

Exploring Triangles

Concepts

- Understanding area of triangles
- Relationships of lengths of mid-segments of triangles
- Justifying parallel lines

Materials

- TI-Nspire™
- TI N-spire document “Exploring Triangles”

Overview

A thorough understanding of triangles and their attributes are often assumed since students are familiar with the shape from a very early age. When they need to utilize properties and attributes to justify conclusions, students need to demonstrate a complete understanding of the area formula and the relationships that exist within certain settings. Exploration 1 is designed to solidify students' understanding of the formula for finding the area of triangles. Exploration 2 is designed to allow students to discover that the segments connecting midpoints of two sides of a triangle is parallel to and $\frac{1}{2}$ the length of the third side.

Construct:

The instructions for this construction are for use by teachers when preparing a lesson.

1. Open a new TI-Nspire™ document and a new Graphs and Geometry application. Use keyboard shortcut Ctrl-G to hide the Function Entry Line.

2. Use the Menu, select 8:Shapes and 2:Triangle (Figure 2)

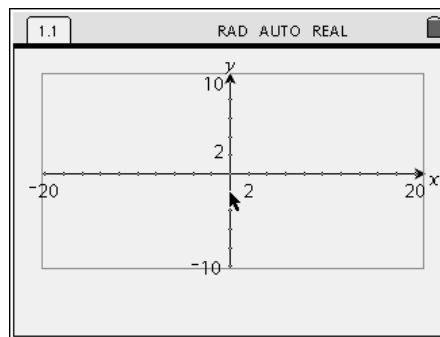


Figure 1

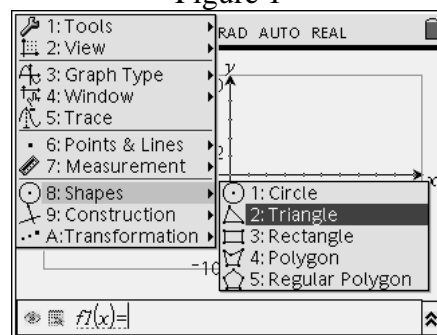


Figure 2

3. Draw a triangle that has its base on the x-axis. (Figure 3)

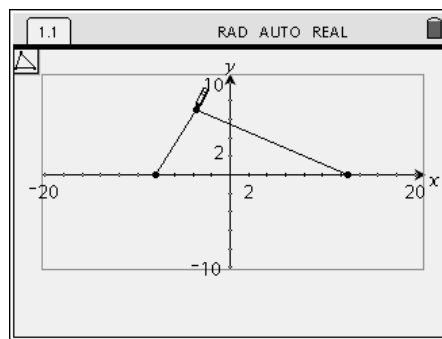


Figure 3

4. Use Menu to select 1: Tools and 5:Text (Figure 4)

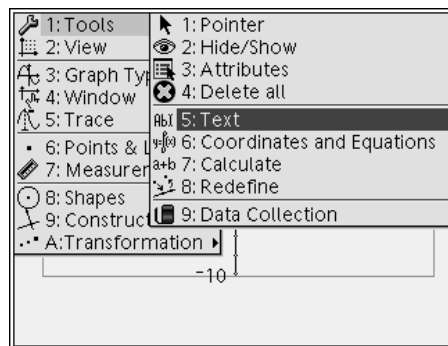


Figure 4

5. Use the Text tool to label the vertex not on the x-axis as A. (Figures 5, 6)

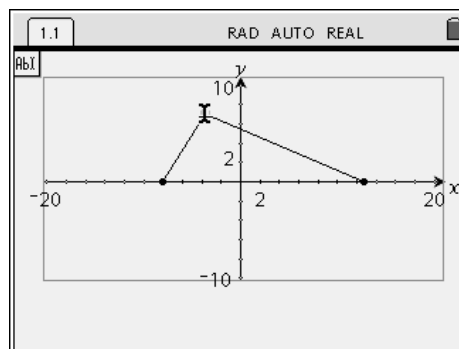


Figure 5

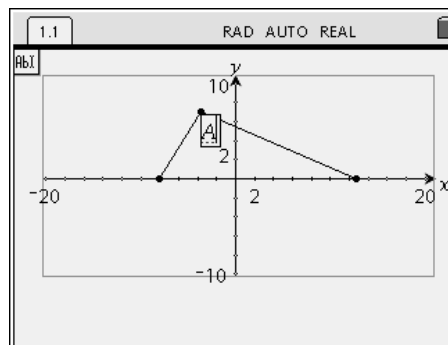


Figure 6

6. Continue to label the vertices as indicated in Figure 7.

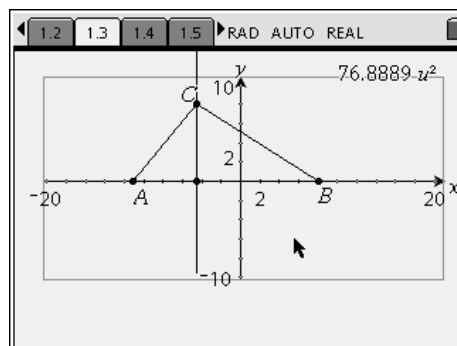


Figure 7

7. To construct the altitude of the triangle through C, use the Menu, select 9: Construction and 1: Perpendicular to construct the perpendicular to the x-axis through C. (Figure 8,9)

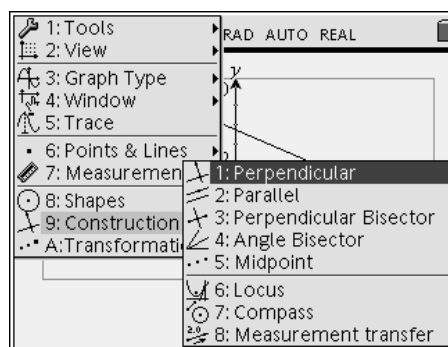


Figure 8

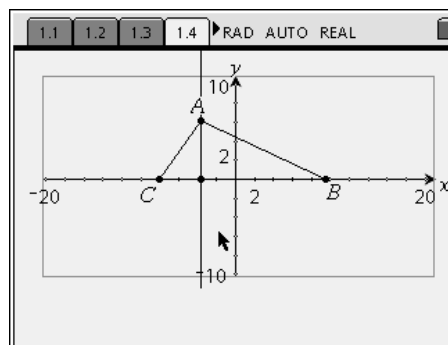


Figure 9

8. In order to have the altitude only and not the line, use 6: Points & Lines and 5:Segment to construct the segment from C to the intersection of the perpendicular and the x-axis. (Figure 10)

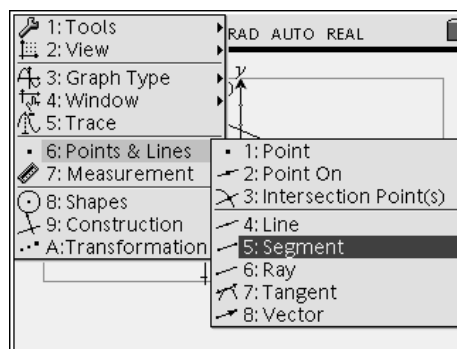


Figure 10

9. Use 1:Tools and 2: Hide/Show to hide the perpendicular line. Be sure to select the line, not the segment. (Figure 11, 12, 13)

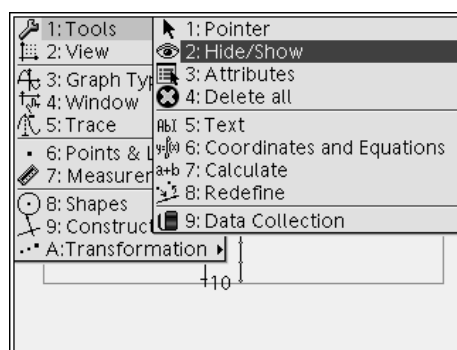


Figure 11

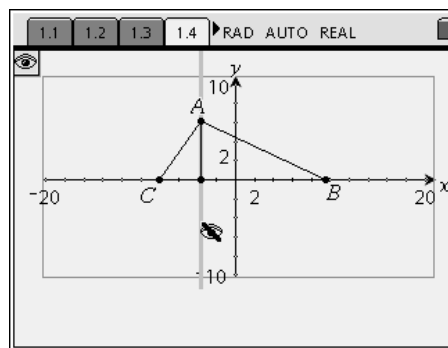


Figure 12

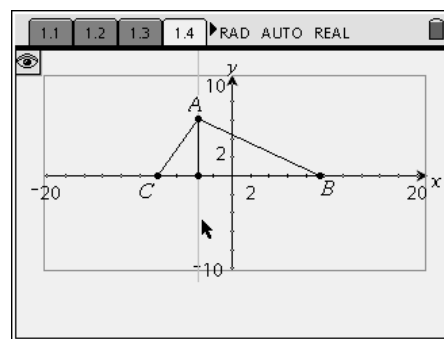


Figure 13

10. Use 1:Tools and 2:Area to measure the area of the triangle. (Figure 14, 15)

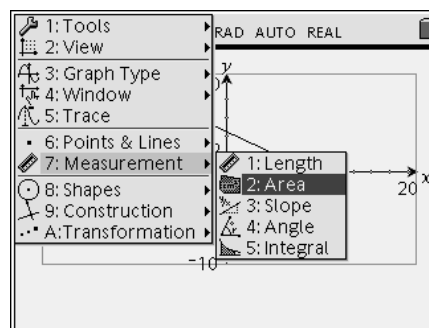


Figure 14

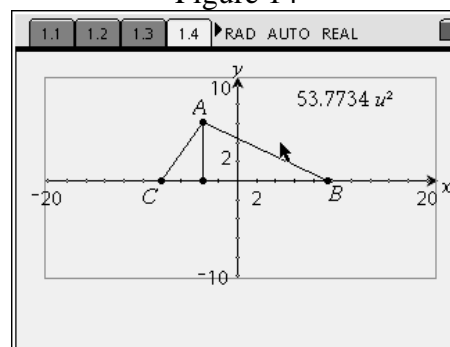
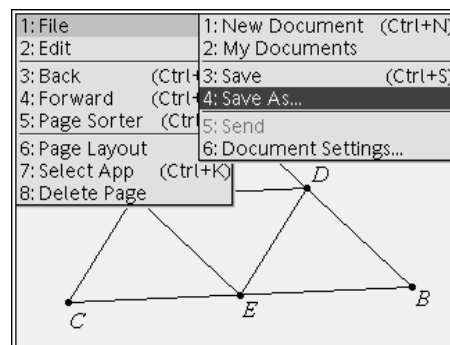


Figure 15

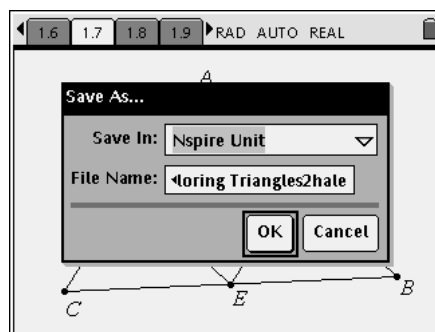
As the teacher, you could download the TI-Nspire™ document named **Exploring Triangles2** to students at this stage to move the investigation along at a faster pace.

Download the TI-Nspire™ document to all student units or computers. This document contains all of the previous construction as well as the questions that follow in the section of this activity.

One of the methods that many teachers use to expedite the use of the file in a student unit is to have the students do a “Save as” of the file using the student’s name in the file name.



This offers two advantages. The student can download the file with answers to the teacher's computer to be graded. It also protects the original file of the activity in the students' unit from corruption and preserves it for the use of other students.

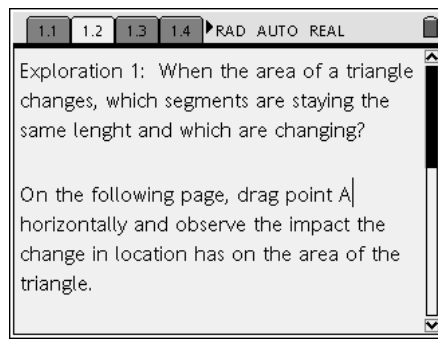
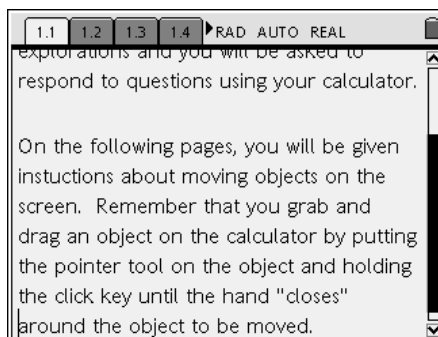
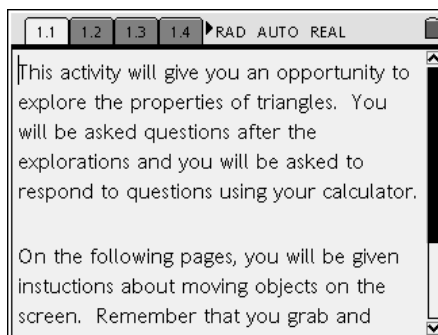


Exploration 1

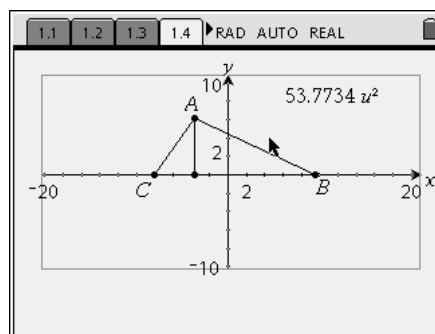
- The following investigation is identical to the pages and problems contained in this file.
- This activity will give you an opportunity to explore the properties of triangles. You will be asked questions after the explorations and you will be asked to respond to questions using your calculator.

On the following pages, you will be given instructions about moving objects on the screen. Remember that you grab and drag an object on the calculator by putting the pointer tool on the object and holding the click key until the hand "closes" around the object to be moved.

- When the area of a triangle changes, which segments are staying the same length and which are changing?
- On the following page, drag point A horizontally and observe the impact the change in location has on the area of the triangle.



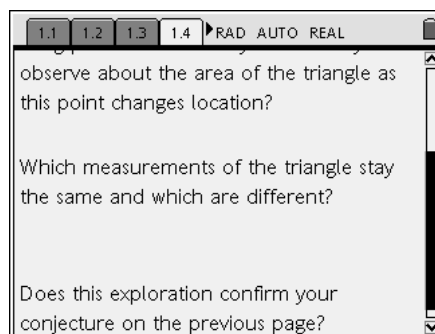
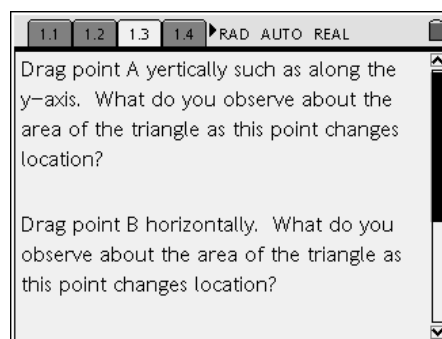
By dragging point A horizontally, the student should observe that the area of the triangle does not change.



- Drag point A vertically such as along the y-axis. What do you observe about the area of the triangle at this point changes location?
- Drag point B horizontally. What do you observe about the area of the triangle as this point changes location?

The students should observe that the area of the triangle changes as the location of these points change as indicated.

- Which measurements of the triangle stay the same and which are different?
- Does this exploration confirm your conjecture on the previous page?



Use the measurement tool to measure those segments that you think impact the change in area. See if your measurements confirm your conjecture.

- What measurements change and result in a change in the area of the triangle?

Exploration 2

In this activity, you will explore the relationships that are created within a triangle when midpoint of the sides are drawn and connected with segments.

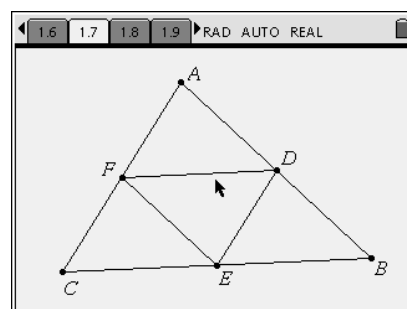
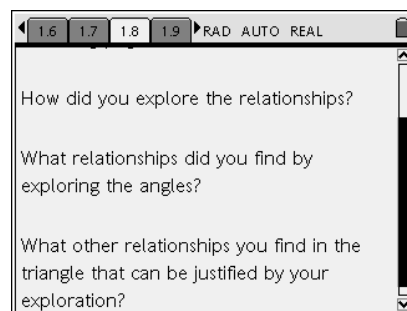
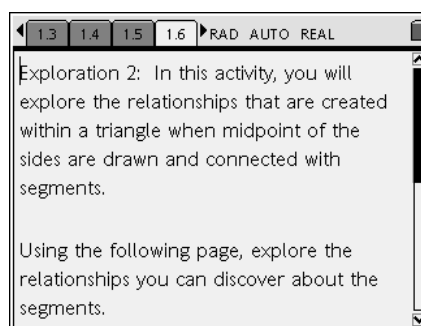
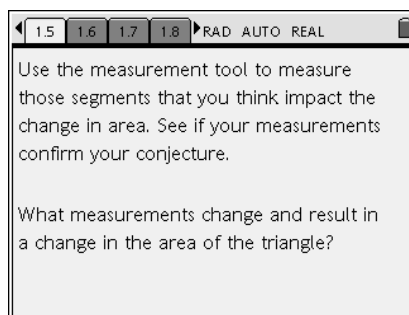
- Using the following page, explore the relationships you can discover about the segments.

Students should discover that segment FD is $\frac{1}{2}$ as long as CB, etc.

Now explore relationships that may exist between the angles in drawing on the following page

- How did you explore the relationships?
- What relationships did you find by exploring the angles?
- What other relationships did you find in the triangle that can be justified by your explorations?

Students should be able to discover that there are pairs of congruent angles that indicate parallel lines.



- Name all the relationships that you found between the angles in the triangle.
- What conclusion can you make about the segments in the triangle base on your exploration about the angles?

Student should be able to conclude that the segment that connects the midpoints of two sides of a triangle is parallel to and $\frac{1}{2}$ the length of the third side of the triangle.

1.7 1.8 1.9 1.10 RAD AUTO REAL

Name all the relationships that you found between the angles in the triangle.

What conclusion can you make about the segments in the triangle based on your exploration about the angles?