

Unit 2: Triangles

Content Area: **Mathematics**
Course(s): **Geometry**
Time Period: **November**
Length: **10 weeks**
Status: **Published**

Unit Overview

Students will begin reviewing basic triangle definitions and properties, single triangle inequality theorems, the Pythagorean Theorem, and basic area formulas, solving problems related to each topic. Following this, students will examine the relationships within special right triangles and use these to solve for unknowns. They will then move into the study of right triangle trigonometric functions and their application in solving real-world problems. Building upon this work, students will define and identify the properties of congruent figures. The study of congruent figures will focus on triangles, as students explore and justify different methods that can be used to demonstrate triangle congruence.

By the end of January, administer the Link IT NJSLs Geometry Form B TEI

Transfer

Students will be able to independently use their learning to...

- Solve real-life and mathematical problems involving triangles and area.
- Solve for unknown measurements in right triangles.
- Solve applied problems involving right triangles, sketching diagrams as needed.
- Determine when figures are congruent.
- Use the properties of congruence to reach accurate conclusions.
- Use geometric relationships as a basis to solve real-life and mathematical problems using numerical and algebraic expressions and equations

Meaning

Understandings

Students will understand that...

- The patterns that exist in Special Right Triangles allow us to solve quickly for unknown measurements in these triangles.
- Right triangle trigonometry is useful in solving a variety of problems.

- Geometric relationships and definitions can be used to construct geometric figures and solve real-world problems.
- Knowing the properties of triangles enables us to reach conclusions and solve for unknown measures related to triangles.

Essential Questions

Students will continue to consider...

- How can geometric figures and their properties be described through careful use of geometric language?
- How can the unique properties of geometric figures be used to determine new information?
- What relationships exist between the sides and/or angles of a triangle?
- What relationships exist between the side lengths and angle measures of right triangles?
- How can right triangle relationships be used to calculate inaccessible measurements?
- When is it possible to form a triangle with given constraints?
- How can we verify that two figures are congruent to one another?

Application of Knowledge and Skill

Students will know...

- The unique relationships that exist within 45-45-90 and 30-60-90 triangles.
- The definitions of the sine, cosine, and tangent ratios.
- That the sine and cosine of complementary angles are equal to one another.
- That right triangles are useful in solving a variety of real-world problems.
- The five basic methods used to prove triangles congruent.
- That all corresponding parts of congruent figures are congruent.

Students will be skilled at...

- Simplifying radical expressions.
- Using Special Right Triangle relationships to solve for unknown measurements.
- Using trigonometric ratios to solve for unknown side lengths and angle measures.
- Choosing the most efficient method to solve various right triangles.
- Creating sketches appropriate to solving applied problems involving right triangles.
- Identifying congruent figures.

- Using the SSS, SAS & ASA postulates, as well as the AAS & HL theorems to demonstrate triangle congruence.

Academic Vocabulary

- 30-60-90 triangle
- 45-45-90 triangle
- acute triangle
- angle-angle-side (AAS)
- angle of depression
- angle of elevation
- angle-side-angle (ASA)
- base
- base angle
- CPCTC
- congruent
- converse
- cosine
- equiangular triangle
- equilateral triangle
- exterior angles
- hypotenuse
- hypotenuse leg (HL)
- interior angles
- isosceles triangle
- obtuse triangle
- Pythagorean Theorem
- right triangle
- scalene triangle
- sine
- side-angle-side (SAS)
- side-side-side (SSS)
- tangent
- triangle
- trigonometric ratios

Learning Goal 2.1

SWBAT solve problems involving triangles.

Daily Target 2.1.1 (Level of Difficulty: Retrieval, DOK 1-Recall)

SWBAT classify triangles by their angles measures and side lengths.

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.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.6	Attend to precision.

Daily Target 2.1.2 (Level of Difficulty: Comprehension, DOK: 2-Skill)

SWBAT apply properties of triangles to solve for unknown measures, including problems involving:

- Interior angles
- Exterior angles
- Isosceles triangles
- Equilateral triangles

MA.G-CO.C.10	Prove theorems about triangles.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.

Daily Target 2.1.3 (Level of Difficulty: Analysis, DOK: 3-Strategic Thinking)

SWBAT justify and apply triangle inequality theorems to compare side lengths and angle measures in triangles, and to determine whether it is possible to create a triangle with given side lengths.

- If two sides of a triangle are not congruent, then the larger angle is opposite the longer side.
- If two angles of a triangle are not congruent, then the longer side is opposite the larger angle.
- The sum of two side lengths of a triangle must be greater than the third side length.
- The measure of an exterior angle of a triangle is greater than the measure of either of its remote interior angles.

MA.G-CO.C.10	Prove theorems about triangles.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.

Daily Target 2.1.4 (Level of Difficulty: Analysis, DOK: 3-Strategic Thinking)

Before beginning this section, review simplifying radical expressions.

SWBAT apply the Pythagorean Theorem to determine unknown segment lengths in right triangles and in real-

world problems.

MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.G-SRT.C.8	Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.

Daily Target 2.1.5 (Level of Difficulty: Knowledge Utilization, DOK: 4-Extended Thinking)

Given their side lengths, SWBAT use the Converses to The Pythagorean Theorem to classify triangles as acute, right, obtuse, or not possible.

MA.K-12.4	Model with mathematics.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.G-SRT.C.8	Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.

Learning Goal 2.2

Students will define trigonometric ratios and solve applied problems involving right triangles.

Daily Target 2.2.1 (Level of Difficulty: Comprehension, DOK: 2-Skill)

SWBAT identify and determine unknown side lengths in 45-45-90 and 30-60-90 triangles.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.G-SRT.C.6	Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.

Daily Target 2.2.2 (Level of Difficulty: Comprehension, DOK: 2-Skill)

SWBAT show and explain the definitions for trigonometric ratios.

Defining Trigonometric Ratios: <https://www.illustrativemathematics.org/content-standards/HSG/SRT/C/6/tasks/1635>

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.
MA.K-12.7	Look for and make use of structure.
MA.G-SRT.C.6	Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.

Daily Target 2.2.3 (Level of Difficulty: Analysis, DOK: 3-Strategic Thinking)

SWBAT use the sine, cosine, and tangent ratios and their inverses to solve for unknown side lengths and angle measures in right triangles.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.G-SRT.C.8	Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.

Daily Target 2.2.4 (Level of Difficulty: Analysis, DOK: 3- Strategic Thinking)

SWBAT solve right triangles (determine all side lengths and all angle measures) using trigonometric ratios, special right triangle relationships, and the Pythagorean Theorem.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.G-SRT.C.8	Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.

Daily Target 2.2.5 (Level of Difficulty: Knowledge Utilization, DOK: 4-Extended Thinking)

SWBAT sketch and use right triangles to solve applied problems efficiently. (Angles of Elevation/Depression)

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.G-SRT.C.8	Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied

problems.

Learning Goal 2.3

Students will be able to determine congruency amongst triangles using properties of angles and sides.

Daily Target 2.3.1 (Level of Difficulty: Analysis, DOK: 3-Strategic Thinking)

SWBAT show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.

Properties of Congruent Triangles: <https://www.illustrativemathematics.org/content-standards/HSG/CO/B/7/tasks/1637>

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.K-12.2	Reason abstractly and quantitatively.
MA.K-12.4	Model with mathematics.
MA.K-12.7	Look for and make use of structure.

Daily Target 2.3.2 (Level of Difficulty: Knowledge Utilization, DOK: 4-Extended Thinking)

SWBAT show and explain how each of the following criteria for triangle congruence extend from the definition of congruence in terms of rigid motions:

- SSS Postulate
- SAS Postulate
- ASA Postulate
- AAS Theorem
- HL Theorem

Why does SAS work? <https://www.illustrativemathematics.org/content-standards/HSG/CO/B/8/tasks/109>

Why does SSS work? <https://www.illustrativemathematics.org/content-standards/HSG/CO/B/8/tasks/110>

Why does ASA work? <https://www.illustrativemathematics.org/content-standards/HSG/CO/B/8/tasks/339>

A quick verification that **SSA** does not guarantee congruence: <https://www.illustrativemathematics.org/content-standards/7/G/A/2/tasks/2150>

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.K-12.2	Reason abstractly and quantitatively.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.

Daily Target 2.3.3

SWBAT solve problems using triangle congruence criteria.

MA.K-12.7	Look for and make use of structure.
MA.G-SRT.B.5	Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.

21st Century Life and Careers

CRP.K-12.CRP1	Act as a responsible and contributing citizen and employee.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP6	Demonstrate creativity and innovation.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP.K-12.CRP9	Model integrity, ethical leadership and effective management.
CRP.K-12.CRP11	Use technology to enhance productivity.
CAEP.9.2.12.C.1	Review career goals and determine steps necessary for attainment.

Technology

TECH.8.1.12.A.CS1	Understand and use technology systems.
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.
TECH.8.1.12.B.CS2	Create original works as a means of personal or group expression.
TECH.8.1.12.C.CS1	Interact, collaborate, and publish with peers, experts, or others by employing a variety of digital environments and media.
TECH.8.1.12.C.CS2	Communicate information and ideas to multiple audiences using a variety of media and formats.
TECH.8.1.12.D.CS1	Advocate and practice safe, legal, and responsible use of information and technology.
TECH.8.1.12.D.CS2	Demonstrate personal responsibility for lifelong learning.
TECH.8.1.12.E.CS1	Plan strategies to guide inquiry.
TECH.8.1.12.E.CS2	Locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media.
TECH.8.1.12.E.CS3	Evaluate and select information sources and digital tools based on the appropriateness for specific tasks.

Formative Assessment and Performance Opportunities

- Academic Games
- Albert
- Carousel Activities
- Class Discussions
- Classwork
- Closure Activities
- Concept Sorting Activities
- Desmos Activities
- Do Nows
- Edpuzzle
- Edulastic
- Exit Tickets
- Four Corner Activities
- Graphic Organizers
- Homework
- Kahoot! Games
- Placemat Activities
- Question-All-Writes
- Quizizz Activities
- Quiz-Quiz-Trade Activities
- Station Activities
- Student Interviews
- Student Self-Rating
- Teacher Observation
- Teacher Questioning
- Think, Pair, Share Discussions
- Thumbs Up/Down
- Turn and Talk Discussions
- Whip Around
- Whiteboard Use

Summative Assessment

- Projects
- Quizzes

- Tests
- Unit Exam

Accommodations and Modifications

- 504 Accommodations
- Challenge Problems
- Graphic Organizers
- Guided Notes
- IEP Modifications
- Learning Centers/Stations
- Leveled Practice Opportunities
- Projects
- Scaffolding Questions
- Small Group Instructions
- Student Companion Website Resources
- Technology
- Use of Manipulatives (Paper Strips, Exploragons, exc)

Unit Resources

- Albert
- Desmos
- Geometer's Sketchpad
- Google Classroom
- Kahoot!
- Kuta Software
- Loom
- Quizizz
- Textbook: Geometry, Common Core Ed. (Holt McDougal, 2012)
- Textbook Resource Kit & Companion Website: <https://my.hrw.com/>
- Youtube

Additional Websites:

- Albert: albert.io
- Dan Meyer's 3-Act Math
Tasks: <https://docs.google.com/spreadsheets/pub?key=0AjIqyKM9d7ZYdEhtR3BJMmdBWnM2YWxWYVM1UWowTEE&output=htmlG>
- Engage NY: Geometry Lesson Notes & Handouts: <https://www.engageny.org/resource/high-school-geometry>
- Geometry Teacher Mike Patterson's Common Core Teaching Notes: <http://www.geometrycommoncore.com/>
- Khan Academy: <https://www.khanacademy.org/>
- NCTM Illuminations Website: Resources for Teaching

Math: <http://illuminations.nctm.org/Default.aspx>

- PARCC Educator Resources: <http://www.parcconline.org/for-educators>
- The Geometer's Sketchpad Resource Center: <http://www.dynamicgeometry.com/>

Interdisciplinary Connections

- Angles of Elevation/Depression Word Problems
- Origami
- Triangles Project

LA.WHST.9-10.1	Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant sufficient textual and non-textual evidence.
LA.WHST.9-10.1.D	Establish and maintain a style and tone appropriate to the audience and purpose (e.g., formal and objective for academic writing) while attending to the norms and conventions of the discipline in which they are writing.
LA.WHST.9-10.2	Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.
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.).
VA.9-12.1.5.12prof.Pr5	Developing and refining techniques and models or steps needed to create products.
VA.9-12.1.5.12prof.Cr2c	Collaboratively develop a proposal for an installation, artwork, or space design that transforms the perception and experience of a particular place.