Unit 8: Right Triangles and Trigonometry

Content Area: **Mathematics**
Course(s): **Geometry, Honors Geometry**
Time Period: **February**
Length: **4 weeks**
Status: **Published**

Unit Overview

- Determine whether a triangle is right, obtuse, or acute based on the Converse of the Pythagorean Theorem and its associated theorems.
- Find the sine, cosine, and tangent of an acute angle
- Use geometric mean to solve problems involving similar right triangles formed by the altitude drawn to the hypotenuse of a right triangle.
- Use sine, cosine, and tangent ratios to solve right triangles
- Use the 45-45-90 and 30-60-90 triangle theorems to solve special right triangles.
- Use the Pythagorean theorem and trigonometric ratios to solve real life problems.
- will understand how to use various methods to solve real life problems involving right triangle

Enduring Understandings

- Algebra is used with geometric formulas and properties to find unknown values.
- Geometric relationships can be used to describe and measure a variety of phenomena in non-mathematical fields.
- Mathematics can be learned through problem solving, inquiry, and discovery.
- Technology can be used to construct and measure parts of geometric figures.

Essential Questions

- How can an unknown length or angle measurement be found?
- Why is geometry taught before higher-level mathematical topics?
- How does learning various problem-solving methods improve foster success in other subjects?
- What are the benefits of finding different methods for solving problems?
- What are the pros and cons of using technology to measure geometric figures?
- What tools can be used to create and measure geometric figures if technology is inaccessible?
- Where do equations occur in geometry?

Student Learning Objectives

- To define the tangent, sine, and cosine ratios for an acute angle
- To determine the geometric mean between two numbers
- To determine the lengths of two sides of a 45-45-90 or a 30-60-90 triangle when the length of the

third side is known

- To solve right triangle problems by correct selection and use of the tangent, sine, and cosine ratios
- To state and apply the converse of the Pythagorean theorem and related theorems about obtuse and acute triangles
- To state and apply the Pythagorean theorem
- To state and apply the relationships that exist when the altitude is drawn to the hypotenuse of a right triangle

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. Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation $(y - 2)/(x - 1) = 3$. Noticing the regularity in the way terms cancel when expanding $(x - 1)(x + 1)$, $(x - 1)(x^2 + x + 1)$, and $(x - 1)(x^3 + x^2 + x + 1)$ might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.
MA.G-SRT.C	Define trigonometric ratios and solve problems involving right triangles
MA.G-SRT.D	Apply trigonometry to general triangles
	Geometry

Indicators

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.
MA.G-SRT.C.7	Explain and use the relationship between the sine and cosine of complementary angles.
MA.G-SRT.C.8	Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.
MA.G-SRT.D.9	Derive the formula $A = (1/2)ab\ sin(C)$ for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side.

MA.G-SRT.D.10	Prove the Laws of Sines and Cosines and use them to solve problems.
MA.G-SRT.D.11	Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces). The definitions of sine, cosine, and tangent for acute angles are founded on right triangles and similarity, and, with the Pythagorean Theorem, are fundamental in many real-world and theoretical situations. The Pythagorean Theorem is generalized to non-right triangles by the Law of Cosines. Together, the Laws of Sines and Cosines embody the triangle congruence criteria for the cases where three pieces of information suffice to completely solve a triangle. Furthermore, these laws yield two possible solutions in the ambiguous case, illustrating that Side-Side-Angle is not a congruence criterion.

Lesson Titles

- Determine unknown side lengths of 45-45-90 and 30-60-90 triangles
- Geometric mean
- Pythagorean Theorem
- Relationships between altitude and hypotenuse of a right triangle
- Right triangle trigonometry
- Tangent, sine and cosine ratios for an acute angle

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.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.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.

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:

- Intro. 30-60-90 triangles
- Intro. 45-45-90 triangles
- Intro. applying the converse of the pythagorean theorem to determine if triangles are right.
- Intro. finding the missing side of a right triangle using pythagorean theorem
- Intro. geometric mean in relationship to the altitude of a right triangle
- Intro. right triangle trigonometry to solve problems
- Intro. similarity in right triangles
- Intro. solving a triangle using trig ratios
- Intro. the converse of the pythagorean theorem
- Intro. the cosine ratio
- Intro. the pythagorean theorem
- Intro. the relationship between the sides to find missing measures of 30-60-90 triangles
- Intro. the relationship between the sides to find missing measures of 45-45-90 triangles
- Intro. the relationship of the sides a triangle to an acute angle
- Intro. the sine ratio
- Intro. the tangent ratio
- Review anticipatory Set
- Review Homework
- Review Quiz
- Review standardized-test practice questions for warmup
- students will take a chapter 8 test on Rigiht Triangles and Trigonometry

Modifications:

ELLs Modifications

- Offer alternate/or modify assessments
- 1:1 testing
- Tutoring during Delsea One
- 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
- teaching the main ideas/concepts (limiting not needed details)to be taught and repeating them in several different ways over several different days (goal is 7 different ways same concept for students with learning disabilities)
- Tutoring during Delsea One

G&T Modifications

- CTE - Additional reinforcement activities soliciting a deeper understanding of curriculum.
- Encourage students to explore concepts in depth and encourage independent studies or investigations
- Math- provide additional rigorous challenge problems for advanced students
- Specific career they are interested in? How would this apply to their interest?
- 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 assessments:

Performance tasks
Project-based assignments
Problem-based assignments
Presentations

Benchmark Assessment

Skills-based assessment- math practice

Formative Assessment

- closure solve problem using trigonometric ratios
- closure use Pythagorean theorem to find segment length
- journal write
- pass out of class
- think-pair-share
- warm up Pythagorean theorem
- warm up special right triangles
- warm up trigonometric ratios

Summative Assessment

- Alternate Assessment
- Marking Period Assessment
- Test Square roots, Pythagorean theorem, special right triangles
- Test trigonometric ratios, law of sines and cosines.

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.