# Pythagorean Proofs

ID: 11604

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

- *This activity was written to be explored with the Cabri Jr. and the Learning Check app on the TI-84.*
- *Before beginning this activity, make sure that all students have the Cabri Jr. and Learning Check applications, and the Cabri Jr. file Trig.8xv and the Learning Check file Trig.edc loaded on their TI-84 calculators.*
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## Associated Materials

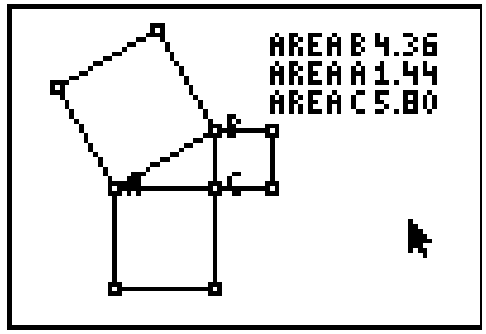
- *GeoWeek12_Pythagorean_Worksheet_TI84.doc*
- *Pythagor.8xv*
- *Pythago.8xv*

## Suggested Related Activities

*To download any activity listed, go to* education.ti.com/exchange *and enter "11604" 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) — 9532*

**Problem 1 – Proof of the Pythagorean Theorem**

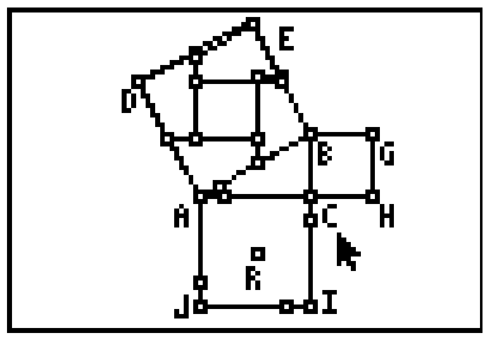



students will begin this activity In the file *PYTHAGOR.8xv* by looking at a right triangle and the square formed by each of the three sides of the right triangle. Students should see the connection between the squares of the sides and the Pythagorean theorem.

Students will collect data in the spreadsheet on their student worksheet. 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.

**Problem 2 – Proof by Dissection of the Pythagorean Theorem**

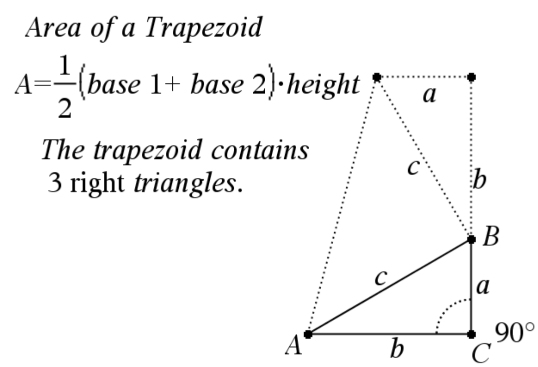



In this problem students are to "prove" the Pythagorean Theorem through a geometric proof. In *PYTHAGO.8xv*, students are given right triangle *ABC* and three squares representing $a^2$, $b^2$, and $c^2$. Students will move the four polygons that form to create $c^2$ to $a^2$ and $b^2$ to discover that the areas are the same.

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

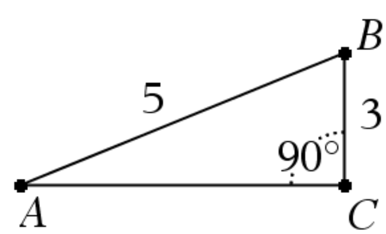
**Problem 3 – President Garfield's Proof of the Pythagorean Theorem**

In this extension 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 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.



**Student Solutions**

1. Sample Answers

| Position | *Area A* ($a^2$) | *Area B* ($b^2$) | *Area C* ($c^2$) | $a^2 + b^2$ |
|---|---|---|---|---|
| **1** | 1.44 | 4.36 | 5.80 | 5.80 |
| **2** | 1.44 | 5.71 | 7.15 | 7.15 |
| **3** | 2.22 | 3.24 | 5.46 | 5.46 |
| **4** | 2.22 | 0.64 | 2.86 | 2.86 |

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. In a right triangle the sum of the square of the two legs is equal to the square of the hypotenuse.
7. Square *ABED*
8. Square *ACIJ*
9. Square *BCHG*
10. The area of $c^2$ and the areas of $a^2$ and $b^2$ are equal.
11. Area of $c^2$ = Area of ($a^2 + b^2$)
12. 

$$\frac{1}{2}(b+a)(a+b) = \frac{1}{2}(b)(a) + \frac{1}{2}(b)(a) + \frac{1}{2}(c)(c)$$
$$\frac{1}{2}(ba + b^2 + a^2 + ab) = ba + \frac{1}{2}c^2$$
$$\frac{1}{2}(2ab + b^2 + a^2) = ba + \frac{1}{2}c^2$$
$$ab + \frac{1}{2}b^2 + \frac{1}{2}a^2 = ab + \frac{1}{2}c^2$$
$$\frac{1}{2}b^2 + \frac{1}{2}a^2 = \frac{1}{2}c^2$$
$$a^2 + b^2 = c^2$$

13. 4
14. $\sqrt{32} = 4\sqrt{2} \approx 5.656$
15. 5
16. 25