Pythagorean Proofs

ID: 11613

Time Required
45 minutes

Activity Overview

In this activity, students will explore proofs of the Pythagorean Theorem. Students will explore the proof of the Pythagorean Theorem using area of squares, area of triangles and trapezoids, and by dissection. Students will then be asked to apply what they have learned about the Pythagorean Theorem.

Topic: Right Triangles & Trigonometric Ratios

- *Pythagorean Theorem*

Teacher Preparation and Notes

- *To complete this activity, students will need to know how to change between pages, grab and move points, and use the Calculator application.*
- *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 and enter "11613" in the quick search box.***

Associated Materials

- *PythagoreanProofs_Student.doc*
- *PythagoreanProofs.tns*
- *PythagoreanProofs_Soln.tns*

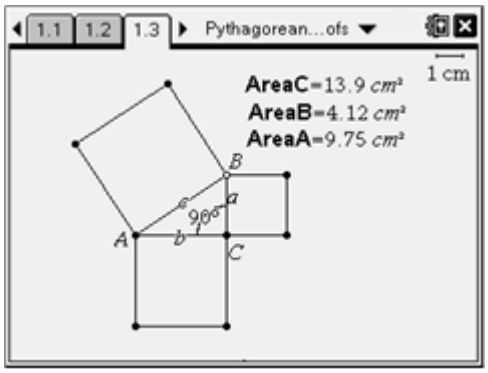
Suggested Related Activities

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

- *The Pythagorean Theorem—and More (TI-Nspire technology) — 8287*
- *"Nspired" by Numb3rs Activity: Investigating the Pythagorean Theorem (TI-Nspire technology) — 11119*
- *The Pythagorean Theorem (TI-84 Plus family) — 9532*

Problem 1 – Proof of the Pythagorean Theorem

Students will begin this activity by looking at a right triangle and the square formed by each of the three sides of the right triangle. Students should see the connection between the squares of the sides and the Pythagorean theorem.



Students will collect data in the spreadsheet on page 1.4 by moving point *B* (on page 1.3) and pressing ctrl + (.). They will do this for four different positions of the point.

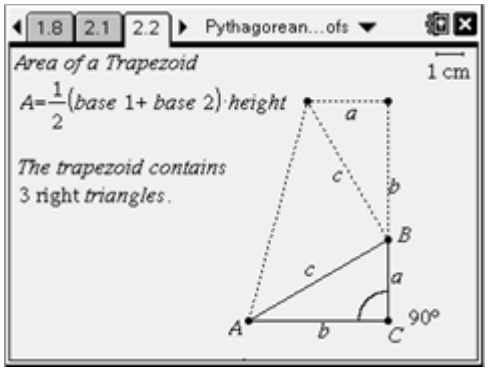
Students are asked several questions about the connection between the figure and the Pythagorean Theorem.

TI-Nspire Navigator Opportunity: *Screen Capture*

See Note 1 at the end of this lesson.

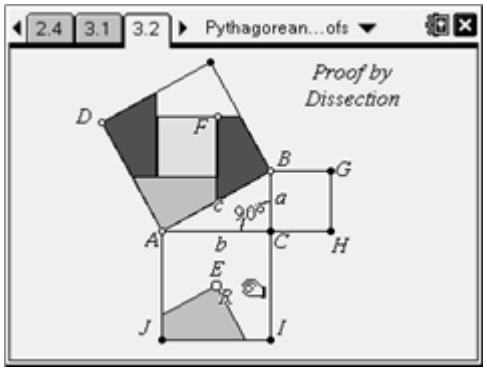
Problem 2 – President Garfield's Proof of the Pythagorean Theorem

For this problem students will construct an algebraic proof of the Pythagorean Theorem using the area of a trapezoid and the sum of the area of three right triangles.



Problem 3 – Proof by Dissection of the Pythagorean Theorem

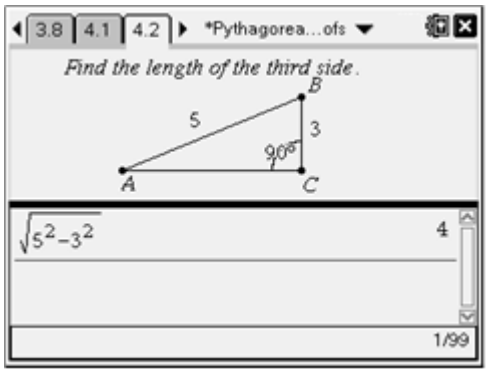
In this problem students are to "prove" the Pythagorean Theorem through a geometric proof. On page 3.2, students are given right triangle *ABC* and three squares representing a^2, b^2, and c^2. Students will move the five polygons that form to create c^2 to a^2 and b^2 to discover that the areas are the same.



Students are asked several questions that inquire as to why this proves the Pythagorean Theorem.

Problem 4 – Application of the Pythagorean Theorem

In Problem 4, students are asked to apply what they have learned about the Pythagorean Theorem to find the length of the third side of a right triangle given two sides of the triangle. The students are given a triangle and a calculator on each page. The students are to use the calculator to find the length of the third side. Note: Students will need to press ctrl + enter for an approximate solution.



TI-Nspire Navigator Opportunity: *Quick Poll*

See Note 2 at the end of this lesson.

Student Solutions

1. Sample Answers

Position	a^2	b^2	c^2	$a^2 + b^2$
1	6.9840386476596	2.9539317454945	9.9379703931541	9.9379703931541
2	11.70446186021	4.9504567768093	16.65491863702	16.654918637019
3	16.877433290168	7.1383891890401	24.015822479208	24.015822479208
4	23.197557605646	9.8115152687787	33.009072874424	33.009072874425

2. They represent a^2, b^2, and c^2.
3. The sum of the area of the two smaller squares equals the area of the larger square.
4. They are equal.
5. $a^2 + b^2 = c^2$
6. $$\frac{1}{2}(b+a)(a+b) = \frac{1}{2}(b)(a) + \frac{1}{2}(b)(a) + \frac{1}{2}(c)(c)$$
$$\frac{1}{2}(ba + b^2 + a^2 + ab) = ba + \frac{1}{2}c^2$$
$$\frac{1}{2}(2ab + b^2 + a^2) = ba + \frac{1}{2}c^2$$
$$ab + \frac{1}{2}b^2 + \frac{1}{2}a^2 = ab + \frac{1}{2}c^2$$
$$\frac{1}{2}b^2 + \frac{1}{2}a^2 = \frac{1}{2}c^2$$
$$a^2 + b^2 = c^2$$

7. In a right triangle the sum of the square of the two legs is equal to the square of the hypotenuse.
8. Square *ABED*
9. Square *ACIJ*
10. Square *BCHG*
11. The area of c^2 and the areas of a^2 and b^2 are equal.
12. Area of c^2 = Area of (a^2 + b^2)
13. 4
14. $\sqrt{32} = 4\sqrt{2} \approx 5.656$
15. 5
16. 25

TI-Nspire Navigator Opportunities

Note 1
Problem 1, *Screen Capture*
This would be a good place to do a screen capture to verify students are able to capture the points into the table. Using a projector and flipping through the screens, students can see different results possible. Later in the activity, you may choose to take screen captures to verify 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.