Unit 8: Right Triangles and Trigonometry

Content Area: **Mathematics**
Course(s): **English I, 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?

Lesson Titles/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.

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.CRP11.1	Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring new technology. They are proficient with ubiquitous technology applications. They understand the inherent risks-personal and organizational-of technology applications, and they take actions to prevent or mitigate these risks.

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.(3).1	Recognize and employ universal construction signs and symbols to function safely.

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 HSPA warmup
- Review Quiz
- students will take a chapter 8 test
- students will take a quiz on 8.1-8.4
- students will take a quiz on 8.5-8.7

Modifications:

ELLs Modifications

- Offer alternate/or modify assessments
- 1:1 testing
- 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)

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?

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

- 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.