Ozobot Classroom Application: Demonstration of the Pythagorean Theorem

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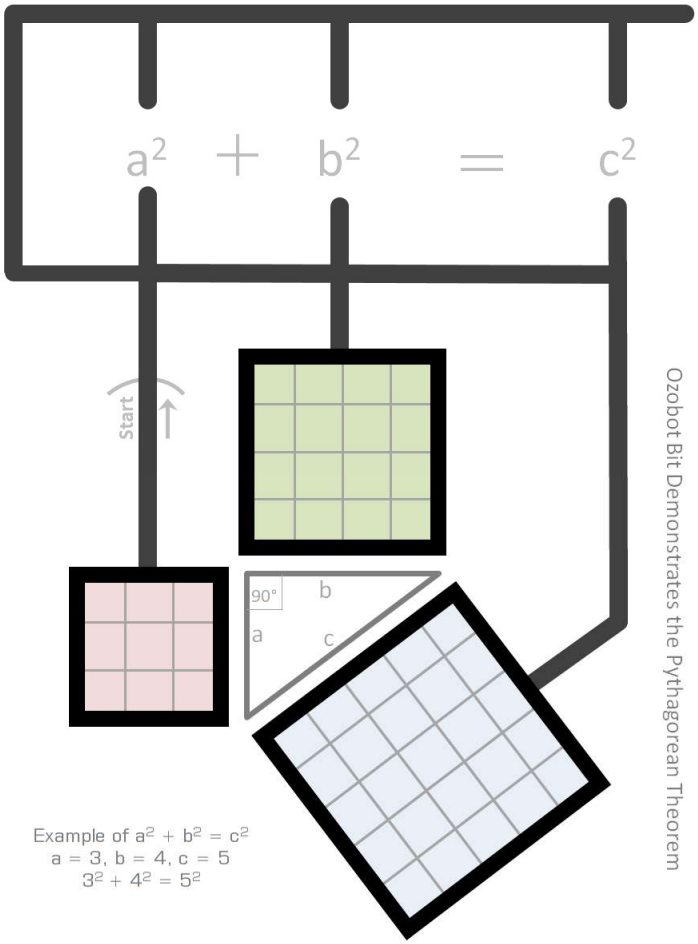
One of the most famous of the early Greek scholars was Pythagoras, who lived circa 500 B.C. The Pythagorean Theorem is named after him, as he is believed to have first proved the theorem. This theorem is clearly one of the most widely known mathematical theorems studied by school children worldwide. The theorem relates the length of the hypotenuse of a right-angled triangle to the lengths of the other two sides. The theorem states that the square of the hypotenuse (the side opposite the right angle) is equal to the sum of the squares of the other two sides. In equation form, the theorem is commonly expressed as $a^2 + b^2 = c^2$, where c is the length of the hypotenuse and a and b are the lengths of the other two sides.

In this classroom application, Ozobot is used to visually and dynamically demonstrate the relationships expressed by the Pythagorean Theorem. For reference while discussing this classroom application, the figure below shows a small version of the Ozobot map that students will use to investigate the relationships. A full-page version that can be printed for use with Ozobot appears on the last page of this document.



The top portion of the map shows the Pythagorean Theorem expressed in the form $a^2 + b^2 = c^2$. The bottom portion of the map shows a right triangle with sides of length a, *b*, and *c*, with the right angle opposite side *c*. As an example, squares with sides of length $a = 3$, $b = 4$, and $c = 5$ are shown adjacent to the three sides of the right triangle. The areas of the three squares, respectively, are 3^2, 4^2, and 5^2, providing an example of a right triangle for which $3^2 + 4^2 = 9 + 16 = 25 = 5^2$. The three squares are shaded red, green, and blue, corresponding to the LED color that Ozobot will display while navigating the squares.

Running the Ozobot Program

1. Load the program *Pythagorean.ozobot* **(share code is kc2hgt)** into Ozobot. Bit or Evo—both work well with this program.
2. Place Ozobot at the location labeled "Start" and facing the direction shown by the gray arrow.
3. Start the program in Ozobot.
4. He will begin by taking the a^2 path, displaying a **red** LED and going around the **red** square three times, giving the teacher time to explain the relationship between the a^2 term and the geometry of its square.
5. Next, Ozobot will take the b^2 path, displaying a **green** LED and going around the **green** square three times, again giving the teacher time to explain the relationship between the b^2 term and the geometry of its square.
6. Finally, he will take the c^2 path, displaying a **blue** LED and going around the **blue** square (adjacent to the hypotenuse of the triangle) three times, giving the teacher time to explain the relationship between the c^2 term and the geometry of its square.
7. Ozobot then stops and powers down.

Classroom Exercise # 1: *A **Pythagorean Triple** (a, b, c) consists of three positive integers a, b, and c for which $a^2 + b^2 = c^2$. A **primitive** Pythagorean Triple is one for which a, b, and c are all co-prime (the greatest common divisor of a, b, and c is 1). Ozobot demonstrated the primitive Pythagorean triple (3, 4, 5). By considering squares of integers through 25, see if you can come up with an additional primitive Pythagorean triple. [When considering squares of integers through 25, there are actually three such primitive Pythagorean triples.]*

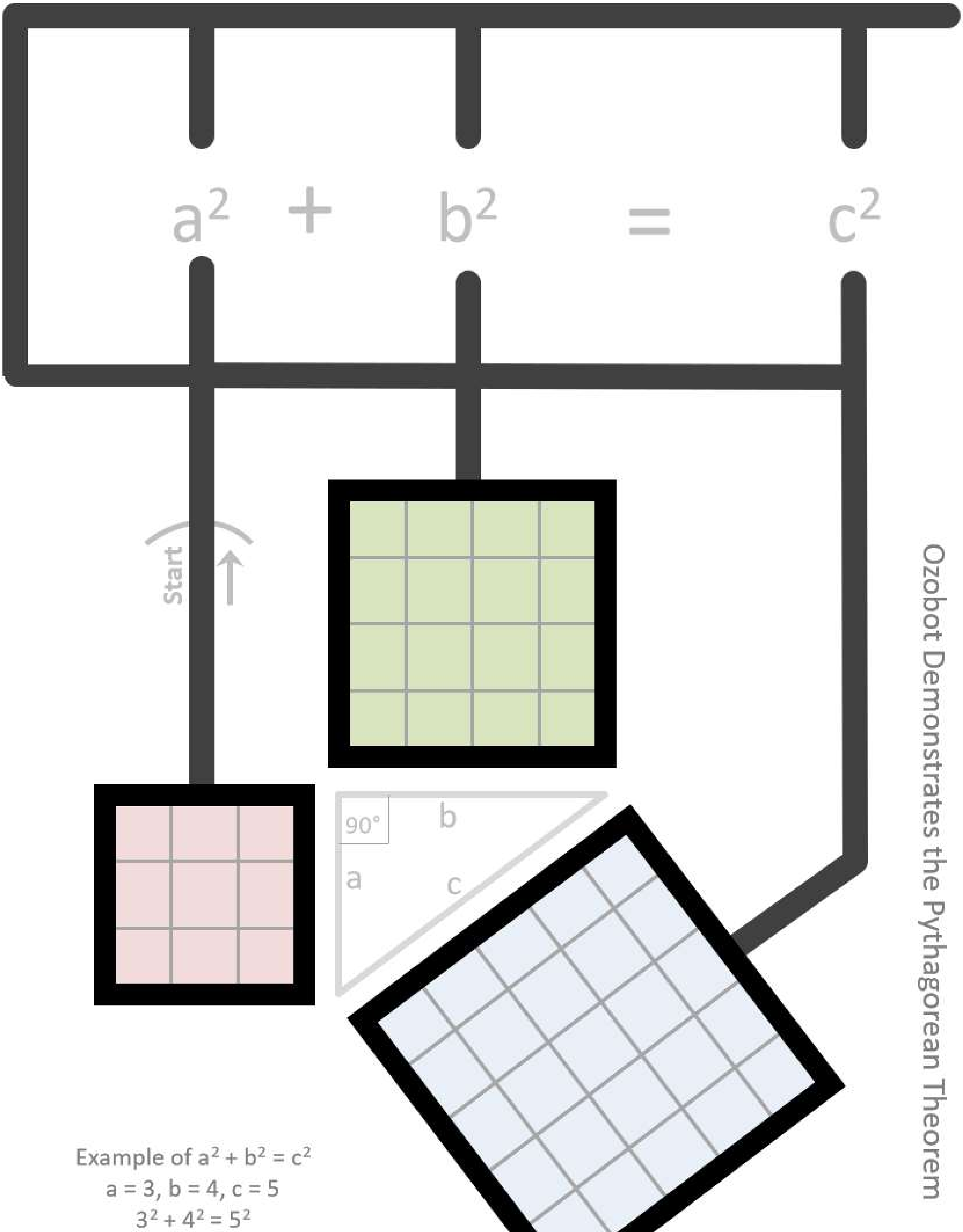
Classroom Exercise # 2: *What would be the length of the hypotenuse of a right triangle whose other two sides have lengths a = 1 and b = 1? This is an example for which the length of the hypotenuse is an irrational number, even though its sides are integers.*

Classroom Exercise #3: *What would the length of the hypotenuse be if the other two sides have length a = 1 and b = √2? This is an example for which the hypotenuse and one of the sides are irrational.*

Classroom Exercise #4: *What would the length of the hypotenuse be if the other two sides have length a = √2 and b = √7? This is an example for which the hypotenuse is an integer, even though the sides are both irrational.*

Classroom Exercise #5: *Can you come up with an example of a right triangle for which all three sides have lengths that are irrational.*

Ozobot Demonstrates the Pythagorean Theorem



Example of $a^2 + b^2 = c^2$
$a = 3, b = 4, c = 5$
$3^2 + 4^2 = 5^2$