

TI-Nspire Activity: Triangle congruency by SSS and Properties of Isosceles triangles using coordinate geometry.

By: Edison Teano, Jr.

Activity Overview

The mathematics goal of this activity is to deepen students' understanding of the properties of isosceles triangles, deductive reasoning, and coordinate geometry. First, students will utilize the SSS postulate to ensure that each of the four trusses of the roof of a dog house that they are building has exactly the same size and shape. Second, they are asked to complete a two-column proof to demonstrate that the two triangular sides formed inside of each truss are congruent. Third, they use CPCTC to prove that the bottom legs of the right triangles formed inside of each truss are congruent. Further, they utilize that information together with the Pythagorean Theorem to calculate the value of the hypotenuse of the right triangle. Fourth, they utilize their knowledge of coordinate geometry to graph the triangle on the Cartesian coordinate system and calculate the mid-point, distance, slope, and perimeter of the triangle. Finally, they calculate the cost of purchasing wood to build the trusses for the roof of a dog house.

At the end of a double- period class, the students should be able to:

1. Calculate the midpoint, distance, perimeter, area, and slope by using the TI-Nspire calculator;
2. Solve real world problems by applying their understanding of isosceles triangles, coordinate geometry, and deductive reasoning;
3. Complete the group activity collaboratively; and
4. Make a reflection about the concept learned for the day.

Concepts

SSS

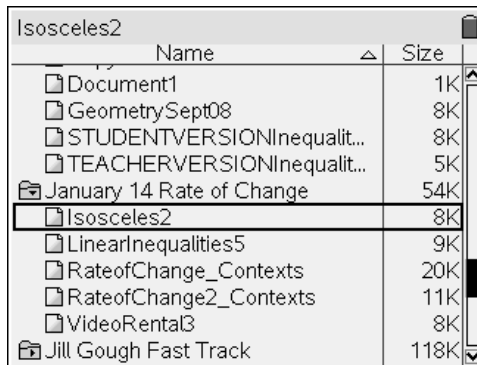
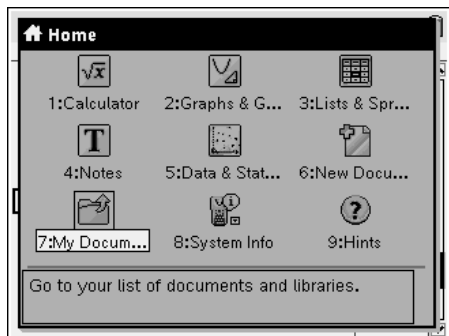
Midpoint

Pythagorean Theorem

CPCTC

Teacher Preparation

Load *Isosceles2.tns* file onto all the students' handhelds. The activity consists of a problem designed to be teacher directed with time for students to investigate and record their observations. Under The Classroom section below, you will find suggestions to guide the students into deeper understanding of the concepts of SSS and coordinate geometry.



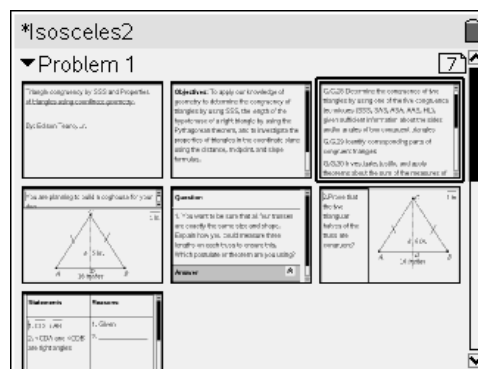
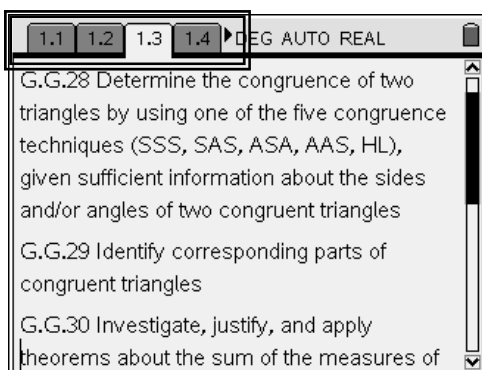
The Classroom

Guide the students in opening the *Isosceles2.tns* document.

- Turn the device on w
- Press the Home Key c.
- Select 7: My Documents.
- Open the folder containing the TNS file by scrolling to the folder using the NavPad and pressing \cdot .
- Scroll to *Isosceles2.tns* document and press \cdot to open it.
 - **If asked if you want to save the other document, press the Tab key e to highlight the No button and press Enter \cdot .

Remind the students how to move between pages.

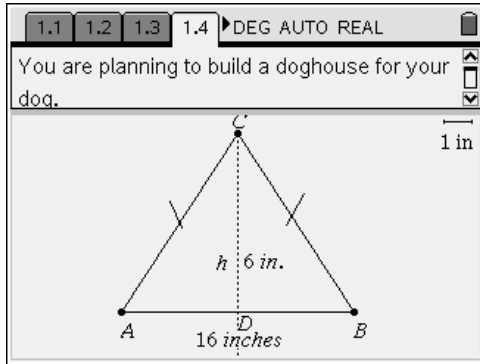
- To move between pages, press / and j or ϕ on the NavPad.
- To scroll ahead or back several pages in a document, press / and ` to view the Page Sorter view of the document. Use the NavPad to move to the desired page and press the center click key x to open the page.



Review the activity's performance indicators with the students.

Problem 1 Comments:

Have students skim the text, and then read the problem and questions aloud for the class. Remind students to press / and e to move from the problem to the questions in the page.



On page 1.4, students learn that the pitched roof of the doghouse that they are building will be supported by four trusses and that each truss will be an isosceles triangle with the dimensions shown above. Further, on page 1.5 students are asked to apply their understanding of the SSS postulate to ensure that each of the three sides of the trusses is exactly the same size and shape.

1.2 1.3 1.4 1.5 DEG AUTO REAL

Question

1. You want to be sure that all four trusses are exactly the same size and shape. Explain how you could measure three lengths on each truss to ensure this. Which postulate or theorem are you using?

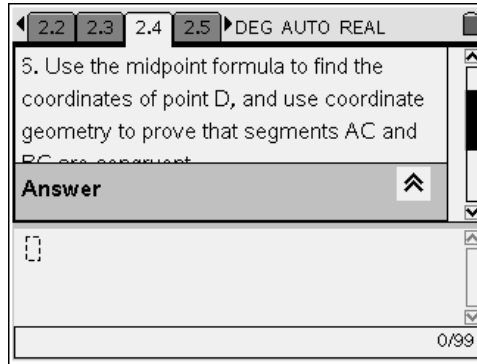
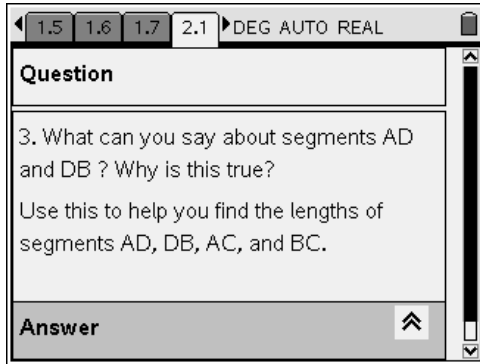
Answer

On pages 1.6 and 1.7, students are asked to use statements and reasons to prove that the two triangular halves of the truss are congruent.

1.4 1.5 1.6 1.7 DEG AUTO REAL

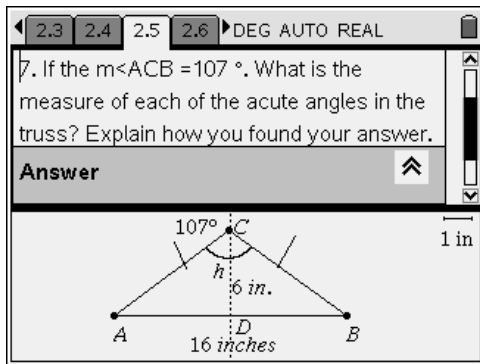
| Statements | Reasons |
|---|----------------------------------|
| 1. $\overline{CD} \perp \overline{AB}$ | 1. Given |
| 2. $\angle CDA$ and $\angle CDB$ are right angles | 2. _____ |
| 3. | 3. Definition of right triangles |

On page 2.1, students apply their understanding of CPCTC to prove that segments AD and DB are congruent. Further, students apply their understanding of the Pythagorean Theorem to find the length of the opposite sides to each congruent angle of the Isosceles triangle.

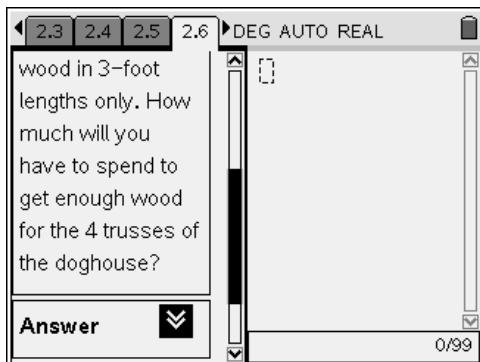


On pages 2.2-2.5 students graph the triangle on the Cartesian coordinate system and apply their understanding of slope, midpoint, and distance to explore some of the properties of Isosceles triangles. Further, they compute both the area and perimeter of the triangle using the TI-Nspire calculator.

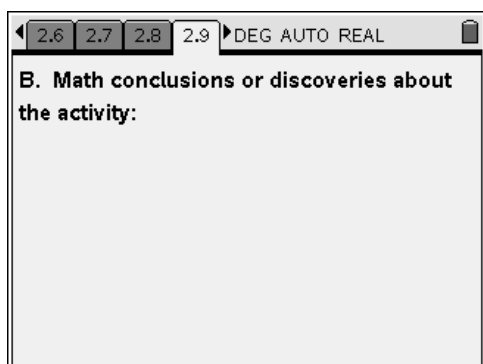
On page 2.5, students use the TI-Nspire calculator to prove that the base angles of Isosceles triangles are congruent.



Finally, on page 2.6 students are asked to compute the amount of money that they will need to buy the wood for the four trusses of the dog house.



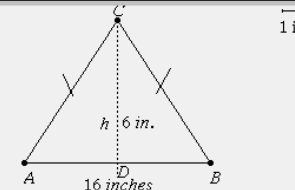
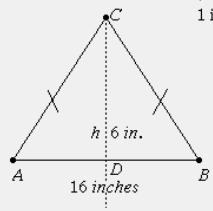
After the students have recorded their calculations and observations on page 2.6, they should each share them with the entire class. Finally, provide students with the opportunity to complete their journal writing on pages 2.7-2.9.



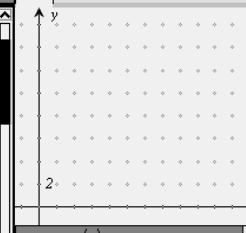
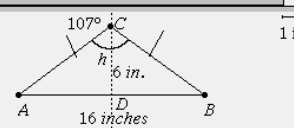
The image shows a digital interface for a journal page. At the top, there is a navigation bar with buttons for pages 2.6, 2.7, 2.8, and 2.9. The 2.9 button is highlighted. To the right of the page numbers, there is a dropdown menu currently set to 'DEG AUTO REAL' and a trash icon. Below the navigation bar, the main content area contains the text: **B. Math conclusions or discoveries about the activity:** followed by a large, empty rectangular box for writing.

The Document

| | | |
|--|--|---|
| <p>1.1 1.2 1.3 1.4 ▶ DEG AUTO REAL</p> <p>Triangle congruency by SSS and Properties of triangles using coordinate geometry.</p> <p>By: Edison Teano, Jr.</p> | <p>1.1 1.2 1.3 1.4 ▶ DEG AUTO REAL</p> <p>Objectives: To apply our knowledge of geometry to determine the congruency of triangles by using SSS, to find the length of the hypotenuse of a right triangle by using the Pythagorean theorem, and to investigate the properties of triangles in the coordinate plane using the distance, midpoint, and slope formulas.</p> | <p>1.1 1.2 1.3 1.4 ▶ DEG AUTO REAL</p> <p>G.G.28 Determine the congruence of two triangles by using one of the five congruence techniques (SSS, SAS, ASA, AAS, HL), given sufficient information about the sides and/or angles of two congruent triangles</p> <p>G.G.29 Identify corresponding parts of congruent triangles</p> <p>G.G.30 Investigate, justify, and apply theorems about the sum of the measures of</p> |
|--|--|---|

| | | |
|--|---|---|
| <p>1.1 1.2 1.3 1.4 ▶ DEG AUTO REAL</p> <p>You are planning to build a doghouse for your dog.</p>  | <p>1.2 1.3 1.4 1.5 ▶ DEG AUTO REAL</p> <p>Question</p> <p>1. You want to be sure that all four trusses are exactly the same size and shape. Explain how you could measure three lengths on each truss to ensure this. Which postulate or theorem are you using?</p> <p>Answer</p> | <p>1.3 1.4 1.5 1.6 ▶ DEG AUTO REAL</p> <p>2. Prove that the two triangular halves of the truss are congruent?</p>  |
|--|---|---|

| <p>1.4 1.5 1.6 1.7 ▶ DEG AUTO REAL</p> <table border="1"> <thead> <tr> <th>Statements</th> <th>Reasons</th> </tr> </thead> <tbody> <tr> <td>1. $\overline{CD} \perp \overline{AB}$</td> <td>1. Given</td> </tr> <tr> <td>2. $\angle CDA$ and $\angle CDB$ are right angles</td> <td>2. _____</td> </tr> <tr> <td>3.</td> <td>3. Definition of right triangles</td> </tr> </tbody> </table> | Statements | Reasons | 1. $\overline{CD} \perp \overline{AB}$ | 1. Given | 2. $\angle CDA$ and $\angle CDB$ are right angles | 2. _____ | 3. | 3. Definition of right triangles | <p>1.5 1.6 1.7 2.1 ▶ DEG AUTO REAL</p> <p>Question</p> <p>3. What can you say about segments AD and DB? Why is this true? Use this to help you find the lengths of segments AD, DB, AC, and BC.</p> <p>Answer</p> | <p>1.6 1.7 2.1 2.2 ▶ DEG AUTO REAL</p> <p>4. You want to make careful plans on a coordinate plane before you begin your construction of the trusses. Each unit of the coordinate plane represents 1 inch. How could you assign coordinates to vertices A, B, and C?</p> <p>Answer</p> |
|---|----------------------------------|---------|--|----------|---|----------|----|----------------------------------|---|--|
| Statements | Reasons | | | | | | | | | |
| 1. $\overline{CD} \perp \overline{AB}$ | 1. Given | | | | | | | | | |
| 2. $\angle CDA$ and $\angle CDB$ are right angles | 2. _____ | | | | | | | | | |
| 3. | 3. Definition of right triangles | | | | | | | | | |

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|---|--|---|
| <p>1.7 2.1 2.2 2.3 ▶ DEG AUTO REAL</p> <p>5. Plot the values in your coordinate plane, compute the area enclosed.</p> <p>An...</p>  <p>$f(x) =$</p> | <p>2.1 2.2 2.3 2.4 ▶ DEG AUTO REAL</p> <p>5. Use the midpoint formula to find the coordinates of point D, and use coordinate geometry to prove that segments AC and BC are congruent.</p> <p>Answer</p> | <p>2.2 2.3 2.4 2.5 ▶ DEG AUTO REAL</p> <p>7. If the $m\angle ACB = 107^\circ$. What is the measure of each of the acute angles in the truss? Explain how you found your answer.</p> <p>Answer</p>  |
|---|--|---|

| | | |
|--|---|--|
| <p>2.3 2.4 2.5 2.6 DEG AUTO REAL</p> <p>8. You can buy the wood for the trusses at Lowe's for \$0.80 a foot. The store sells the wood in 3-foot lengths only. How much will you have to spend to</p> <p>0/99</p> | <p>2.7 2.8 2.9 2.10 DEG AUTO REAL</p> <p>JOURNAL WRITING</p> | <p>2.7 2.8 2.9 2.10 DEG AUTO REAL</p> <p>A. Process Used:</p> |
|--|---|--|

2.7 2.8 2.9 2.10 DEG AUTO REAL

B. Math conclusions or discoveries about the activity:

2.7 2.8 2.9 2.10 DEG AUTO REAL

D. I need to know more about

[Teacher:]