Ozobot Classroom Application: Demonstration of a Mathematical Identity

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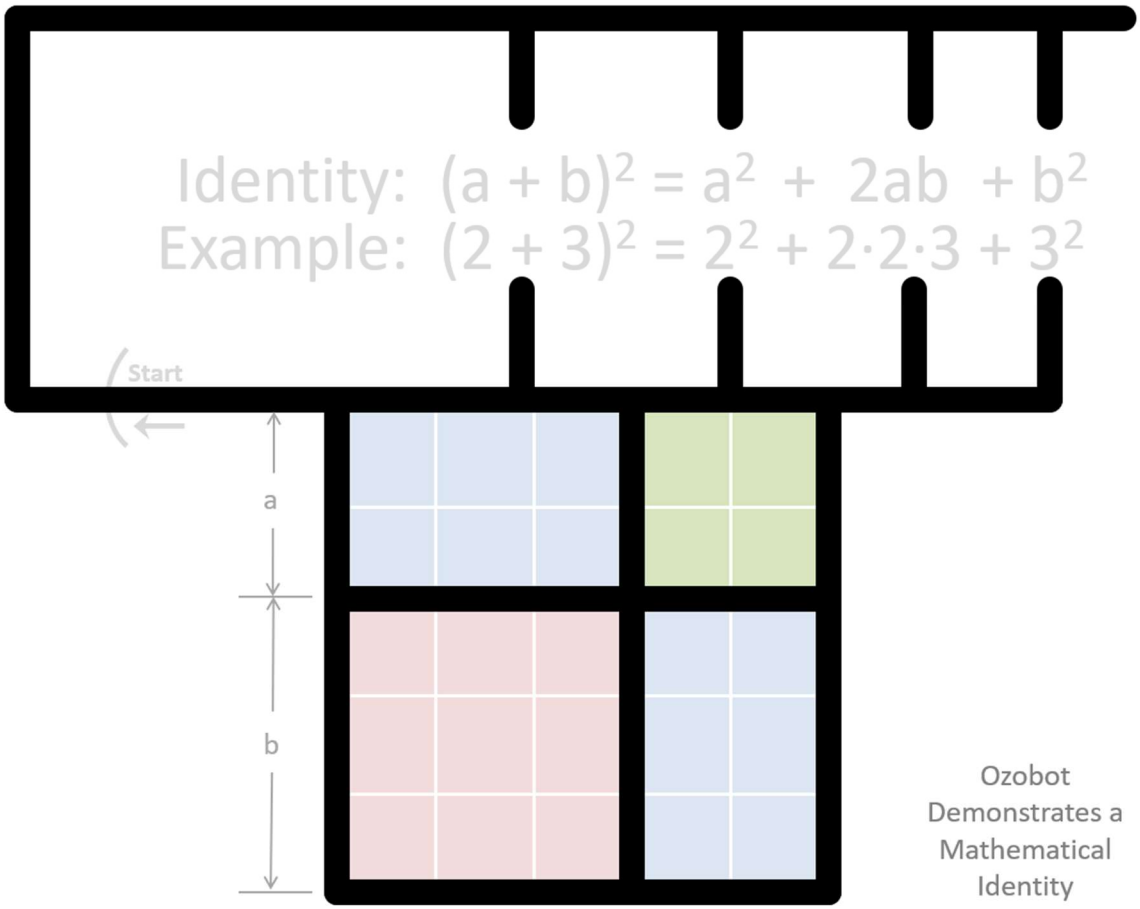
A ***mathematical identity*** is an equation that is true regardless of the values of its component variables. These equations can range from axioms such as the commutative law of addition, $a + b = b + a$, to more complex equations involving trigonometric functions such as $\sin(\alpha + \beta) = \sin\alpha\cos\beta + \cos\alpha\sin\beta$. For many mathematical identities there is a beautiful relationship between the algebraic identity itself and a corresponding geometric view of the identity. A big plus for such a relationship is that it provides the student with a visual aid to remembering the algebraic identity.

In this classroom application, Ozobot is used to demonstrate the relationship between the well-known algebraic identity $(a + b)^2 = a^2 + 2ab + b^2$, and its corresponding geometric view. For reference while discussing this application, the figure below shows a small version of the Ozobot map that students will use to investigate the relationship between the identity and its geometry. A full page version that can be printed for use with Ozobot Bit appears on the last page of this document.

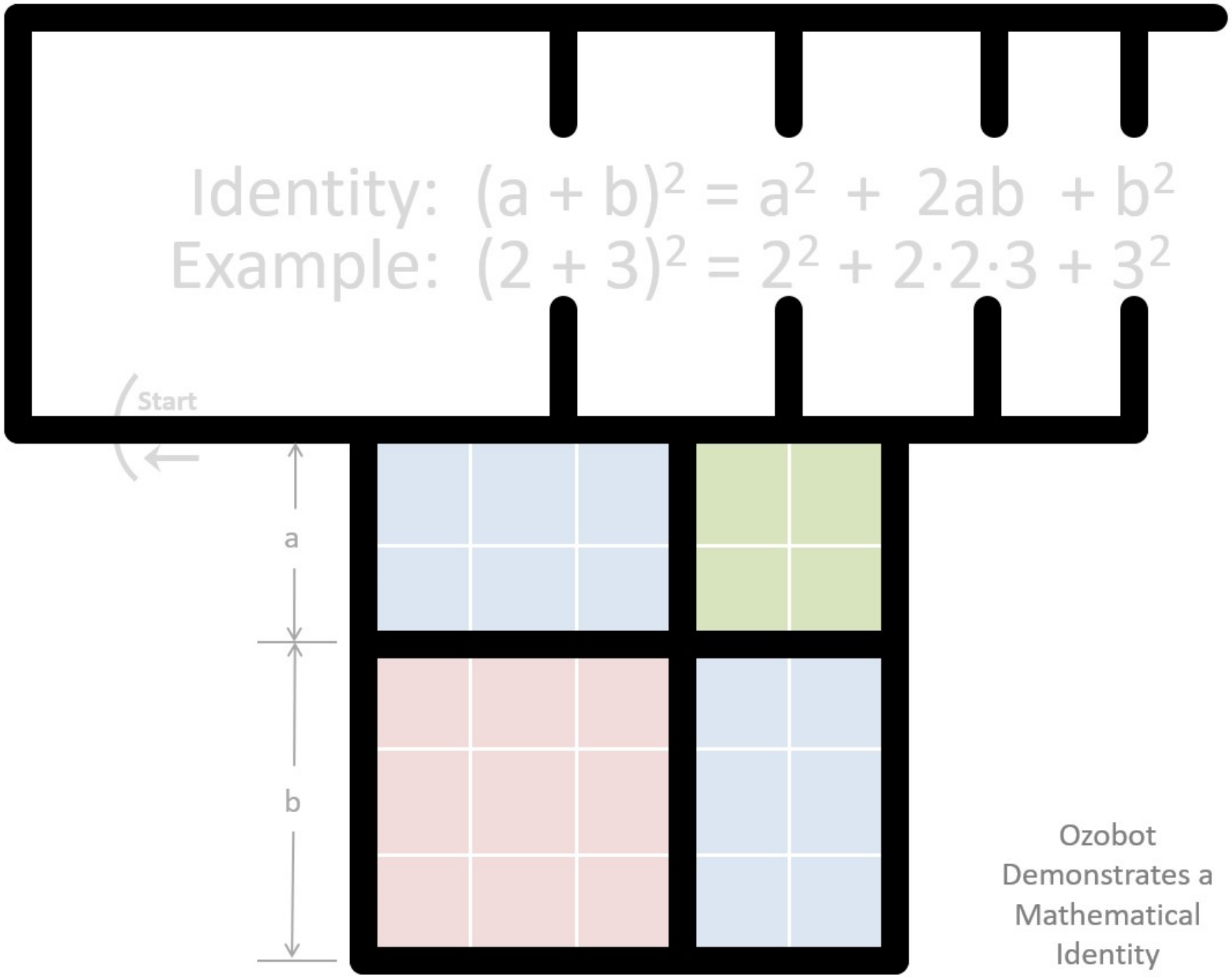


The top half of the map shows the identity $(a + b)^2 = a^2 + 2ab + b^2$ and an example of the identity where $a = 2$ and $b = 3$: $(2 + 3)^2 = 2^2 + 2 \cdot 2 \cdot 3 + 3^2$. The bottom half of the map shows a large square with sides of length $a + b$, or 2 + 3 as in the example. The large square consists of two smaller squares and two identical rectangles. One square is shaded **green**, with sides of length a, or 2 as in the example, and having an area of $\boldsymbol{a^2}$ or $2^2 = 4$ as in the example. The other smaller square, shaded **red** has sides of length b or 3 as in the example and area b^2 or $3^2 = 9$ as in the example. Finally there are two rectangles, both shaded **blue**. Each of the rectangles has an area ab, for a total area of $\boldsymbol{2ab}$ or $2 \cdot 2 \cdot 3$ as in the example. When Ozobot demonstrates the identity, he will show an LED that corresponds to the color of the region in the large square that he is navigating around.

Running the Ozobot Program

1. Load the program *IdentityDemonstration.ozobot* into Ozobot Bit or Evo **(share code is 3s8nby)**. This is a large program, so it may take a couple of minutes to load—"patience is a virtue".
2. Place Ozobot at the location labeled "Start" and facing the direction shown by the gray arrow.
3. Start Ozobot's program.
4. He will take the $(a + b)^2$ path and then go around the large square with sides of length $a + b$ three times, giving the teacher time to explain the relationship between that term in the equation and corresponding geometry.
5. Next, he will take the a^2 path and then go around the small **green** square three times while displaying a **green** LED, again giving the teacher time to explain the relationship between that term in the equation and corresponding geometry.
6. Next, he will take the *2ab* path and then go around the two **blue** rectangles three times while displaying a **blue** LED, giving the teacher time to discuss the relationship between that term in the equation and corresponding geometry.
7. Finally, he will take the b^2 path and then go around the **red** square three times while displaying a **red** LED, again giving the teacher time to explain the relationship between that term in the equation and corresponding geometry.
8. Ozobot will then stop and power down.

Classroom Exercise: *Ask the students to sketch the geometry for $(3 + 5)^2$, using the identity and the three terms on the right-hand side of the identity.*



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