, 2.1.2.EH.1, 6.1.2.CivicsCM.2).
TECH.9.4.2.CI.2	Demonstrate originality and inventiveness in work (e.g., 1.3A.2CR1a).
TECH.9.4.2.CT.3	Use a variety of types of thinking to solve problems (e.g., inductive, deductive).
TECH.9.4.2.DC.3	Explain how to be safe online and follow safe practices when using the internet (e.g., 8.1.2.NI.3, 8.1.2.NI.4).
TECH.9.4.2.TL.2	Create a document using a word processing application.
TECH.9.4.2.TL.3	Enter information into a spreadsheet and sort the information.

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?

Student Learning 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 state 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.

Lesson Titles

- AAS Theorem
- Congruent Triangles
- Congruent triangles
- HL Theorem
- Isosceles triangles
- Median & altitude of a triangle & perpendicular bisector

Equity Considerations

LGBTQ and Disabilities Considerations

Students will engage in learning different mathematicians from the LGBTQ community along with those with disabilities that have made significant impacts in math.

LGBTQ:

Sir Francis Bacon (1561–1626)

Florence NightingaleFrancis Bacon | Philosophy, Scientific Method, & Facts | Britannica(1820-1910)

George Washington Carver (1861-1943)

Sara Josephine Baker (1873-1945)

Alan Turing (1912-1954)

Allan Cox (1926-1987)

Sally Ride (1951-2012)

Ben Barres (1954-2017)

Ruth Gates (1962-2018)

Tim Cook (1960)

STEM

Disabilities:

Leonardo da Vinci (1452-1519)- Dyslexia

Isaac Newton (1664-1727)- Epilepsy

Thomas Edison (1847-1931)- Hearing

Charles Darwin (1809-1882)- Stutter, Dyslexia

Alexander Graham Bell (1847-1922)- Deaf

Albert Einstein (1879-1955)- Aspergers

Florence B. Seibert (1897-1991)- Mobility

Stephen Hawking (1942-2019)- ALS

John Forbes Nash (1928-2015)- Schizophrenia

Temple Grandin (1947)- Autism

Asian Americans and Pacific Islanders Considerations

Students will engage in learning different AAPI mathematicians that have contributed to mathematical processes and developments.

https://www.youtube.com/watch?v=_pUHaSapfuo

https://www.ngpf.org/blog/math/math-monday-celebrating-aapi-mathematicians/

https://ideas.ted.com/8-asian-americans-and-pacific-islanders-whose-innovations-have-changed-your-life-really/

Climate Change

Students will embark in several activities that connect the issues of climate change with coordinate geometry.

https://mathsforplanetearth.ouce.ox.ac.uk/?cat=16

SCI.HS-ESS2-2	Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems.

Inter-Disciplinary Connections

LA.RL.9-10.1	Cite strong and thorough textual evidence and make relevant connections to support analysis of what the text says explicitly as well as inferentially, including determining where the text leaves matters uncertain.
LA.RL.9-10.4	Determine the meaning of words and phrases as they are used in the text, including figurative and connotative meanings; analyze the cumulative impact of specific word choices on meaning and tone (e.g., how the language evokes a sense of time and place; how it sets a formal or informal tone).
LA.RI.9-10.1	Accurately cite strong and thorough textual evidence, (e.g., via discussion, written response, etc.) and make relevant connections, to support analysis of what the text says explicitly as well as inferentially, including determining where the text leaves matters uncertain.
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.RI.9-10.4	Determine the meaning of words and phrases as they are used in a text, including

	figurative, connotative, and technical meanings; analyze the cumulative impact of specific word choices on meaning and tone (e.g., how the language of a court opinion differs from that of a newspaper).
LA.WHST.9-10.1.E	Provide a concluding paragraph or section that supports the argument presented.

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

- Chapter 4 test on Congruent Triangles
- 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 Quiz
- Review standardized-test practice questions for warmup

Modifications:

ELLs Modifications

- 1:1 testing
- Offer alternate/or modify assessments
- Tutoring during Delsea One
- 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
- Tutoring during Delsea One

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
- Tutoring during Delsea One

At Risk Modifications

- Additional help during tutoring/Delsea One/Academic Enrichment
- Retesting
- Speaking to students privately when redirecting behaviors
- Study Guides
- Tutoring during Delsea One

Alternative Assessment

Performance tasks
Project-based assignments
Problem-based assignments
Presentations

Benchmark Assessment

Skills-based assessment- math practice

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

- Marking Period 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.