

Ozobot Bit Classroom Application: Demonstration of the Pythagorean Theorem

Created by

Richard Born

Associate Professor Emeritus

Northern Illinois University

nichb@rborn.org

Topics

Pythagorean Theorem

Mathematics

Algebra

Geometry

Ages

Grades 6-10

Duration

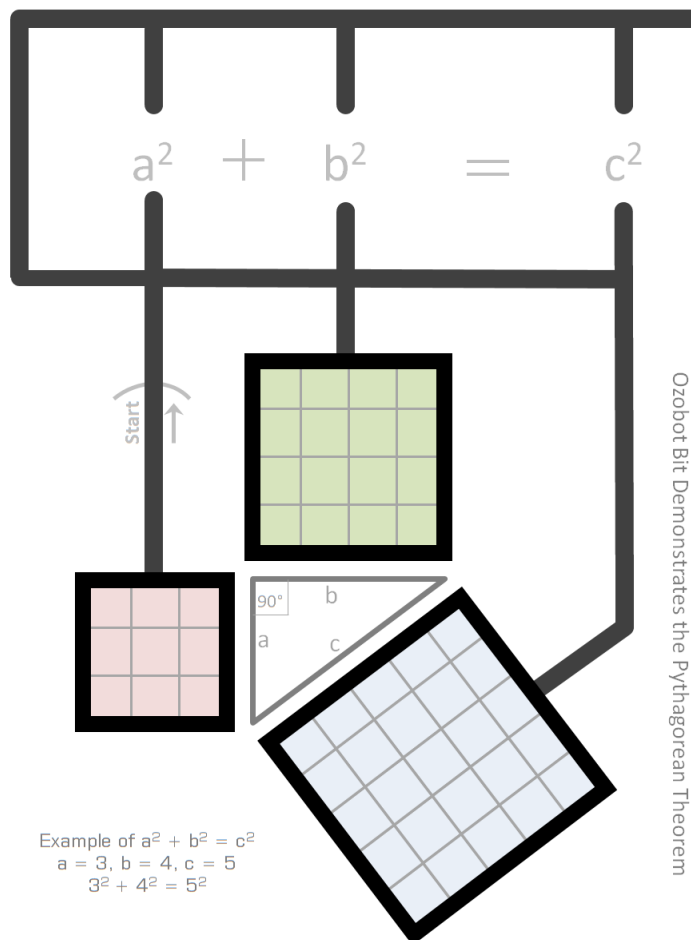
Approximately 10 minutes;
more time if the five classroom exercises are
also done in the classroom

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Associate Professor Emeritus
Northern Illinois University
rborn@niu.edu

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 Bit 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 Bit map that students will use to investigate the relationships. A full page version that can be printed for use with Ozobot Bit 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 bit will display while navigating the squares.

Running the Ozobot Bit Program

1. Load the program *Pythagorean.ozobot* into Ozobot Bit
2. Make sure that Ozobot Bit is calibrated on paper before running the program.
3. Make sure that Ozobot Bit has clean wheels and plenty of battery charge.
4. Place Ozobot Bit at the location labeled "Start" and facing the direction shown by the gray arrow.
5. Start Ozobot by double-pressing the start button.
6. 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.
7. Next, Ozobot Bit 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.
8. 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.
9. Ozobot Bit 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 Bit 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.]

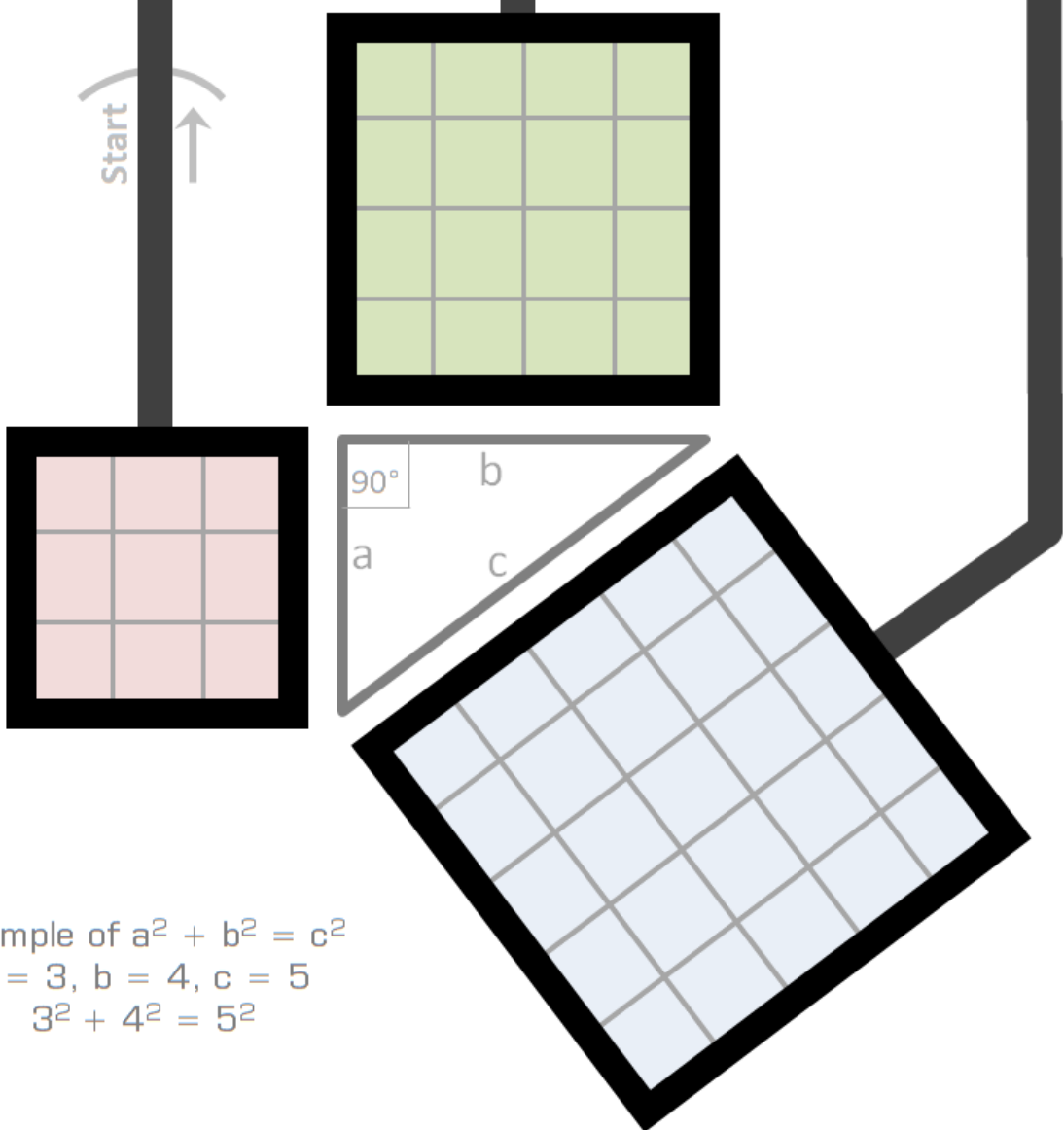
Classroom Exercise # 2: What would be the length of the hypotenuse of a right triangle whose other two sides have lengths $a = 1$ and $b = 1$? This is an example for which the length of the hypotenuse is an irrational number, even though its sides are integers.

Classroom Exercise #3: What would the length of the hypotenuse be if the other two sides have length $a = 1$ and $b = \sqrt{2}$? 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 $a = \sqrt{2}$ and $b = \sqrt{7}$? 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.

$$a^2 + b^2 = c^2$$



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

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