

**Ratios of Right Triangles**

ID: 11577

**Time Required**

45 minutes

**Activity Overview**

In this activity, students will explore the ratios of right triangles. Students will discover that we can find the measure of the angles of a right triangle given the length of any two sides.

**Topic: Right Triangles & Trigonometric Ratios**

- Sine
- Cosine
- Tangent

**Teacher Preparation and Notes**

- This is an introductory activity where students will need to know how to move between pages, grab and drag points, and use the Lists & Spreadsheet and Calculator applications.
- The multiple choice items are self-check and students can check them by pressing  ctrl + ▲.
- Notes for using the TI-Nspire™ Navigator™ System are included throughout the activity. The use of the Navigator System is not necessary for completion of this activity.
- To download the student and solution TI-Nspire documents (.tns files) and student worksheet, go to [education.ti.com/exchange](http://education.ti.com/exchange) and enter “11577” in the keyword search box.

**Associated Materials**

- RatiosOfRightTriangles\_Student.doc
- RatiosOfRightTriangles.tns
- RatiosOfRightTriangles\_Soln.tns

**Suggested Related Activities**

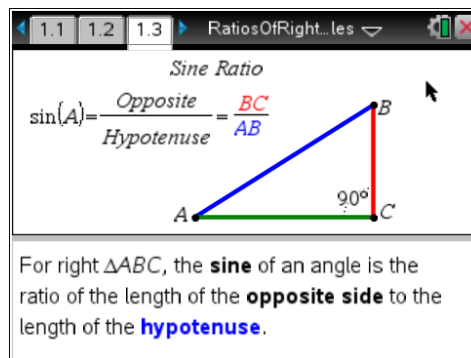
To download any activity listed, go to [education.ti.com/exchange](http://education.ti.com/exchange) and enter the number in the keyword search box.

- Ratio in Right Triangles (TI-84 Plus family) — 4054
- Introduction to Trigonometric Ratios (TI-Nspire technology) — 9350
- Sin, Cos, and Tan of Right Triangles (TI-84 Plus family) — 4625

**Problem 1 – Exploring the Definition of Right Triangle Trigonometry**

Students will begin this activity by looking at the definition of sine, cosine, and tangent of a right triangle. On pages 1.3, 1.4, and 1.5, students are given the definition for sine, cosine, and tangent of a right triangle, respectively. Students should copy the definitions onto their accompanying worksheet.

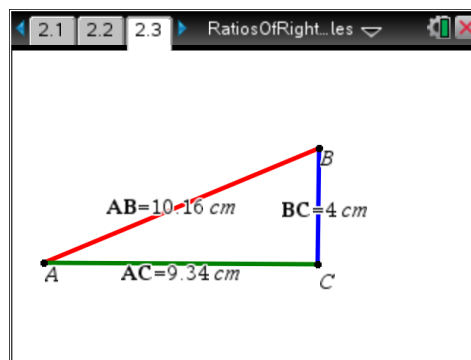
Students are asked to give the ratio of several triangles on their handheld or their accompanying worksheet.



**Problem 2 – Exploring the Sine Ratio of a Right Triangle**

For this problem, students will investigate the sine ratio of two sides of a triangle. On page 2.2, students are given right triangle  $ABC$ . The spreadsheet on page 2.4 contains 3 columns: **bc\_l** (length of  $\overline{BC}$ ), **ab\_l** (length of  $\overline{AB}$ ), and **rbc2ab** (ratio of  $BC$  to  $AB$ ).

Students will collect data in the spreadsheet on page 2.4 by moving point  $B$  (on page 2.3) and pressing **ctrl** + **.**. They will do this for four different positions of the point.



Students will discover that the ratio of  $BC$  to  $AB$  remains constant, no matter how large the triangle is; Therefore, students will be able to use the inverse of sine to find the measure of the angles in  $\triangle ABC$ .

Students will need to answer several questions on their handheld or their accompanying worksheet.

	A	B	C	D
	bc_l	ab_l	rbc2ab	angl
	=capture(bc)=capture(ab)=bc_l/ab_l =sin^1(rb			
1	3.68538	9.37439	0.393133	23.1
2	3.24055	8.2429	0.393133	23.1
3	2.49504	6.34655	0.393133	23.1
4	1.77987	4.5274	0.393133	23.1
5				
6				
A1	=3.6853829998968			

TI-Nspire™ Navigator™ Opportunity: Class Capture  
See Note 1 at the end of this lesson.

**Problem 3 – Exploring the Cosine Ratio of a Right Triangle**

Students will repeat the exploration in Problem 2, but with the cosine ratio.

A	B	C	D
ac_l	ab_l	rac2ab	angl
=capture(ac	=capture(ab	=ac_l/ab_l	=cos <sup>-1</sup> (r
1	6.01469	7.52083	0.799738 36.8
2	6.78371	8.48242	0.799738 36.8
3	7.64082	9.55416	0.799738 36.8
4	9.2125	11.5194	0.799738 36.8
5	3.68828	4.61186	0.799738 36.8
A7	=6.0146908009265		

**Problem 4 – Applying the Sine, Cosine, and Tangent Ratios of a Right Triangle**

In Problem 4, students are asked to apply what they have learned about sine, cosine, and tangent ratios to find the measure of an angle of a right triangle given two sides of the triangle. The students are given a triangle and a *Calculator* application at the bottom on each page. The students are to use the *Calculator* application to find the measure of angles A and B. Note: Students will need to press **ctrl** + **enter** for an approximate solution.

Find the measures of angles A and B.

*Diagram: Right triangle ABC with right angle at C. Hypotenuse AB = 5, vertical leg BC = 2.*

$\sin^{-1}\left(\frac{2}{5}\right)$  23.5782

$90 - 23.578178478202$  66.4218

2/2

**TI-Nspire™ Navigator™ Opportunity: Quick Poll**

**See Note 2 at the end of this lesson.**

**Student Solutions**

- |  |                                    |                                    |
|--|------------------------------------|------------------------------------|
| <p>1. For right triangle <i>ABC</i>, the sine of an angle is the ratio of the length of the opposite side to the length of the hypotenuse.</p>       | <p>4. <math>\frac{3}{5}</math></p> | <p>7. <math>\frac{4}{5}</math></p> |
| <p>2. For right triangle <i>ABC</i>, the cosine of an angle is the ratio of the length of the adjacent side to the length of the hypotenuse.</p>     | <p>5. <math>\frac{4}{5}</math></p> | <p>8. <math>\frac{3}{5}</math></p> |
| <p>3. For right triangle <i>ABC</i>, the tangent of an angle is the ratio of the length of the opposite side to the length of the adjacent side.</p> | <p>6. <math>\frac{3}{4}</math></p> | <p>9. <math>\frac{4}{3}</math></p> |

10. Sample Answers:

Position	$BC$	$AB$	$\frac{BC}{AB}$	$\sin^{-1} \frac{BC}{AB}$
1	2.4376781463393	6.2006451991814	0.39313298342907	23.149583787224
2	3.0769811671077	7.8268201774092	0.39313298342907	23.149583787224
3	3.6665092204124	9.3263841370716	0.39313298342906	23.149583787223
4	4.3154341679767	10.977034107736	0.39313298342905	23.149583787222

11. The ratio remains the same.

13. 23.1496

12. No, the angle does not change.

14. 66.8504

15. Sample Answers:

Position	$AC$	$AB$	$\frac{AC}{AB}$	$\cos^{-1} \frac{AC}{AB}$
1	7.0816099136391	8.8549125969341	0.7997379800328	36.894911430193
2	8.0238624186986	10.033114118664	0.79973798003277	36.894911430196
3	9.0235078139592	11.283080257848	0.79973798003279	36.894911430194
4	3.7704816328074	4.7146462053143	0.79973798003281	36.894911430192

16. 36.8949

20.  $A = 21.8^\circ, B = 68.2^\circ$

24.  $A = 42.83^\circ, B = 47.17^\circ$

17. 53.1051

21.  $A = 23.96^\circ, B = 66.04^\circ$

25.  $A = 45^\circ, B = 45^\circ$

18.  $A = \tan^{-1} \frac{BC}{AC}$

22.  $A = 53.13^\circ, B = 36.87^\circ$

26.  $A = 29.05^\circ, B = 60.95^\circ$

19.  $A = 23.57^\circ, B = 66.42^\circ$

23.  $A = 15.07^\circ, B = 74.93^\circ$

TI-Nspire™ Navigator™ Opportunities

Note 1

Problem 1, Class Capture

This would be a good opportunity to use Class Capture to verify that students are able to capture the points into the spreadsheet. Using a projector and flipping through the screens, students can see different results possible. Later in the activity, you may choose to use Class Capture to verify that students are able to complete the tasks.

Note 2

Problems 1- 4, Quick Poll

You may choose to use Quick Poll throughout the activity to assess student understanding. The worksheet questions can be used as a guide for possible questions to ask.