



Standard #: MAFS.912.G-SRT.3.8

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Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems. ★

Grade: 912

Cluster: Define trigonometric ratios and solve problems involving right triangles. (Geometry - Major Cluster) - Clusters should not be sorted from Major to Supporting and then taught in that order. To do so would strip the coherence of the mathematical ideas and miss the opportunity to enhance the major work of the grade with the supporting clusters.

Date Adopted or Revised: 02/14

Content Complexity Rating: Level 2: Basic Application of Skills & Concepts - [More Information](#)

Date of Last Rating: 02/14

Status: State Board Approved

Assessed: Yes

TEST ITEM SPECIFICATIONS

Item Type(s): This benchmark may be assessed using: EE item(s)

Also assesses:

MAFS.912.G-SRT.3.6

MAFS.912.G-SRT.3.7

Assessment Limits :

Items will assess only sine, cosine, and tangent to determine the length of a side or an angle measure.

Calculator :

Neutral

Clarification :

Students will use trigonometric ratios and the Pythagorean theorem to solve right triangles in applied problems.

Students will use similarity to explain the definition of trigonometric ratios for acute angles.

Students will explain the relationship between sine and cosine of complementary angles.

Students will use the relationship between sine and cosine of complementary angles.

Stimulus Attributes :

For G-SRT.3.8, items must be set in a real-world context.

For G-SRT.3.6 and G-SRT.3.7, items must be set in a mathematical context.

For G-SRT.3.8, items may require the student to apply the basic modeling cycle.

Response Attributes :

Items may require the student to find equivalent ratios.

Items may require the student to use or choose the correct unit of measure.

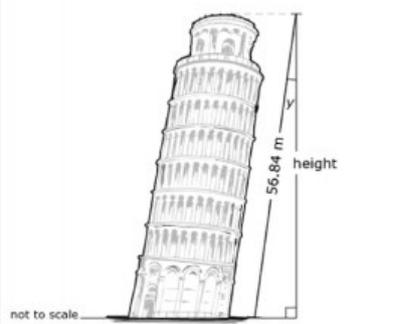
Multiple-choice options may be written as a trigonometric equation.

Equation Editor items may require the student to use the inverse trigonometric function to write an expression.

SAMPLE TEST ITEMS (1)

Test Item #: [Sample Item 1](#)

The Leaning Tower of Pisa is 56.84 meters (m) long.



Question:

In the 1990s, engineers restored the building so that angle y changed from 5.5° to 3.99° .

To the nearest hundredth of a meter, how much did the restoration change the height of the Leaning Tower of Pisa?

Difficulty: N/A

Type: [EE: Equation Editor](#)

Related Courses

Course Number	Course Title
1200400:	Intensive Mathematics (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
1202340:	Pre-Calculus (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
1211300:	Trigonometry (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
1206310:	Geometry (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
1206320:	Geometry Honors (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
1206315:	Geometry for Credit Recovery (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
7912065:	Access Geometry (Specifically in versions: 2015 and beyond (current))

Related Access Points

Access Point

Access Points Number	Access Points Title
MAFS.912.G-SRT.3.AP.8a:	Apply both trigonometric ratios and Pythagorean Theorem to solve application problems involving right triangles.

Related Resources

Lesson Plan

Name	Description
Are You Pulling My Trig?:	This lesson is an introduction of the application of trigonometric ratios. It introduces ratios as related to angle and side measurements of right triangles. Students will learn the basics through real-world word problems.
Discovering Trigonometric Ratios:	Students investigate and discover trigonometric ratios by drawing and measuring side lengths for five triangles that have equivalent angle measure. Students collect, analyze, and discuss data to draw conclusions. This is the introductory lesson to facilitate student discovery of trigonometric ratios and allows students to secure a solid foundation before the use of trigonometry to find missing sides. This lesson has students solving application problems by finding an unknown angle based on length measurements.
How Tall am I?:	Students will determine the height of tall objects using three different methods of calculations. They will work in groups to gather their data and do their calculations. A whole-class discussion is conducted at the end to compare results and discuss some of the possible errors.
Let's Get "Triggy":	This lesson helps students discover trigonometric ratios and how to apply them to find the measure of sides and angles of a right triangle. Students will think about problems, discuss concepts with a partner and then share ideas with the class. Students will collaborate and offer supportive coaching to help deepen each others understanding.
Pythagoras - You Clever Dog:	This lesson starts with an introduction of the Pythagorean Theorem and the Converse. It introduces vocabulary, formulas and concepts related to right triangles and the use of the Pythagorean Theorem in the real world. Students will learn the basics through real world application.
	This lesson unit is intended to help you assess how well students are able to solve quadratics in one variable. In

Solving Quadratic Equations: Cutting Corners:	particular, the lesson will help you identify and help students who have the following difficulties; making sense of a real life situation and deciding on the math to apply to the problem, solving quadratic equations by taking square roots, completing the square, using the quadratic formula, and factoring, and interpreting results in the context of a real life situation.
Splash and Learn:	Students will utilize their knowledge about projectiles to devise a method to launch a water balloon so that it lands on a 1 meter square cloth target at least 25 meters away. If they hit the target with the balloon (not just splash a few drops on it), they receive extra credit on the lab.
Survey Says... We're Using TRIG!:	Students will find this review lesson interesting and fun. This lesson is meant as a review for students after being taught basic trigonometric functions. It will allow students to see and solve problems from real-world setting. The Perspectives video presents math being used in the real-world as a multimedia enhancement to this lesson.
THE COPERNICUS' TRAVEL:	This lesson is using the concept of Inverse Trigonometric Ratios to find the measure of the acute angles in a right triangle and their application in word problems. The Pythagorean Theorem and Special Right Triangles are reviewed and involved in the problems as well. A summary of the basic applications and a simple method to follow in the solution of the exercises is shown.
The Seven Circles Water Fountain :	This lesson provides an opportunity for students to apply concepts related to circles, angles, area, and circumference to a design situation.
The Trig Song:	This lesson is a group project activity that is designed to reinforce the concepts of sine and cosine. The lesson begins with a spiral review of the concepts, which will move into the group project - writing an original song to demonstrate understanding and application of sine and cosine ratios.

Original Student Tutorial

Name	Description
Around the World with Right Triangles:	Learn how to use trigonometric ratios to solve a real-world application. There are many famous monuments across the world. The measurements of these monuments were often found using trigonometric ratios. Today, there are devices that use laser beams to measure distances and heights, but trigonometric ratios are still widely used.

Tutorial

Name	Description
Basic Trigonometry:	This tutorial gives an introduction to trigonometry. This resource discusses the three basic trigonometry functions, sine, cosine, and tangent.
LSSS Tutorial: Introduction to Vectors and Scalars:	This resource is intended to serve as a concise introduction to vector and scalar quantities for teachers of secondary math and science. It provides definitions of vectors and scalars as well as physical examples of each type of quantity, and also illustrates the differences between these two types of quantities in both one and two dimensions, through determinations of both distance (scalar) and displacement (vector).
Projectile at an angle:	This video discusses how to figure out the horizontal displacement for a projectile launched at an angle.
Using Trigonometry to solve for missing information:	This tutorial will show students how to use trigonometry to solve for missing information in right triangles. This video shows worked examples using trigonometric ratios to solve for missing information and evaluate other trigonometric ratios.

Problem-Solving Task

Name	Description
Coins in a circular pattern:	Using a chart of diameters of different denominations of coins, students are asked to figure out how many coins fit around a central coin.
Finding the area of an equilateral triangle:	This problem solving task asks students to find the area of an equilateral triangle.
Mt. Whitney to Death Valley:	This task engages students in an open-ended modeling task that uses similarity of right triangles.
Neglecting the Curvature of the Earth:	This task applies geometric concepts, namely properties of tangents to circles and of right triangles, in a modeling situation. The key geometric point in this task is to recognize that the line of sight from the mountain top towards the horizon is tangent to the earth. We can then use a right triangle where one leg is tangent to a circle and the other leg is the radius of the circle to investigate this situation.
Setting Up Sprinklers:	This modeling task involves several different types of geometric knowledge and problem-solving: finding areas of sectors of circles, using trigonometric ratios to solve right triangles, and decomposing a complicated figure involving multiple circular arcs into parts whose areas can be found.
Seven Circles III:	This provides an opportunity to model a concrete situation with mathematics. Once a representative picture of the situation described in the problem is drawn (the teacher may provide guidance here as necessary), the solution of the task requires an understanding of the definition of the sine function.
Shortest Line Segment from a Point P to a Line L:	This is a foundational geometry task designed to provide a route for students to develop some fundamental geometric properties that may seem rather obvious at first glance. In this case, the fundamental property in question is that the shortest path from a point to a line meets the line at a right angle which is crucial for many further developments in the subject.

Virtual Manipulative

Name	Description
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Demonstrate the Pythagorean Theorem:	Representation to illustrate the Pythagorean Theorem.
Pythagorean Theorem Manipulatives:	This web address, from the National Library of Virtual Manipulatives, will help teachers and students validate the Pythagorean Theorem both geometrically and algebraically. It can be used interactively with the Smartboard and the Promethean Board to create a better understanding of the topic.
Right Triangle Solver:	This virtual manipulative will help the students in understanding that the relationships found in right triangles can be used to solve many applied problems in science and engineering. The right triangle solver manipulative displays a triangle with some its sides and angles given. The student is then asked to determine values of the remaining sides and angles by choosing a workable strategy.
Triangle Solver:	The triangle solver manipulative displays a triangle with some of its sides and angles given. The students are then asked to determine values of the remaining sides and angles. Students are motivated to choose a workable strategy such as using the Pythagorean theorem, the sine, cosine, tangent relationships, the law of sines, or the law of cosines. They are directed through the key steps of the chosen strategy to find the unknown sides and the angles.

Formative Assessment

Name	Description
Holiday Lights:	Students are asked to solve a problem in a real world context requiring the use of the Pythagorean Theorem.
Lighthouse Keeper:	Students are asked to find the difference between two lengths in a real world context requiring right triangle trigonometry.
Perilous Plunge:	Students are asked to find an unknown length in a real world context requiring right triangle trigonometry.
River Width:	Students are asked to find an unknown length in a real world context requiring right triangle trigonometry.
Step Up:	Students are asked to explain the relationship among angles in a diagram involving a right triangle and to find one angle of the right triangle.
TV Size:	Students are asked to solve a problem in a real world context requiring the use of the Pythagorean Theorem.
Washington Monument:	Students are asked to find the angle of elevation in a real world situation modeled by a right triangle.
Will It Fit?:	Students are asked to solve a problem in a real world context using the Pythagorean Theorem.

Teaching Idea

Name	Description
Measuring the Distance to Nearby Stars Using Parallax:	This video provides a very complete and detailed overview of the parallax effect and how it can be used to measure astronomical distances using the tangent function. A number of student activities are presented throughout the 26 minute video, so students can have the opportunity to engage in measuring distances to stars and other local landmarks and can try making the required calculations on their own. The relevance of this concept to other fields, such as surveying, is also noted in the video.

Video/Audio/Animation

Name	Description
MIT BLOSSOMS - The Juice Seller's Problem:	"This video lesson presents a real world problem that can be solved by using the Pythagorean theorem. The problem faces a juice seller daily. He has equilateral barrels with equal heights and he always tries to empty the juice of two barrels into a third barrel that has a volume equal to the sum of the volumes of the two barrels. This juice seller wants to find a simple way to help him select the right barrel without wasting time, and without any calculations - since he is ignorant of mathematics. The prerequisite for this lesson includes knowledge of the following: the Pythagorean theorem; calculation of a triangle's area knowing the angle between its two sides; cosine rule; calculation of a circle's area; and calculation of the areas and volumes of solids with regular bases. Materials necessary include: equilateral containers of equal heights; sand; and measuring devices. Examples of in-class activities for the breaks between video segments include class discussions, individual calculations and small group problem solving." (from MIT Blossoms' "Pythagoras and the Juice Seller")

Perspectives Video: Expert

Name	Description
Oceanography & Math:	A discussion describing ocean currents studied by a physical oceanographer does and how math is involved.

Assessment

Name	Description
Sample 1 - High School Geometry State Interim Assessment:	This is a State Interim Assessment for 9th-12th grade.
Sample 2 - High School Geometry State Interim Assessment:	This is a State Interim Assessment for 9th-12th grade.
Sample 3 - High School Geometry State Interim Assessment:	This is a State Interim Assessment for 9th-12th grade.

Lesson Study Resource Kit

Name	Description
The Motion of Objects:	This 9-12 Lesson study resource kit is designed to engage teachers of physical science and physics in the planning and design of an instructional unit and research lesson pertaining to the motion of objects. Included in this resource kit are unit plans, concept progressions, formative and summative assessments, complex informational texts, and etc. that align to relevant NGSSS science, and the new Florida standards for mathematics and English language arts.

Student Resources

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Around the World with Right Triangles:	Learn how to use trigonometric ratios to solve a real-world application. There are many famous monuments across the world. The measurements of these monuments were often found using trigonometric ratios. Today, there are devices that use laser beams to measure distances and heights, but trigonometric ratios are still widely used.
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Finding the area of an equilateral triangle:	This problem solving task asks students to find the area of an equilateral triangle.
Mt. Whitney to Death Valley:	This task engages students in an open-ended modeling task that uses similarity of right triangles.
Neglecting the Curvature of the Earth:	This task applies geometric concepts, namely properties of tangents to circles and of right triangles, in a modeling situation. The key geometric point in this task is to recognize that the line of sight from the mountain top towards the horizon is tangent to the earth. We can then use a right triangle where one leg is tangent to a circle and the other leg is the radius of the circle to investigate this situation.
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