

04 Right Triangles and Trigonometry

Content Area: **Math**
Course(s):
Time Period: **Full Year**
Length: **4-5 weeks**
Status: **Published**

General Overview, Course Description or Course Philosophy

[NJSLs Geometry Overview](#)

In this unit students connect the relationships that exist in right triangles to the concept of similarity to develop the basis for right triangle trigonometry. Students explore right triangle relationships including the Pythagorean Theorem, similar right triangles created when an altitude is drawn to a hypotenuse, and special right triangles (45-45-90 and 30-60-90). Students are then introduced to the sine, cosine, and tangent ratios. Students learn how to determine the trig ratios for a given right triangle and then how to use these ratios to calculate missing side lengths in right triangles. Inverse trig functions are introduced and utilized to calculate missing angles measures. These concepts are combined to allow students to solve right triangles and connect these ideas to a variety of application questions.

OBJECTIVES, ESSENTIAL QUESTIONS, ENDURING UNDERSTANDINGS

Objectives:

- Students will be able to solve right triangles using the Pythagorean Theorem, Trigonometric ratios, and inverse trig functions.
- Students will recognize that the Pythagorean Theorem can be proven using similar right triangles created by an altitude drawn to the hypotenuse
- Students will utilize right triangle and trigonometric relationships to model and solve problems.

Essential Questions:

- How do right triangles and similarity server as the foundation for Trigonometry?
- What specific relationships exist among right triangles that aid in problem solving?

Enduring Understandings:

- By AA similarity, any two right triangles with corresponding congruent acute angles must be similar, and therefore the exists a specific proportional relationship among the sides.
- Trigonometric functions can be used to solve for missing side lengths in right triangles if one side length and one acute angel are known.
- By applying the Pythagorean theorem to special right triangles, specific relationships among the side

lengths can be developed and applied to broader cases.

- Right triangle trigonometry serves as the foundation for wider applications of trigonometric relationships which are addressed in subsequent courses.

CONTENT AREA STANDARDS

G.C

A. Understand and apply theorems about circles

B. Find arc lengths and areas of sectors of circles

G.CO

A. Experiment with transformations in the plane

B. Understand Congruence in terms of rigid motions

C. Prove geometric theorems

D. Make geometric constructions

G.GMD

A. Explain volume formulas and use them to solve problems

B. Visualize relationships between two-dimensional and three-dimensional objects

G.GPE

A. Translate between the geometric description and the equation for a conic section

B. Use coordinates to prove simple geometric theorems algebraically

G.MG

A. Apply geometric concepts in modeling situations

G.SRT

A. Understand similarity in terms of similarity transformations

B. Prove theorems involving similarity**C. Define trigonometric ratios and solve problems involving right triangles****D. Apply trigonometry to general triangles**

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically.
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.
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).
MA.G-MG.A.3	Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).

RELATED STANDARDS (Technology, 21st Century Life & Careers, ELA Companion Standards are Required)

LA.K-12.NJSLSA.R1	Read closely to determine what the text says explicitly and to make logical inferences and relevant connections from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
LA.RH.9-10.4	Determine the meaning of words and phrases as they are used in a text, including vocabulary describing political, social, or economic aspects of history and the social sciences; analyze the cumulative impact of specific word choices on meaning and tone.
LA.RH.9-10.7	Integrate quantitative or technical analysis (e.g., charts, research data) with qualitative analysis in print or digital text, to analyze information presented via different mediums.
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.
CS.K-12.2.c	Solicit and incorporate feedback from, and provide constructive feedback to, team members and other stakeholders.
CS.K-12.2.d	Evaluate and select technological tools that can be used to collaborate on a project.
CS.K-12.3.a	Identify complex, interdisciplinary, real-world problems that can be solved computationally.
CS.K-12.3.b	Decompose complex real-world problems into manageable sub-problems that could

	integrate existing solutions or procedures.
CS.K-12.3.c	Evaluate whether it is appropriate and feasible to solve a problem computationally.
WRK.K-12.P.4	Demonstrate creativity and innovation.
WRK.K-12.P.5	Utilize critical thinking to make sense of problems and persevere in solving them.
WRK.K-12.P.8	Use technology to enhance productivity increase collaboration and communicate effectively.

STUDENT LEARNING TARGETS

Declarative Knowledge

Students will understand that:

- Trigonometric ratios relate side lengths in right triangles to each other based on specific angle measures
- Trigonometric ratios/functions can be used to calculate side lengths in right triangles
- Inverse trig functions can be used to calculate angle measures in right triangles
- Properties of right triangle trig can be extended to develop relationships for non-right triangles

Procedural Knowledge

Students will be able to:

- (+) Derive the formula $A = \frac{1}{2} ab \sin(C)$ for the area of a triangle. *Knowledge Utilization*
- (+) Prove the Laws of Sines and Cosines and use them to solve problems. *Knowledge Utilization*
- (+) Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles. *Analysis*
- Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.(★) *Analysis*
- Explain and use the relationship between the sine and cosine of complementary angles. *Comprehension*
- 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. *Comprehension*

EVIDENCE OF LEARNING

Benchmark Assessments

Benchmark Assessments conducted three times per year, using Pear Assessment (Standards Based Assessments)

Alternative Assessments

- Portfolios
- Verbal Assessment (instead of written)
- Multiple choice
- Modified Rubrics
- Performance Based Assessments

Formative Assessments

- Student feedback/questioning/observation
- Exit Ticket
- Error analysis
- Specific skill assessment/questions
- Survey/polling
- Reflection questions
- Scored/evaluated class work or homework
- Task completion

Summative Assessments

Lesson Quizzes

Unit Test

Performance Tasks

RESOURCES (Instructional, Supplemental, Intervention Materials)

Core Instructional Materials

Envisions Geometry

Kuta Software

Supplemental Materials

NJ DOE Model Curriculum unit: [Trigonometry](#)

Illustrative Mathematics unit: [Right Triangle Trigonometry](#)

Khan Academy unit: [Right Triangles and Trigonometry](#)

NJCTL unit: [Similar Triangles and Trigonometry](#)

INTERDISCIPLINARY CONNECTIONS

Interdisciplinary connections are frequently addressed through modeling and application problems whereby students solve and analyze situations taken from business, physics, engineering, biology, statistics, geography, and numerous other fields. Examples can be found in topic specific textbook problems and digital resources.

ACCOMMODATIONS & MODIFICATIONS FOR SUBGROUPS

See link to Accommodations & Modifications document in course folder.