

# Right Triangle Trigonometry Unit

Geometry - 10th Graders

10 Days

Designer: Marissa Misura with help from resources from [Natrina Newell](#), [3-Act Math Creator](#) and Mark Roxas (creator of desmos activity on day 6)

## **Standards:**

CCSS.MATH.CONTENT.HSG.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.

CCSS.MATH.CONTENT.HSG.SRT.C.8  
Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.

## **Essential Questions:**

Do you know how to use the Pythagorean Theorem?

Do you know how to use the Converse of the Pythagorean Theorem?

Do you know how to identify and use relationships of Special Right Triangles?

Do you know how to use sine, cosine, and tangent to solve for a missing side of a right triangle?

Do you know how to use sine, cosine, and tangent inverse functions to solve for a missing angle of a right triangle?

## **Monitoring and Feedback:**

Students will work individually  
Students will work in pairs  
Students will work in groups  
Call and Response  
Desmos student observation  
I Try, We Try, You Try Practice Problems

## **Assessment Evidence:**

Students will be creating artifacts each day in foldables that will go into their Interactive student notebook that can be assessed as a portfolio of work.

Students will complete a 3-Act Math Lab

## Overview

Units Prior: Similar Triangles and Polygons, Properties of Quadrilaterals

[Day 1: Pythagorean Theorem](#)

[Day 2: Converse of the Pythagorean Theorem](#)

[Day 3: Discovering 45-45-90 Special Right Triangles](#)

[Day 4: Discovering 30-60-90 Special Right Triangles](#)

[Day 5: Practice with Special Right Triangles](#)

[Day 6-7: Introduction to and Discovery of Sine, Cosine, Tangent](#)

[Day 8: Sine, Cosine, Tangent Gallery Walk](#)

[Day 9: Practice with Solving Right Triangles](#)

[Day 10: Completion of 3-Act Activity](#)

Units After: Circles, Area, Surface Area and Volume

### **Day 1: Pythagorean Theorem**

Materials needed:

Ruler

Highlighter

[Pythagorean Map](#) - enough for pairs of students

[Pythagorean booklet](#) - enough for each student

At this point in the year my students have used 'rise<sup>2</sup> + run<sup>2</sup> = distance<sup>2</sup>' to find the distance between points on a graph. The activity 'Pythagorean Map' will show them that it will work without a grid as well. Students should use a ruler to measure the distance along straight roads to then calculate the length of the hypotenuse. After students find the total measure, introduce this as the Pythagorean theorem and have them complete the Pythagorean booklet to find missing side lengths on a right triangle. Both should be added to their Interactive Notebook.

### **Day 2: Converse of the Pythagorean Theorem**

Materials needed:

[Powerpoint of side lengths](#)

[Converse of the Pythagorean Theorem trifold booklet](#) - enough for each student

Have each student fold their Converse Theorem trifold booklet and read through and fill out the front page showing them that if given all sides of a potential right triangle if you plug them into the Pythagorean theorem and they are equal it is, if the hypotenuse is greater it is obtuse (which should make sense because obtuse is bigger than 90), and if the hypotenuse is less it is acute. Remind students that to even create a triangle the two smaller sides must add up to be greater than the longest side. Next using the Powerpoint of side lengths do the first 3 potential triangle side lengths with students and have them sort them into the appropriate categories in their trifold booklet. Have students put scratch work on the left hand side of their Interactive Notebook and final answers should then be copied over under the correct heading in their trifold booklet.

### **Day 3: Discovering 45-45-90 Special Right Triangles**

Materials needed:

[Special Triangles Discovery](#) - enough for each student (they will use 1st half today, 2nd half tomorrow)

[Special Right Triangle Discovery pg 1](#) - enough for half students (there are 2 to a page)

[Special Right Triangles Chart pg 1](#) - enough for half students (there are 2 to a page)

[Special Right Triangles Powerpoint](#)

Have students work in pairs to solve for all the sides of the right triangles in the first half of the Special Triangles Discovery worksheet. Students should notice that 1 triangle is not like the others, and that the other 5 triangles are all right isosceles

triangles, therefore 45-45-90 triangles and that their sides have a special relationship. Share out as a class what they notice and wonder about these triangles.

Take students through the algebra for how and why the hypotenuse will always be square root 2 times as much as the legs. Have students add their 5 discovery triangles to the Special Right Triangles Chart and notice the pattern there as well. Start filling in ONE column of the chart and have students come up with the 2 missing sides. All handouts should be added to their Interactive Notebook.

Review before the end of the hour the pattern with the Special Right Triangles Powerpoint and have students answer practice problems orally.

#### **Day 4: Discovering 30-60-90 Special Right Triangles**

\*This will look very much like yesterday's lesson, simply with the discovery of 30-60-90 triangles instead.

Materials needed:

[Special Triangles Discovery](#) - enough for each student (they will use the 2nd half today)

[Special Right Triangle Discovery pg 1](#) - enough for half students (there are 2 to a page)

[Special Right Triangles Chart pg 1](#) - enough for half students (there are 2 to a page)  
[Special Right Triangles Powerpoint](#)

Have students work in pairs to solve for all the sides of the right triangles in the second half of the Special Triangles Discovery worksheet. Students should notice that these triangles have a special relationship. Have them notice the relationship between the short leg and the hypotenuse and then the relationship between the short leg and the long leg. Share out as a class what they notice and wonder about these triangles.

Take students through the algebra for how and why the long leg will always be square root 3 times as much as the shorter leg. Have students add their 6 discovery triangles to the Special Right Triangles Chart and notice the pattern there as well. Start filling in ONE column of the chart and have students come up with the 2 missing sides. All handouts should be added to their Interactive Notebook.

Review before the end of the hour the pattern with the Special Right Triangles Powerpoint and have students answer practice problems orally.

#### **Day 5: Practice and Application of Special Right Triangles**

Materials Needed:

[Special Right Triangles Powerpoint](#)

[Special Right Triangles](#) WS

Remind students of their 2 special right triangle patterns and then go through the

final part of the Powerpoint to have students orally practice the pattern. Then have students work in groups of 2-3 to complete the Special Right Triangles worksheet to practice applications of special right triangles.

### **Day 6: Introduction to Trigonometric Functions**

Materials Needed:

Each student will need their Chromebook

Single use code, or link to their class for the following desmos activity:

[Development of Trigonometry Ratios](#)

Inform students that Pythagorean Theorem is great if you have two sides of a right triangle, special right triangles are nice given that you have the type and you know one side length at least, but if you are in a situation that is not a special right triangle and you do not have two sides of the right triangle you need another method to solve the sides of a right triangle. Students will work through looking at similar right triangles to come up with a rule about non-special right triangles.

Have students open Chromebooks and access the desmos activity listed above, Development of Trigonometry Ratios. Read through the 1st slide with students, allow them time to play with the slider and when they are ready they can move to slide 2 and complete it but pause there.

Next read slide 3 with students and give them approximately 10 minutes to complete slides 4- 6. Note: on slide 5, students do not need to calculate these ratios themselves, as long as they type in the numerator side length, forward slash, denominator side length and then hit enter desmos will calculate the ratio for them (even though it is hard to see in this small table it's there and more obvious in slide 6).

Have students share with the class some of their noticings/wonderings from slide 6 and then move to slide 7 and then 8. Before students start finding the ratios for a 40 degree triangle, have them guess if they think the opposite/hypotenuse ratio will be bigger or smaller than the 30 degree triangle. Have students complete slides 8-10 giving them approximately 10 minutes. Share out as a class what they notice about their ratios, did they guess correctly?

Have students complete slides 11 - 13 and check with their neighbor on slide 13 after 10 minutes. Wrap up by reading slide 14 to the class about Trig Ratio names. Desmos will save all of their progress and we will finish the activity tomorrow.

### **Day 7: Introduction to Trigonometric Functions Continued**

Materials Needed:

Each student will need their Chromebook

Single use code, or link to their class for the following desmos activity:

[Development of Trigonometry Ratios](#)

[Trig Foldable](#)

Have students log back into their desmos activity (desmos will have saved their progress) and have them navigate to slide 14 and re-read and remind students of their discovery of the 3 trig ratios. Read through slides 15 and 16 with students and talk about using trig tables, have them practice on slide 17, 18 and 19. Give students 10 minutes to complete the activity.

After completing the desmos activity fill out the Trig Foldable to introduce and show students the process for solving a non-special right triangle. Impress upon them that when taking a sine, cosine, or tangent you are just finding out the decimal equivalent of that ratio that has been found and stored in your calculator for you. Add foldable to Interactive Notebook.

### **Day 8: Sine, Cosine, Tangent Gallery Walk**

#### [Trigonometry Gallery Walk](#)

Orange, Green, Blue, and Purple Post-Its

\*Note: Gallery Walk should be posted with corresponding color post-it notes with each frame around the classroom/hallway prior to students arriving

After students complete the desmos activity they can work in pairs to complete the Gallery Walk. Students should have something to write with and at each frame they should get a post it note of the corresponding color, write out how the problem is solved and then move to another frame. It does not matter the order, however after they have completed all frames, they should take all of their post it notes of corresponding color and compare how they are similar to each other and how they are different from the other colors. Students should notice that each color is solved the same way with the same trig function and that differing colors solve with different trig functions, but also similarly (by just multiplying the denominator). Students may also be pushed to notice that when solving for  $x$  when in the denominator the diagonals of the ratios just swap.

### **Day 9: Practice with Solving Right Triangles**

Materials Needed:

[SOHCAHTOA Foldable](#)

[Using Trigonometry to Solve Right Triangles](#) SlideShow

Yesterday students were introduced to solving for a missing side in a non-special right triangle, using the SlideShow above students will practice solving on their own. These should be done on the left hand side of their Interactive Notebook across from their Trig Foldable from day 7. After 4 practice problems, then fill out the SOHCAHTOA Foldable to show students how to solve for a missing angle in a right triangle. Add this foldable to the next right hand side page of their Interactive Notebook and then do 4 more practice problems on the left hand side of that page. Finally introduce their 3 - Act Math Activity (also contained in the SlideShow). Only show the act 1 video students can make some predictions but work on the activity

tomorrow.

### **Day 10: Completion of 3-Act Math Activity**

Materials Needed:

[Using Trigonometry to Solve Right Triangles](#) SlideShow

Open up the SlideShow again to the Act 1 video and show the video to students again. Have students create a neat and organized 'lab report' to solve this real life task. Begin by having them take 5-10 minutes to write about the 4 questions on that slide. Have them discuss in pairs what they wrote, and then have students share with the class. They may adjust their lab report to add anything else they are curious about or cross out anything they think is unnecessary.

Have students consider what information is necessary to 'figure out' if the boat will make it under the bridge or not. Give them 5 minutes to write out on their lab report some information they would like to know. Have students discuss with their neighbor and then share out as a class. Once students decide as a class what information they would like to have to figure out if the boat will make it under the bridge or not, share Act 2. Leave the final slide of Act 2 on the board so that students have a full picture of the information that they need and give them time to solve.

Have students draw a diagram on their lab report and start solving to figure out if the boat will make it or not. Have students share with their neighbor and finally as a class whether they think the boat will make it under the bridge or not.

Share Act 3 video and have students write down any final thoughts on their lab report.