

Triangle Inequalities

ID: 11757

Time Required

45 minutes

Activity Overview

In this activity, students will discover the Triangle Inequality Theorem and explore the possible lengths of the third side of a triangle given the other two side lengths. Students will also classify the type of triangle as acute, obtuse, or right using the Pythagorean inequalities.

Topic: Right Triangles & Trigonometric Ratios

- *Triangle Inequality*
- *Derive the Triangle Inequality as a corollary of the Pythagorean Theorem and apply it*

Teacher Preparation and Notes

- *This activity was written to be explored using Cabri Jr. on the TI-84 Plus.*
- *Before beginning this activity, make sure that all students have the Cabri Jr. application and the Cabri Jr. files TRI1.8xv, TRI2.8xv and TRI3.8xv loaded on their TI-84 calculators.*
- ***To download the teacher and student worksheet, go to education.ti.com/exchange and enter "11757" in the quick search box.***

Associated Materials

- *GeoWeek15_Inequalities_Worksheet_TI84.doc*
- *TRI1.8xv*
- *TRI2.8xv*
- *TRI3.8xv*

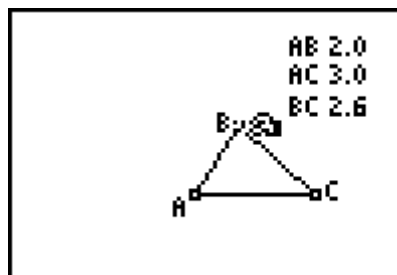
Suggested Related Activities

To download any activity listed, go to education.ti.com/exchange and enter the number in the quick search box.

- *Triangle Inequality (TI-84 Plus) — 7299*
- *Discovering the Triangle Inequality Theorem (TI-Nspire technology) — 9767*
- *Triangle Inequalities (TI-Nspire technology) — 7857*

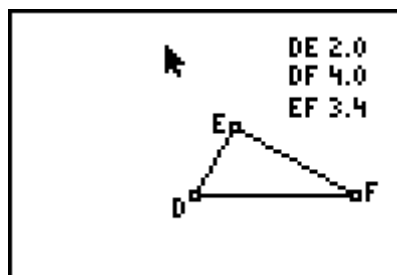
Problem 1 – Triangle Inequality Theorem

Students will begin this activity by looking at a triangle and investigating the possible lengths of the third side given the other two sides. In *TRI1.8xv*, students are given triangle *ABC*. Segments *AB* and *AC* have fixed lengths 2 units and 3 units, respectively. By moving point *B*, students will discover the possible lengths of *BC*.



Note that when *A*, *B*, and *C* lie on the same line, there is not a triangle.

In *TRI2.8xv*, students are asked several questions about how the minimum and maximum lengths of the third side are determined by the lengths of the other two sides. The questions that ask about minimum and maximum values are not the true maximum and minimum lengths, because when the sides are of the maximum and minimum lengths the triangles will be degenerate and form a line.

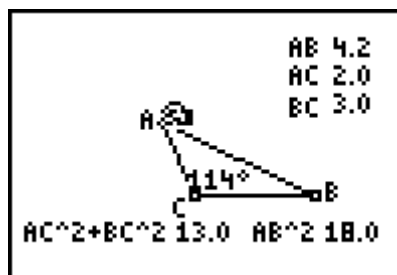


Students will repeat this for a triangle with lengths 2 and 4 to determine a pattern.

Students will be led to the discovery of the *Triangle Inequality Theorem*—the sum of the lengths of any two sides of a triangle is greater than the length of the third side.

Problem 2 – Pythagorean Inequalities

Students begin Problem 2 by exploring a triangle In *TRI3.8xv*. Students are given triangle *ABC*, $m\angle C$, the lengths of all sides, $a^2 + b^2$, and c^2 . Make sure that students are aware that *a* refers to the length of the side opposite $\angle A$, *b* refers to the length of the side opposite $\angle B$, and *c* refers to the length of the side opposite $\angle C$. Students will be asked to move point *A* and to determine for what kind of triangle is $a^2 + b^2 = c^2$, $a^2 + b^2 > c^2$, and $a^2 + b^2 < c^2$.



Students will discover that $a^2 + b^2 = c^2$ for a right triangle, $a^2 + b^2 > c^2$ for an acute triangle, and $a^2 + b^2 < c^2$ for an obtuse triangle.

Note that $a < b < c$ for Problem 2. Discuss with students what kind of triangles are formed if $a = b$.

Problem 3 – Application of the Triangle Inequalities

In Problem 3, students are asked to apply what they have learned about the Triangle Inequality Theorem and the Pythagorean Inequalities.

Student Solutions

1. 1
2. 11
3. $2 < x < 12$
4. $7 + 5 = 2$
5. $7 - 5 = 12$
6. No
7. Yes
8. No
9. $a + b < c$, $a + c < b$, and $b + c < a$
10. Right
11. Acute
12. Obtuse
13. No
14. $4 < x < 16$
15. Obtuse
16. 8, 10, 12
17. 10, 11
18. 12, 13