Interactive GEOBOARD

Designed in California by Fred Ventura, Ph.D.

This manual provides additional support materials for educators who are using the Interactive Geoboard app for iPad.

A Note to Teachers…

The elementary mathematics curriculum traditionally has been designed to provide students with the opportunity to develop skills and acquire knowledge that would be important in adulthood and to prepare students to enter careers that would not require a high level of mathematical ability. Today the context of mathematics instruction needs to be much broader. The accelerated pace at which modern society produces technological change requires that high school graduates be prepared for careers in which mathematics will be very important. In order to be successful in many careers students will need to be confident in their mathematical abilities. They will need to be able to solve problems, to communicate mathematical ideas and to think logically.

The National Council of Teachers of Mathematics (NCTM) in the Curriculum and Evaluation Standards for School Mathematics calls for the establishment of a framework for a core curriculum in grades K-8 that reflects the needs of all students. The second standard of the NCTM document address the need for the mathematics curriculum to…

Include the continued development of the language and symbolism to communicate mathematical ideas so that all students can —

- ❑ Reflect upon and clarify their thinking about mathematical ideas and relationships;
- ❑ Formulate mathematical definitions and express generalizations discovered through investigations;
- ❑ Express mathematical ideas orally and in writing;
- ❑ Read written presentations of mathematics with understanding;
- ❑ Ask clarifying and extending questions related to mathematics the have read or heard about;

  Appreciate the economy, power and elegance of mathematical notation and its role in the development of mathematical ideas.

(NCTM)

The Interactive Geoboard is a iOS App that is intended to help students develop their ability to understand geometry and to communicate geometric ideas and concepts. It is specifically designed to create a learning environment where the vocabulary of geometry can be learned in an enjoyable way. The Interactive Geoboard gives students the ability to use a computer as a tool for exploring basic geometry and ideas related to area, perimeter and symmetry. This type of open-ended interactive app is most effective if the students work in groups of two so that the discussion of mathematical ideas is facilitated. Comments and feedback on the effectiveness of this app and supporting material are always welcome.

The Interactive Geoboard is an interactive learning system that has been designed to provide a hands-on learning experience for students in grades kindergarten through eighth grade. Several approaches to geometry instruction are combined in the design of this educational app. The Interactive Geoboard is designed to make a bridge to abstract mathematical reasoning from representational learning experiences. The Interactive Geoboard is a great way for elementary math teachers to introduce the abstract concepts related to area, perimeter and symmetry. It also provides a way for students to work with the terminology of geometry in a hands-on way. An actual physical geoboard usually includes pegs arranged in a 5x5 array and rubber bands. In the Interactive Geoboard app pegs can be set to a 5x5, 7x7 or 9x9 array. Lines can be drawn on the geoboard can use nine different colors.

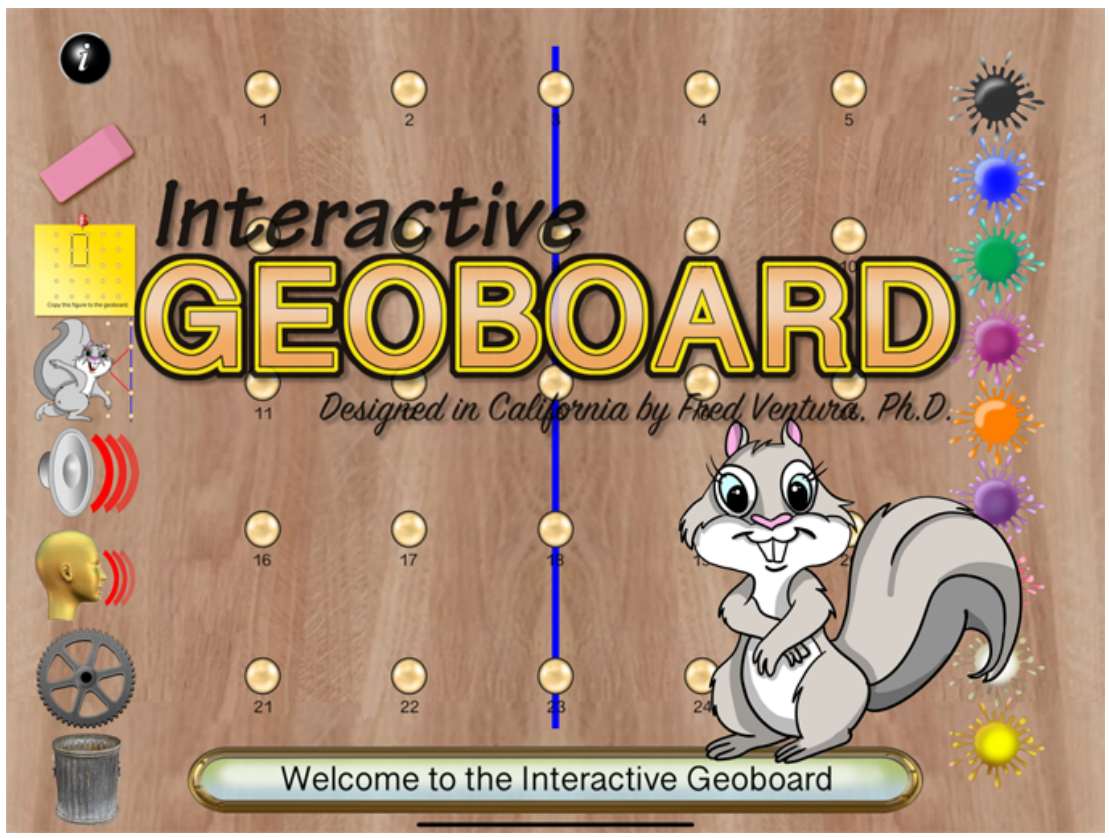
The figures draw on the geoboard represent important concepts related to the study of geometry. By tapping icons students get challenges involving perimeter, area, symmetry and learn the terminology of geometry.

Special features make using the Interactive Geoboard fun:

1. The app helps students visualize abstract geometric concepts.
2. Perimeter, area, symmetry and other ideas can be represented using line segments.
3. Ideas such as reflection, congruence, parallel, perpendicular and other concepts related to beginning geometry can be shown on the geoboard.
4. Speech and sound effects can be turned on or off.
5. The Interactive Geoboard is available exclusively for Apple iPad.

The main instructional goals of the Interactive Geoboard app are given in these educational objectives:

1. To provide practice identifying and matching terminology related to introductory geometry. This app graphically represents geometric figures, presenting key concepts of geometry in a way that motivates students to learn the associated geometric ideas as well providing an ability to explore geometry in a creative way.
2. To incrementally build an understanding of fundamental concepts by providing an easy-to-use format for exploring geometry.
3. To support the development of a student's sense of confidence in his or her mathematical ability by measuring and reporting progress toward achieving specific goals.



Activities

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2. Perpendicular Lines
3. Intersecting Lines
4. Parallelograms
5. Squares
6. Diagonals
7. Similar Figures
8. Introducing Perimeter
9. Introducing Area
10. Isosceles Triangle
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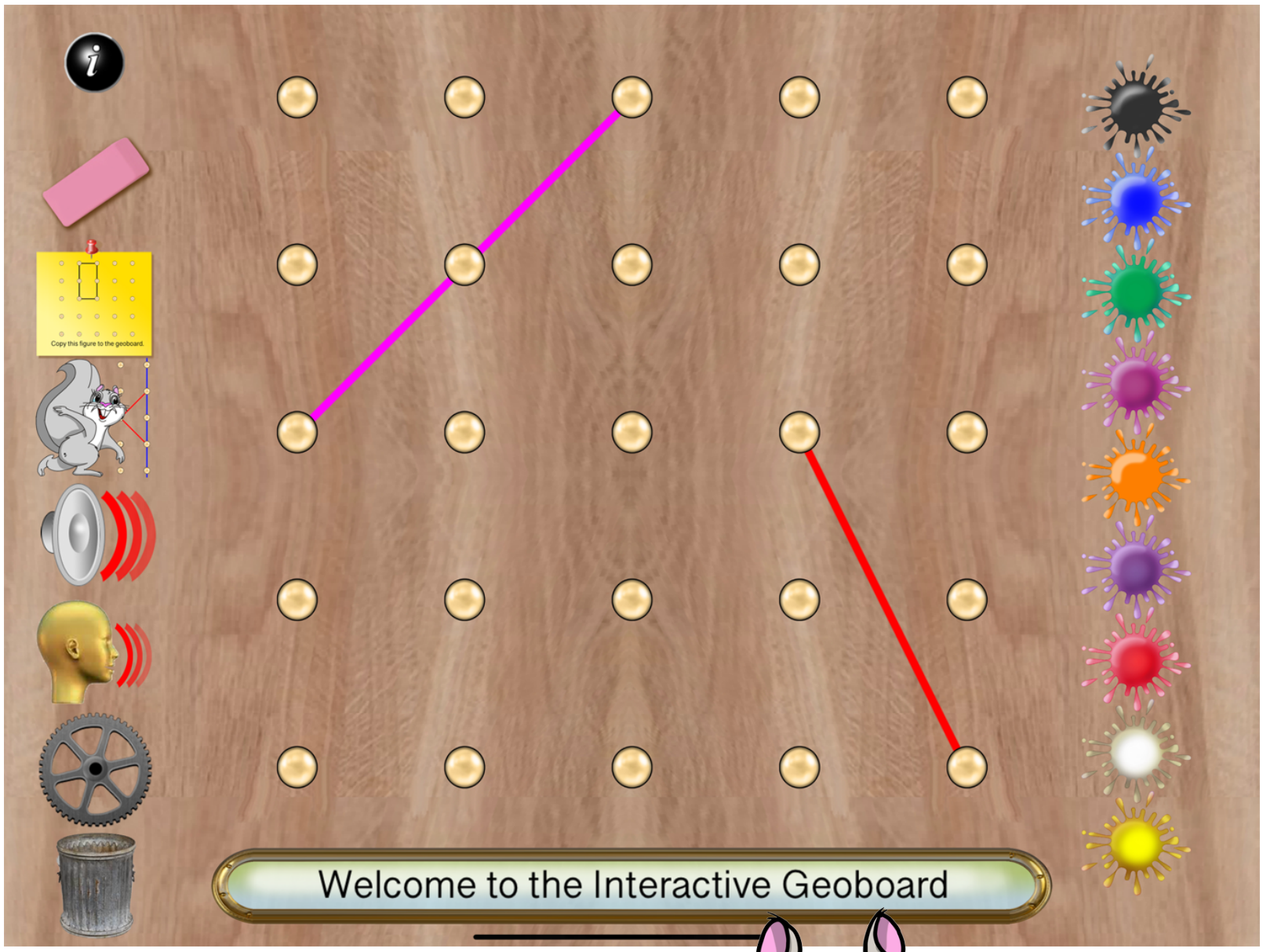
Send your questions or comments by email. We want to hear from you.

Activity #1

Interactive Geoboard Exploration: Parallel Lines

Draw two sets of parallel lines. Copy these figures to your geoboard. Draw two lines that are parallel.



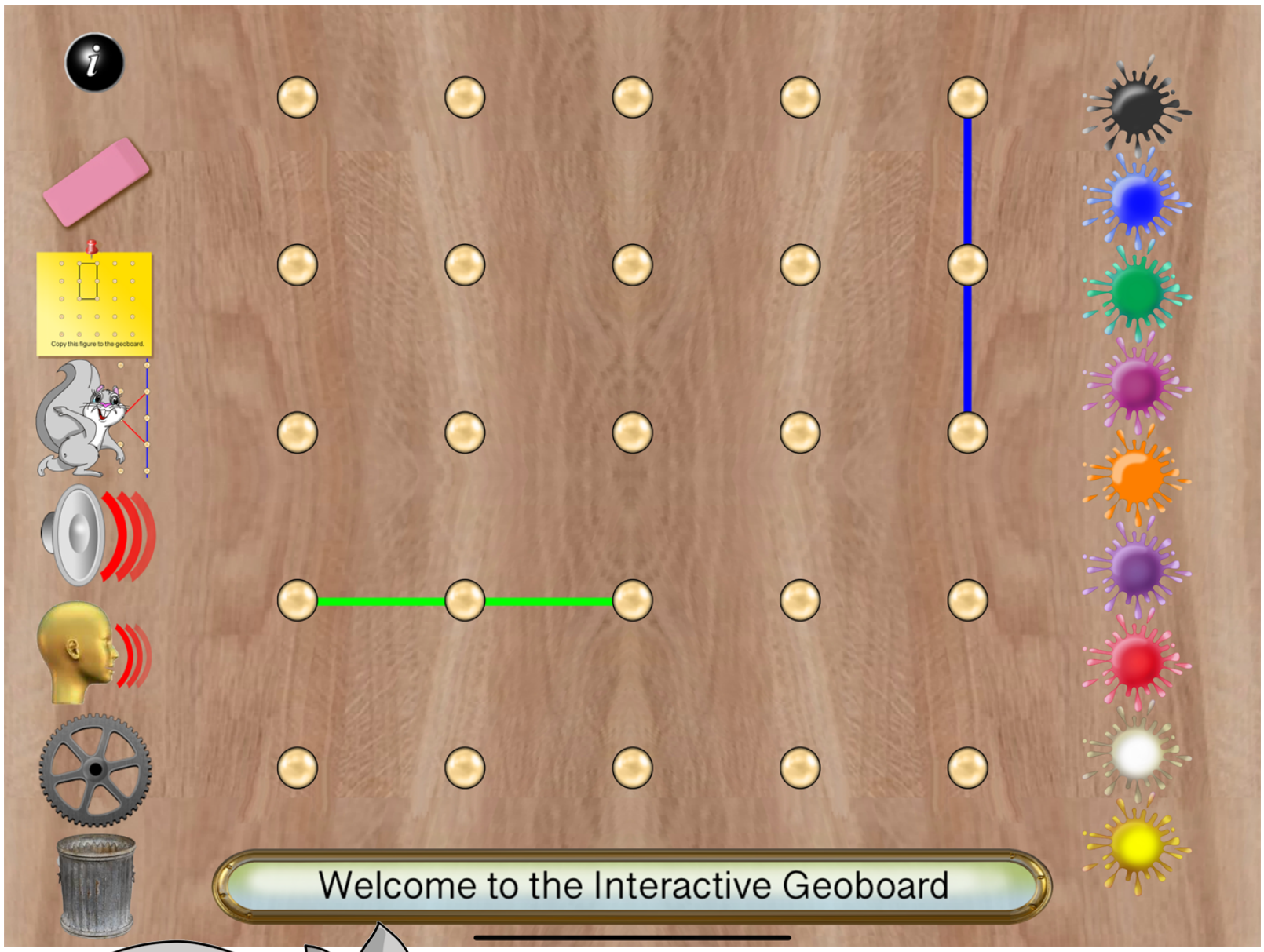
Self Check:

1. Parallel lines do not intersect.
2. Parallel lines are equidistant.

Activity #2

Interactive Geoboard Exploration: Perpendicular Lines

Draw two sets of perpendicular lines. Copy these figures to your geoboard. Draw two lines that are perpendicular.



Self Check:

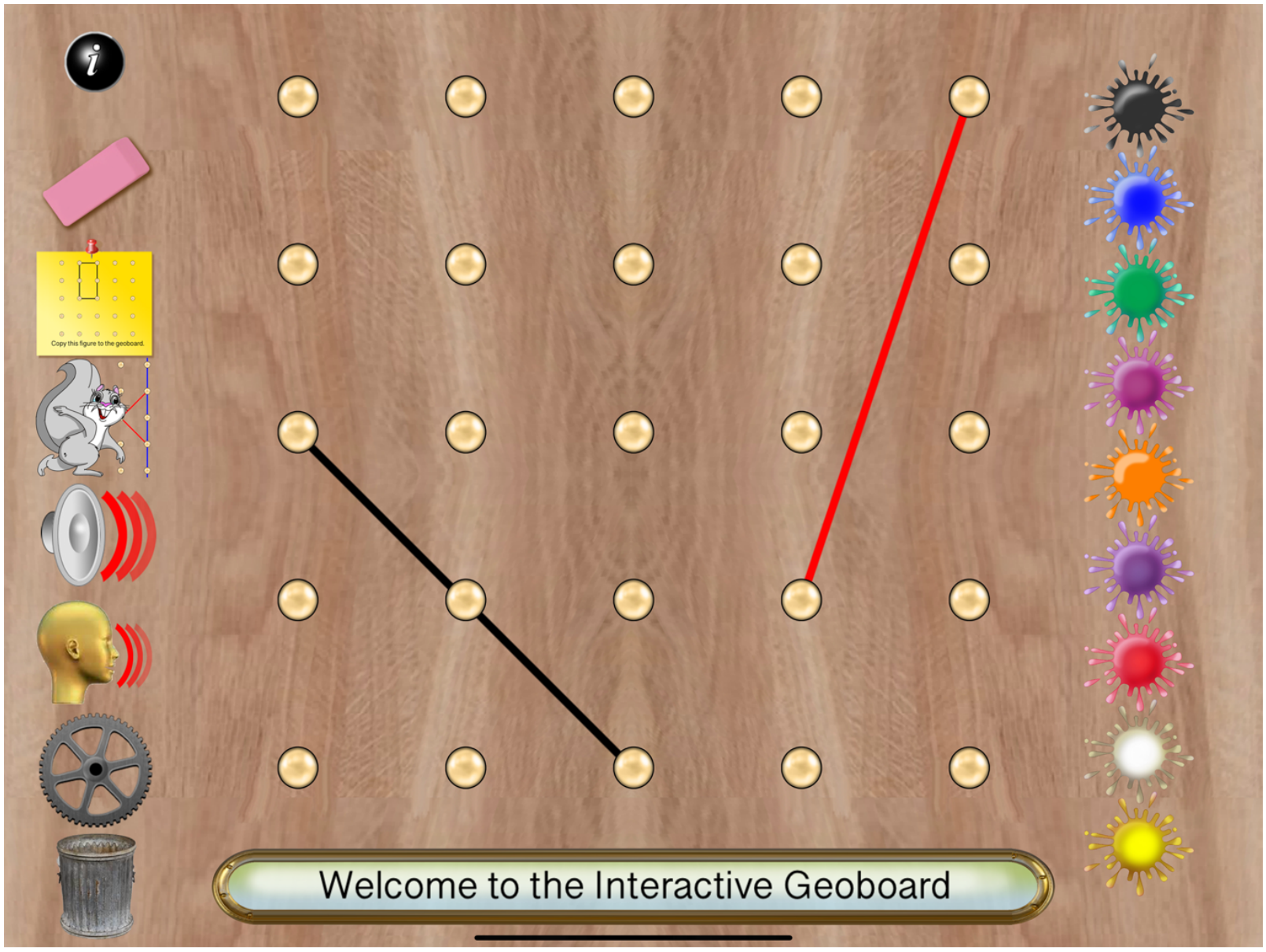
1. Perpendicular lines intersect to form 90° angles.

2. If two lines are perpendicular to the same line, the lines are parallel.

Activity #3

Interactive Geoboard Exploration: Intersecting Lines

Draw two sets of intersecting lines. Copy these figures to your geoboard. Draw two lines that are not perpendicular and not parallel.



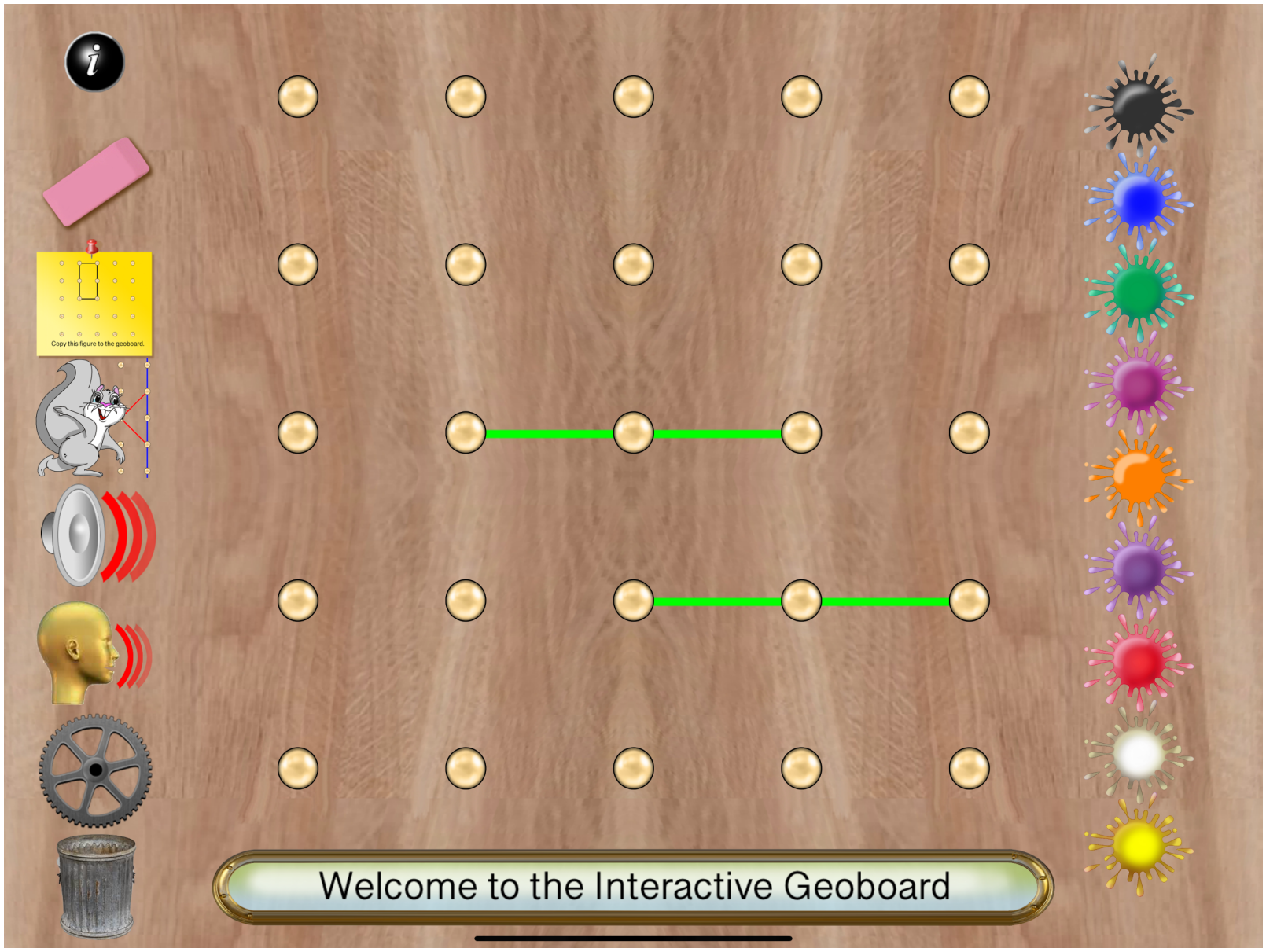
Self Check:

1. Intersecting lines form two sets of congruent angles.
2. Opposite angles are congruent.

Activity #4

Interactive Geoboard Exploration: Parallelograms

Copy these two parallel lines to your geoboard. Add two more lines to make a parallelogram.



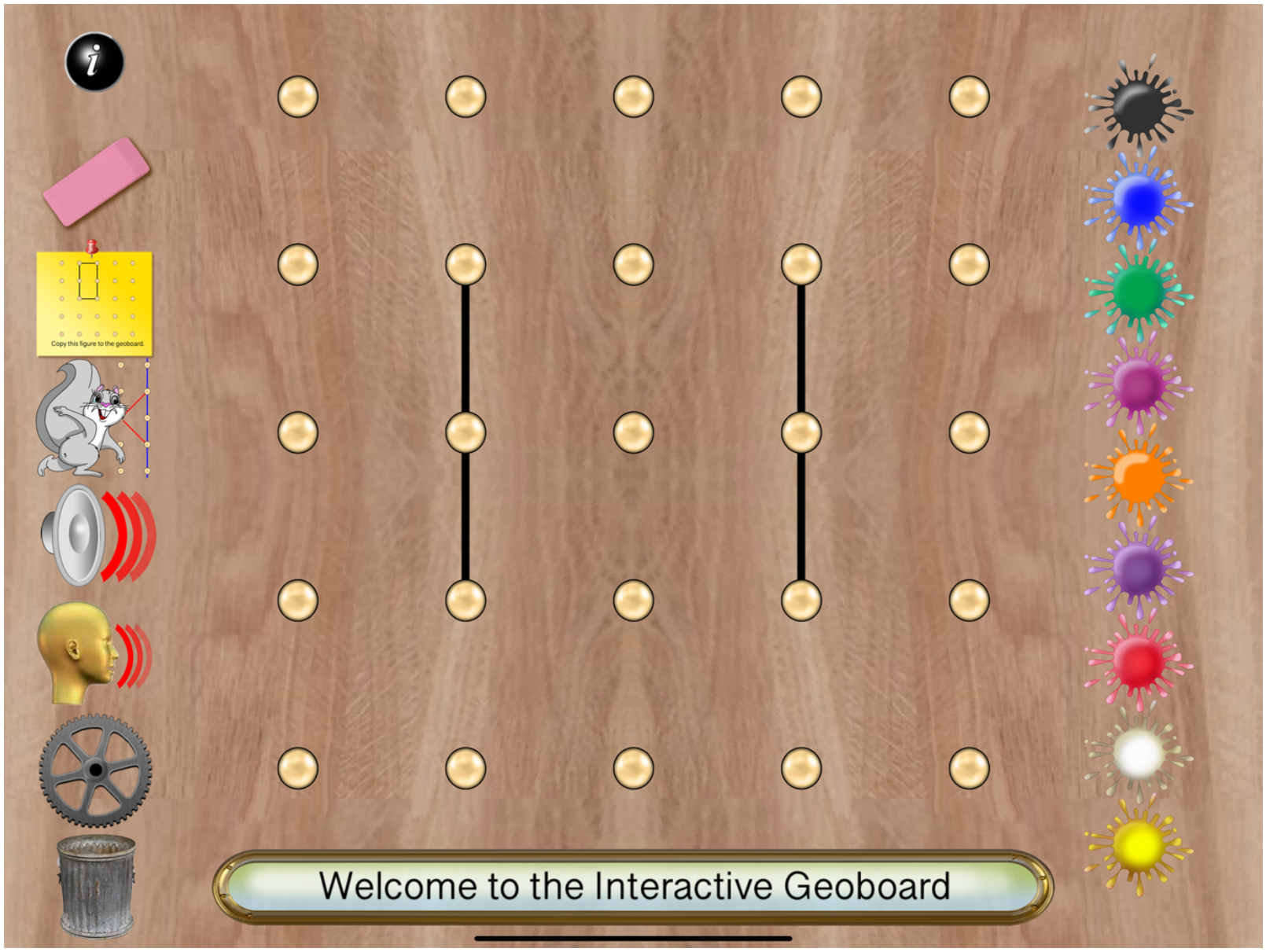
Self Check:

1. Opposite sides of a parallelogram are congruent.
2. Opposite angles are congruent.
3. Consecutive angles are supplementary.
4. If one angle is a right angle then all the angles are right angles.
5. The diagonals of a parallelogram bisect each other.

Activity #5

Interactive Geoboard Exploration: Squares

Copy these two parallel lines to your geoboard. Add two more lines to make a square.



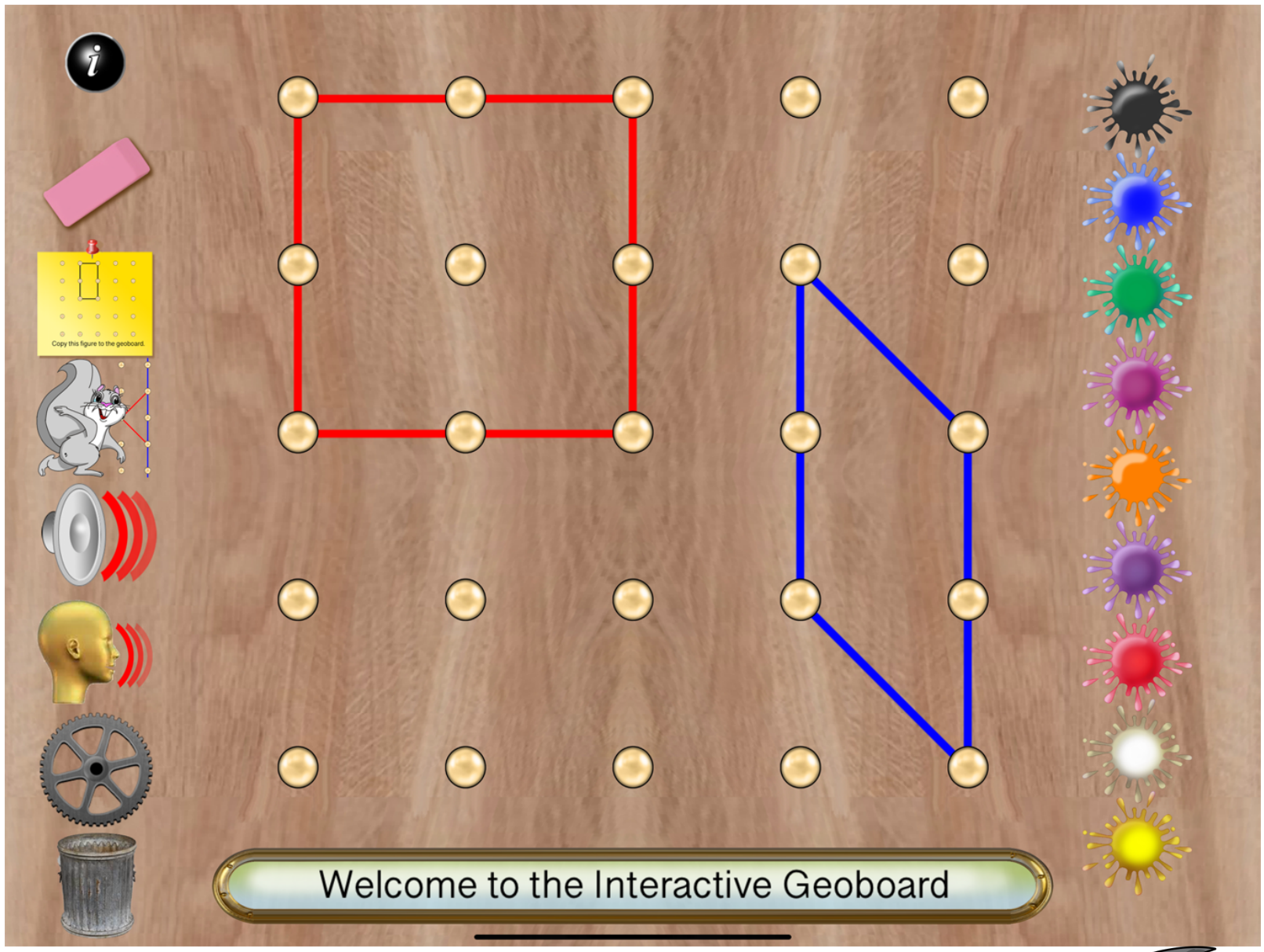
Self Check:

1. All four interior angles are equal to 90°.
2. All four sides of the square are cogent or equal to each other.
3. The opposite sides of the square are parallel to each other.
4. The diagonals of the square bisect each other at 90°.
5. The two diagonals of a square are equal to each other.

Activity #6

Interactive Geoboard Exploration: Diagonals

Copy these two figures to the geoboard. The red figure is a square. The blue figure is a parallelogram. Use green to draw the diagonals for the square and the parallelogram.



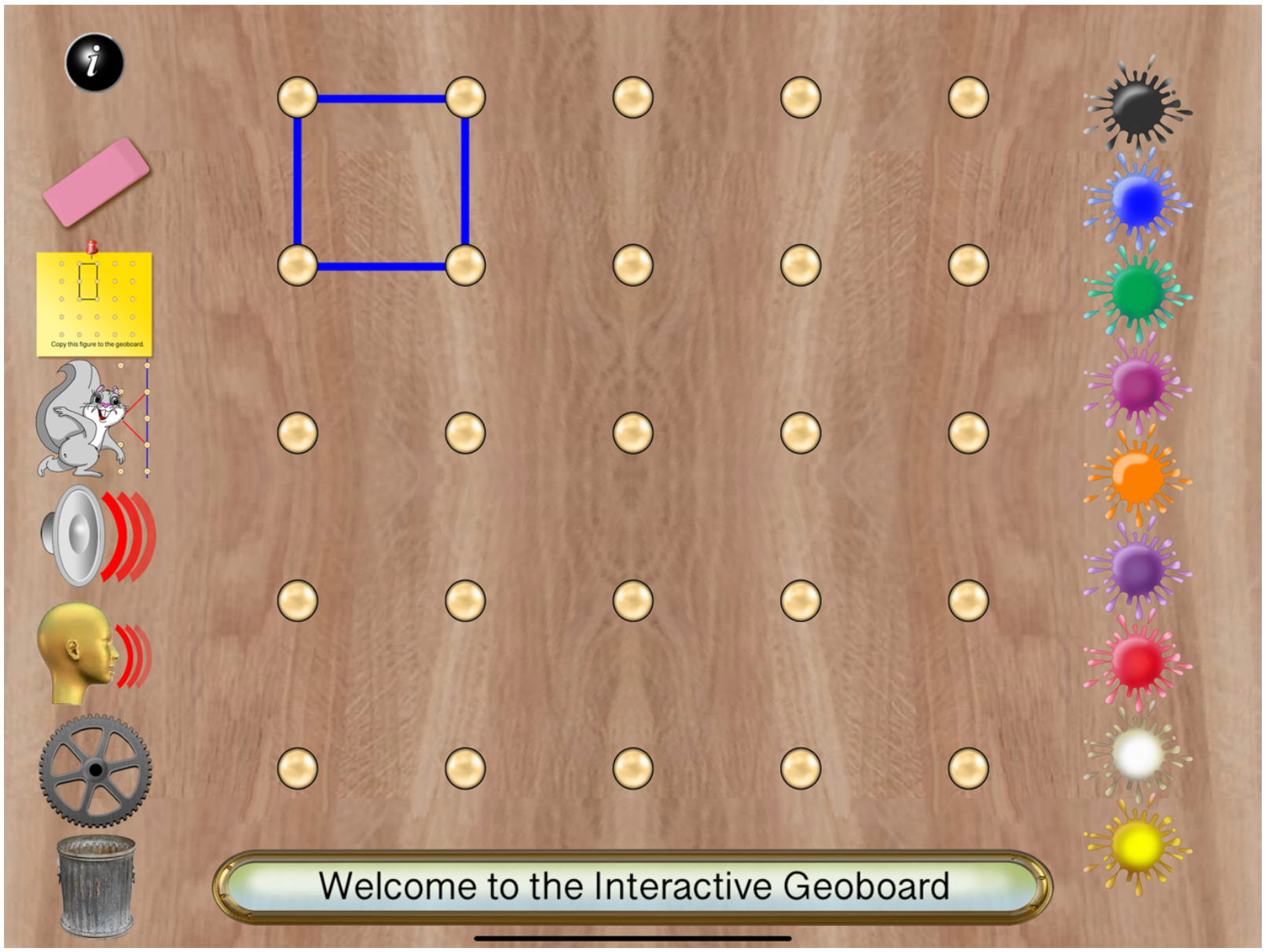
Self Check:

1. The diagonals of a square intersect to form 90° angles.
2. In the parallelogram the opposite angles are congruent.

Activity #7

Interactive Geoboard Exploration: Similar Figures

Copy this figure to the geoboard. Each side of the figure is 1 unit. Each vertex is 90°. The figure is a square. Draw three similar squares on the geoboard.



Self Check:

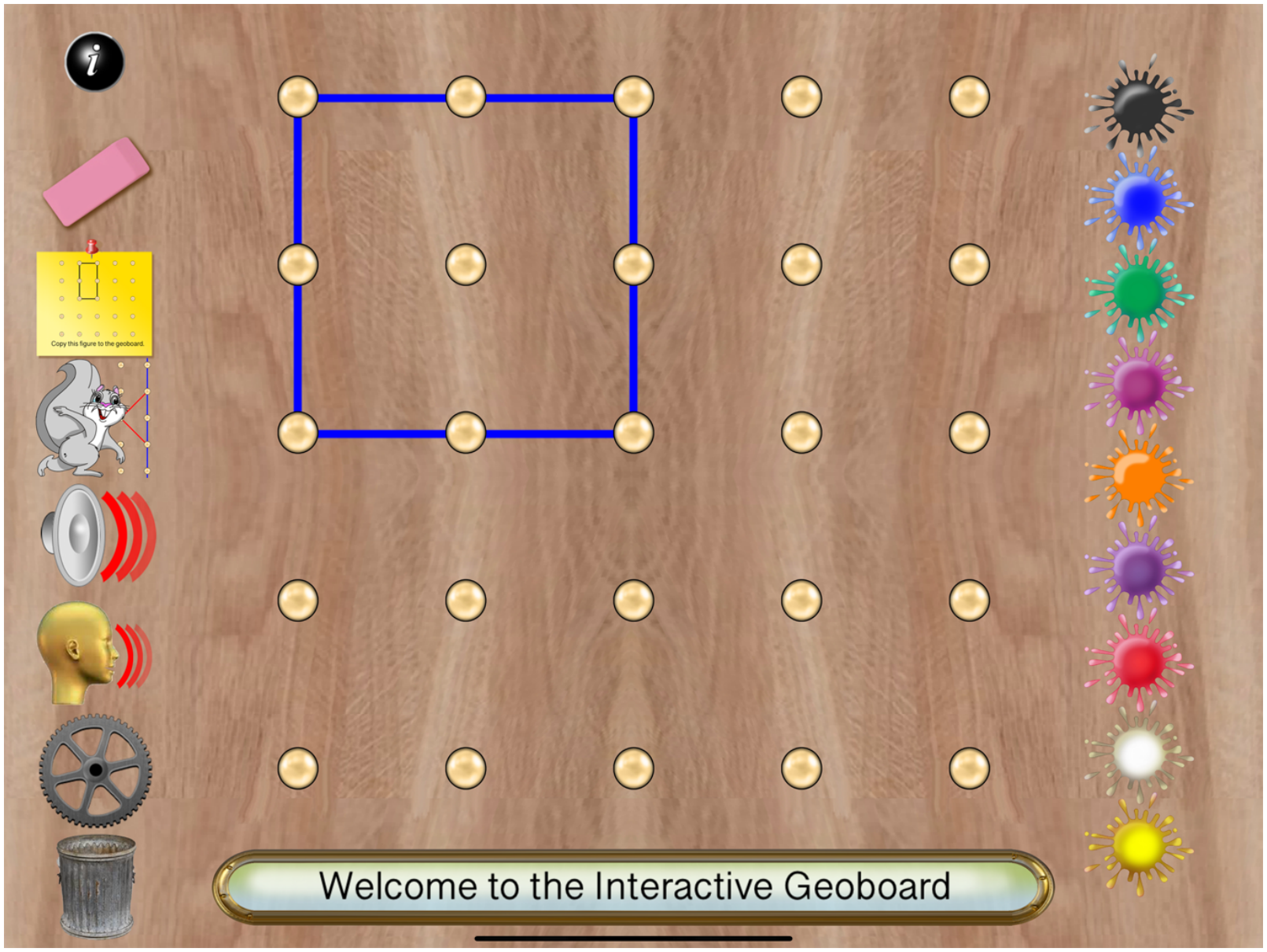
1. Similar figures have the same shape.
2. Two figures are similar if their corresponding angles are congruent.
3. Two figures are similar if their corresponding sides are equal.

Activity #8

Interactive Geoboard Exploration: Introducing Perimeter

Copy this figure to the geoboard. Each side of the figure is 2 unit. Each vertex is 90°. The figure is a square. The perimeter of the square is 8 units. This formula is used to find the perimeter of a square. Draw three squares and find the perimeter of each.

$$P = 4s$$



Self Check:

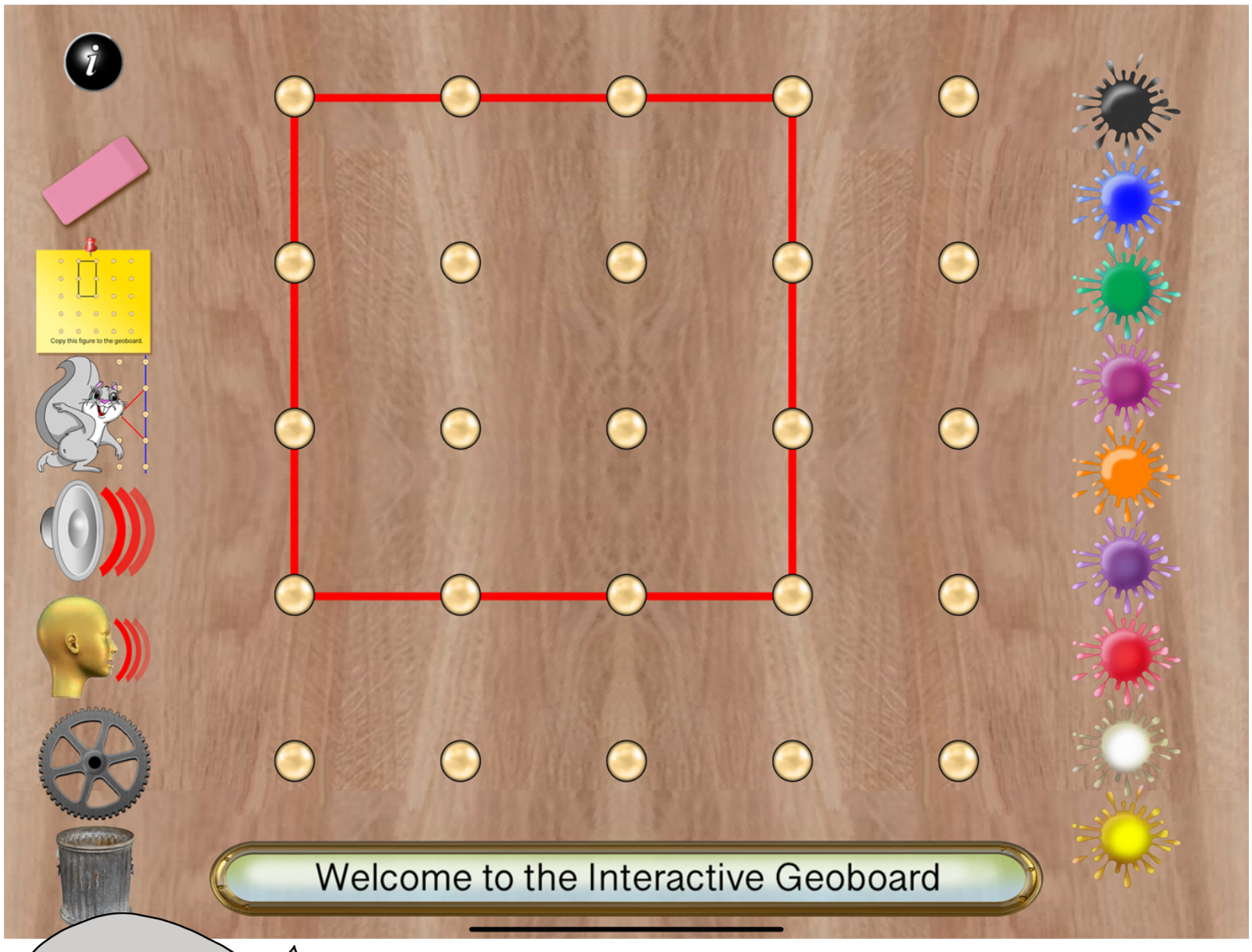
1. The perimeter of each square should be 4 times the length of any side.
2. All the angles of each square is 90*.

Activity #9

Interactive Geoboard Exploration: Introducing Area

Copy this figure to the geoboard. Each side of the figure is 3 unit. Each vertex is 90°. The figure is a square. The area of the square is 9 units. This formula is used to find the area of a square. Draw three squares using different colors and find the area of each.

$$A = s^2$$



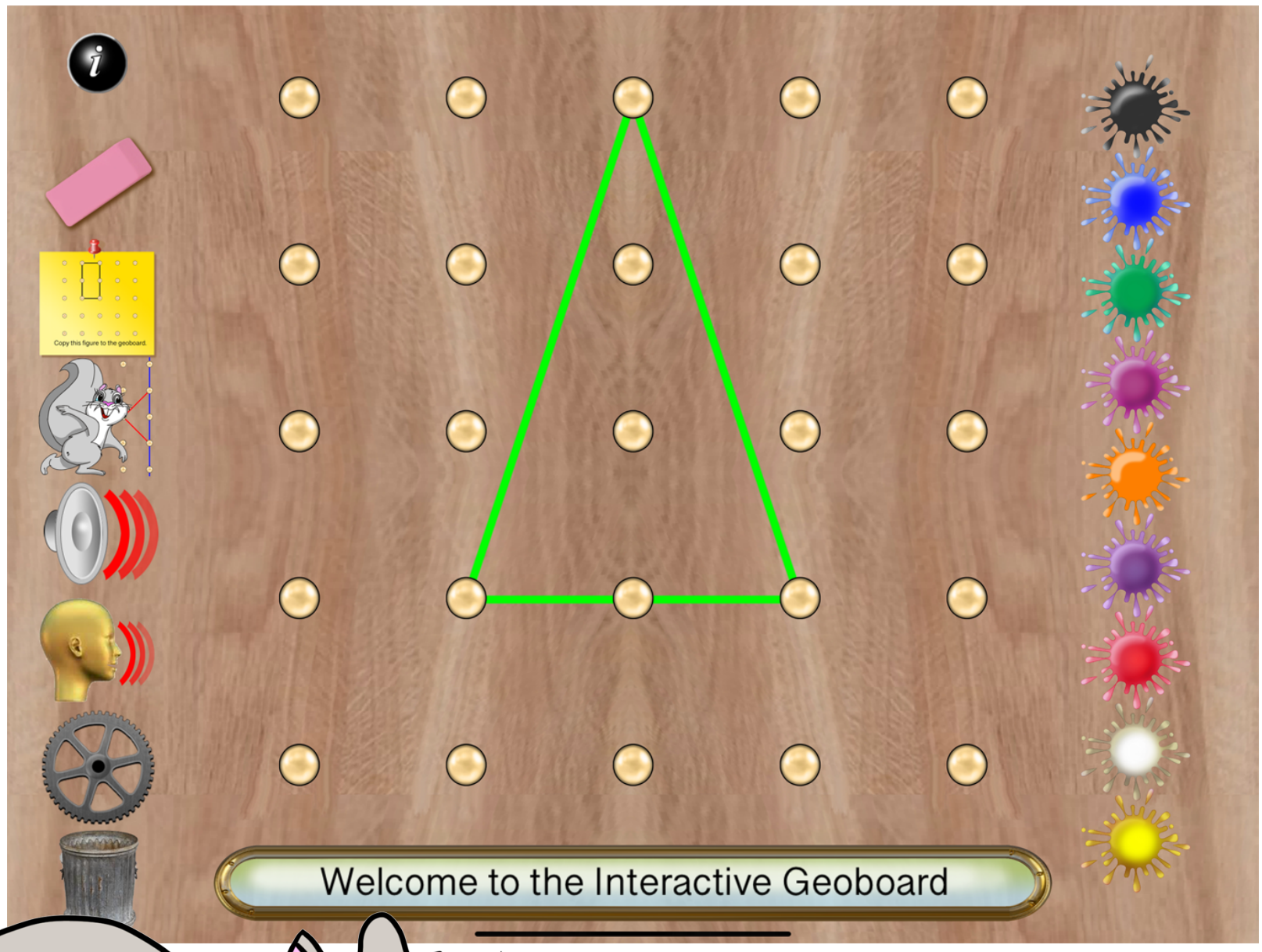
Self Check:

1. The area of a square is found by multiplying a side times a side.
2. The area of a square is the side squared.

Activity #10

Interactive Geoboard Exploration: Isosceles Triangle

Copy this figure to the geoboard. Two sides of the triangle are congruent. Two sides of the triangle are congruent. This is an isosceles triangle. Draw two other isosceles triangles using different colors.

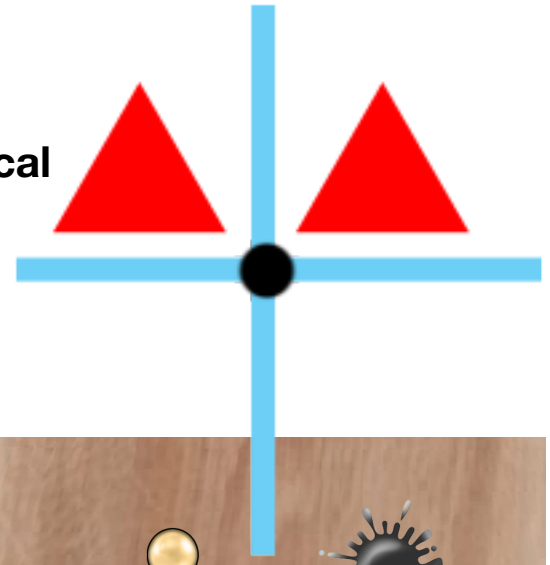


Self Check:

1. An isosceles triangle is a polygon that consists of two equal sides.
2. An isosceles triangle has two equal angles.
3. A triangle has three edges.
4. A triangle has three vertices and the sum of internal angles of a triangle equal to 180^0.

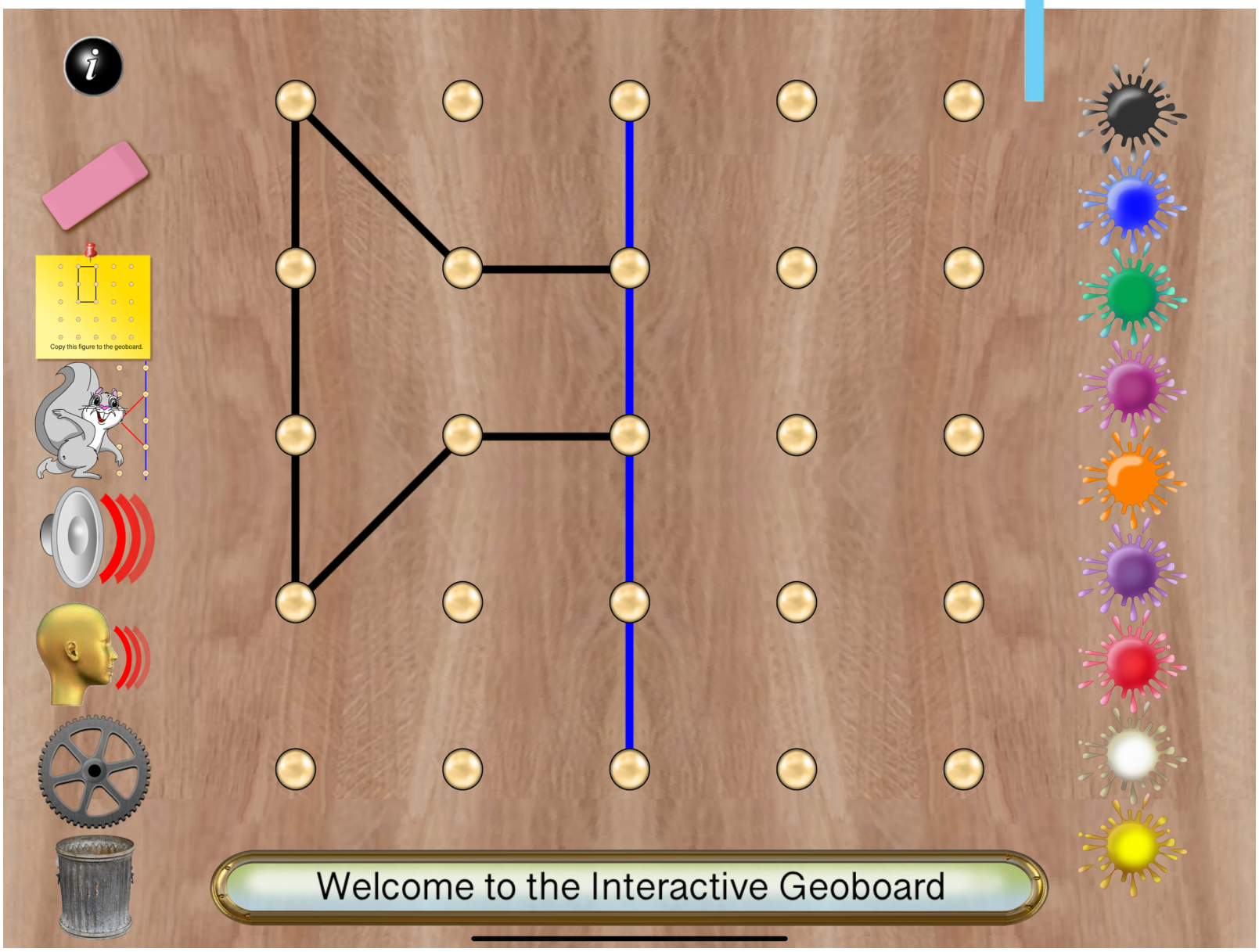
Activity #11

Interactive Geoboard Exploration: Symmetry - Vertical



Use the settings option to enable a vertical mirror.

Copy the left side of this figure.



Self Check:

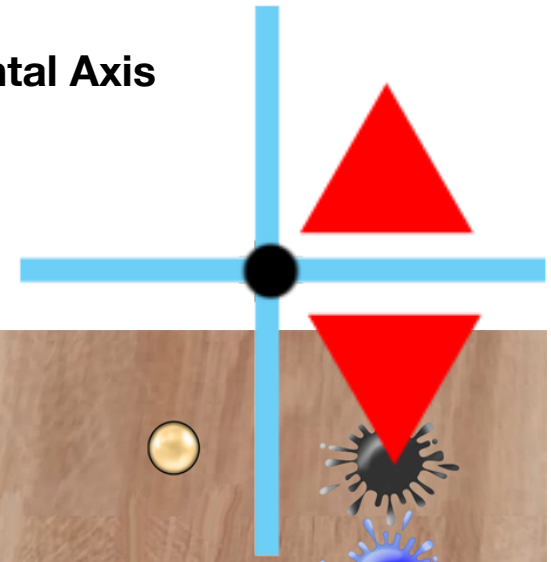
1. Each line segment and angle has a corresponding line segment and angle on the opposite side of the vertical line of symmetry.

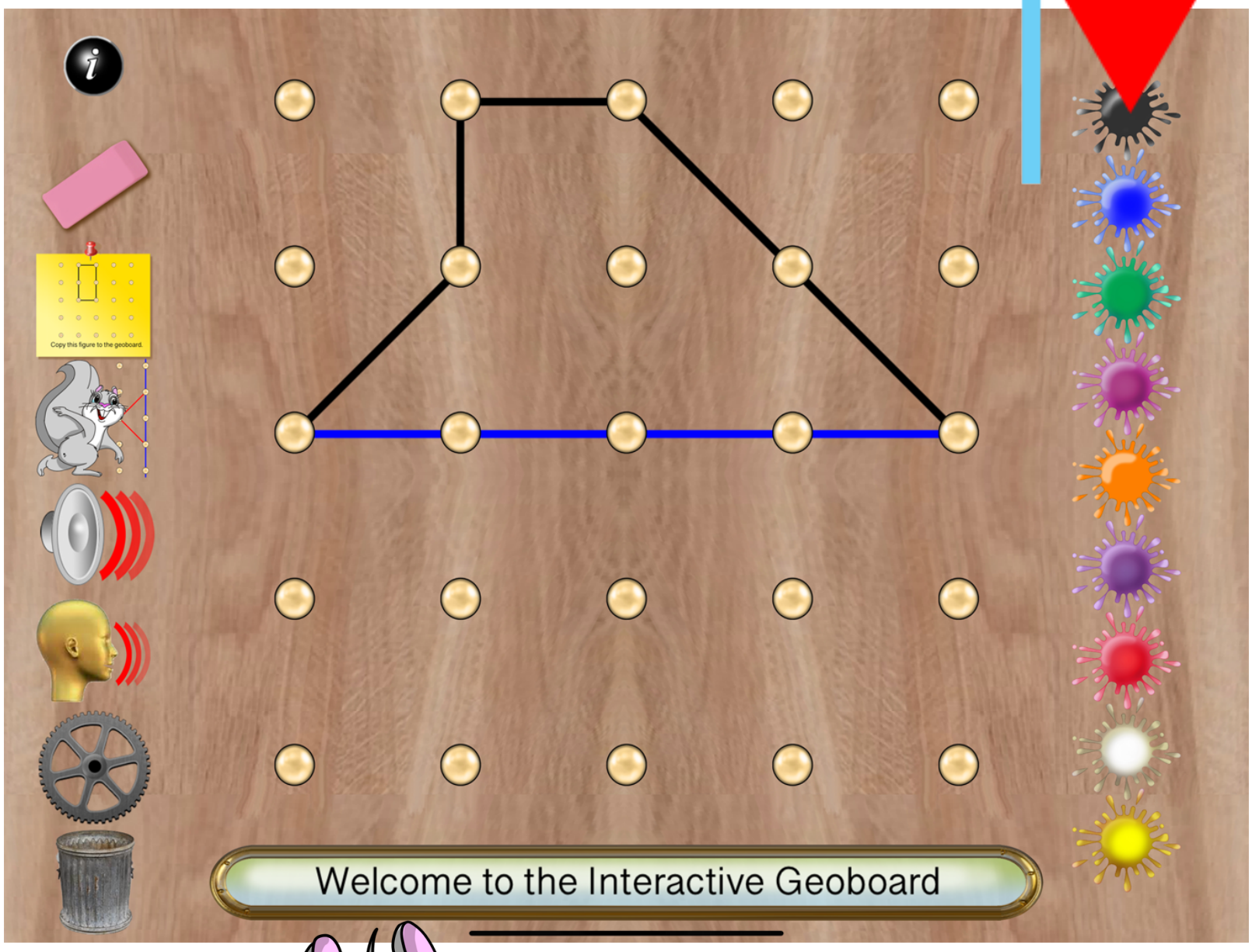
Activity #12

Interactive Geoboard Exploration: Symmetry - Horizontal Axis

Use the settings option to enable a horizontal mirror.

Copy the top side of this figure.





Self Check:

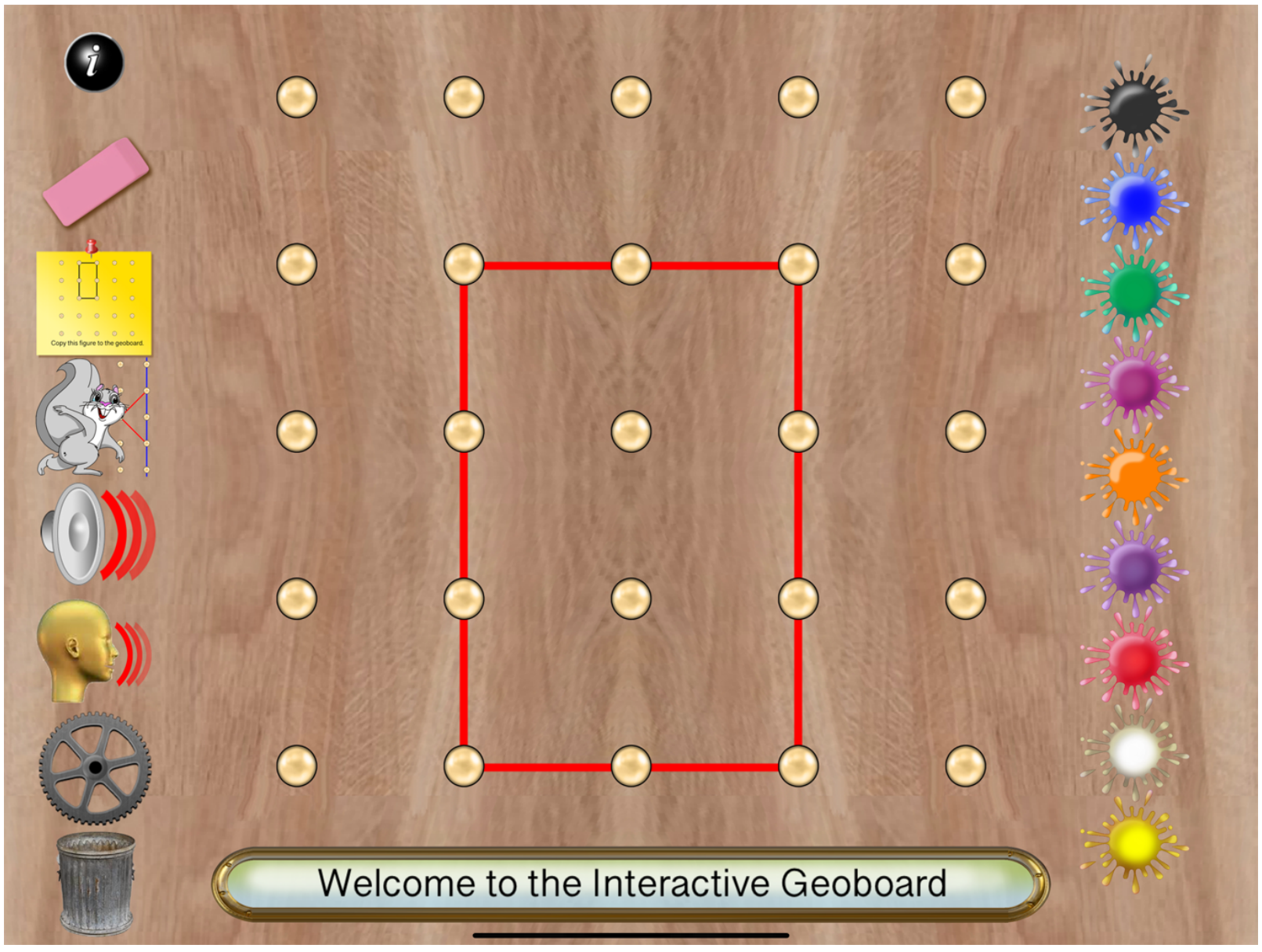
1. Each line segment and angle has a corresponding line segment and angle on the opposite side of the vertical line of symmetry.

Activity #13

Interactive Geoboard Exploration: Practice Finding the Perimeter

Copy this figure to the geoboard. Each vertex is 90°. The figure is a rectangle. The length and width are used to find the perimeter. The perimeter of a rectangle can be found using this formula. Draw the figure on your geoboard and find the perimeter.

$$P = 2(l + w)$$



Self Check:

1. The perimeter of each square should be 4 times the length of any side.
2. All the angles of each square is 90*.

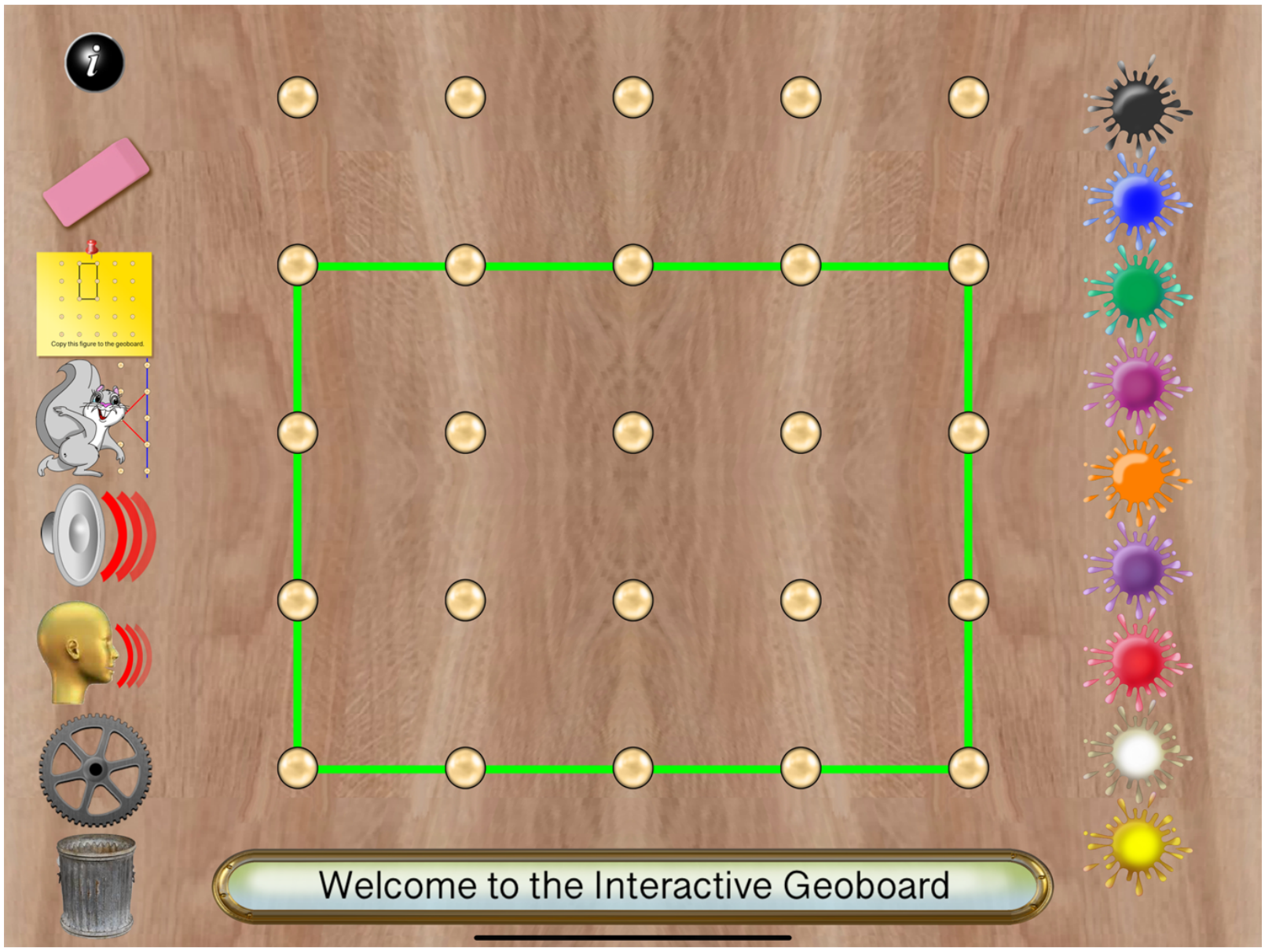
Perimeter: _____

Activity #14

Interactive Geoboard Exploration: Practice Finding the Perimeter

Copy this figure to the geoboard. Each vertex is 90°. The figure is a rectangle. The length and width are used to find the perimeter. The perimeter of a rectangle can be found using this formula. Draw the figure on your geoboard and find the perimeter.

$$P = 2(l + w)$$



Self Check:

1. The perimeter of each square should be 4 times the length of any side.
2. All the angles of each square is 90*.

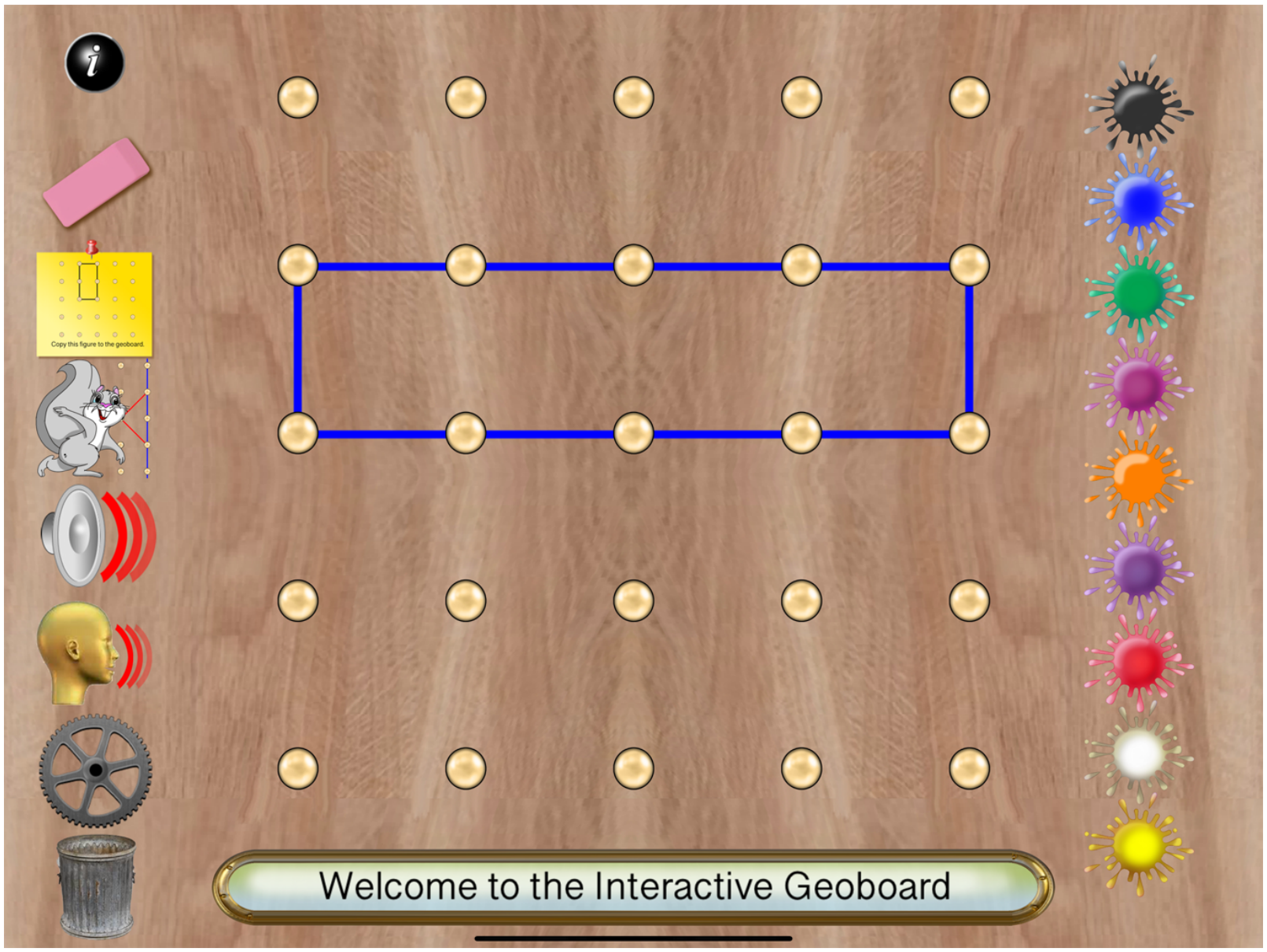
Perimeter: _____

Activity #15

Interactive Geoboard Exploration: Practice Finding the Perimeter

Copy this figure to the geoboard. Each vertex is 90°. The figure is a rectangle. The length and width are used to find the perimeter. The perimeter of a rectangle can be found using this formula. Draw the figure on your geoboard and find the perimeter.

$$P = 2(l + w)$$



Self Check:

1. The perimeter of each square should be 4 times the length of any side.

2. All the angles of each square is 90*.

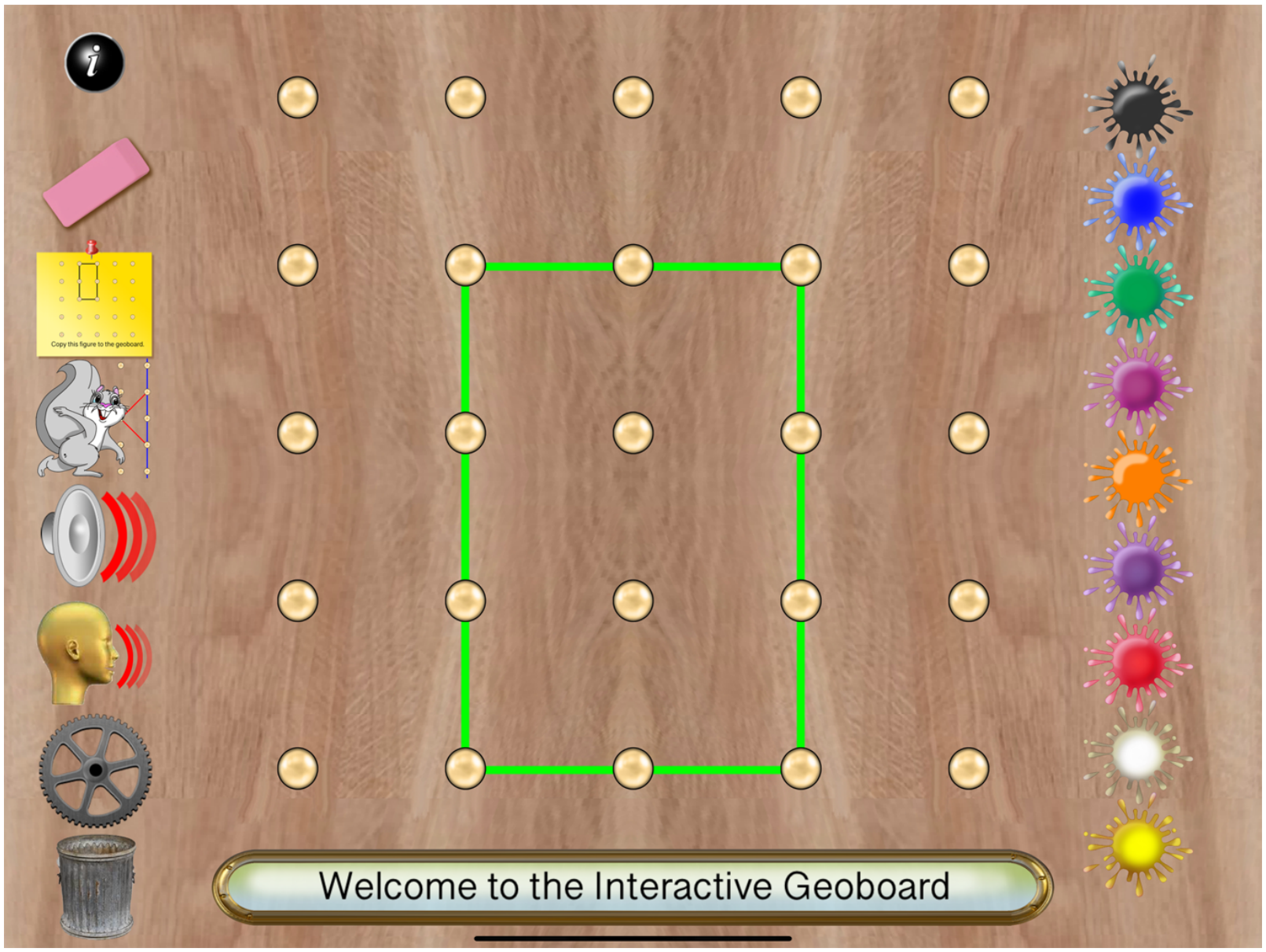
Perimeter: _____

Activity #16

Interactive Geoboard Exploration: Practice Finding the Perimeter

Copy this figure to the geoboard. Each vertex is 90°. The figure is a rectangle. The length and width are used to find the perimeter. The perimeter of a rectangle can be found using this formula. Draw the figure on your geoboard and find the perimeter.

$$P = 2(l + w)$$



Self Check:

1. The perimeter of each square should be 4 times the length of any side.
2. All the angles of each square is 90*.

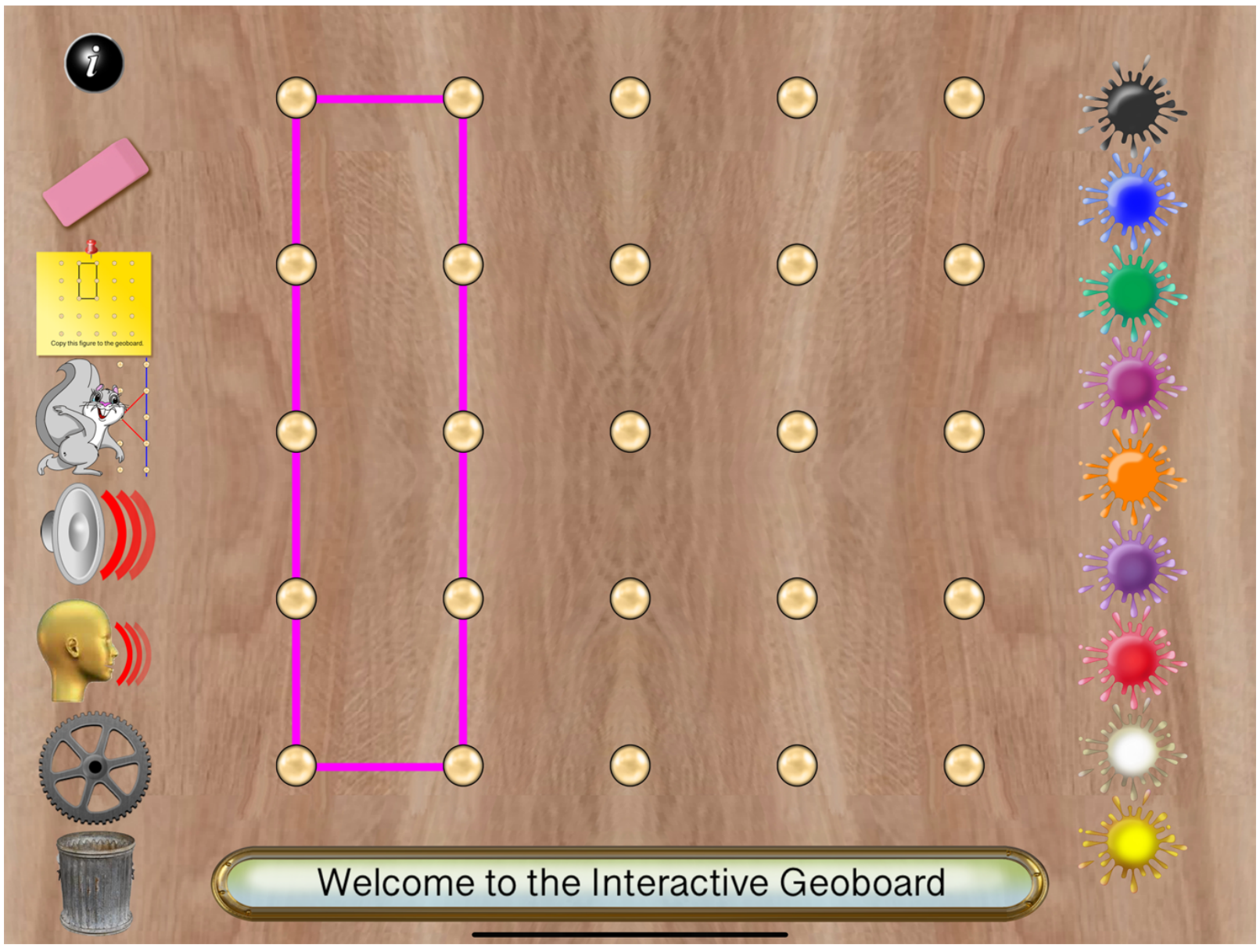
Perimeter: _____

Activity #17

Interactive Geoboard Exploration: Practice Finding the Perimeter

Copy this figure to the geoboard. Each vertex is 90°. The figure is a rectangle. The length and width are used to find the perimeter. The perimeter of a rectangle can be found using this formula. Draw the figure on your geoboard and find the perimeter.

$$P = 2(l + w)$$



Self Check:

1. The perimeter of each square should be 4 times the length of any side.
2. All the angles of each square is 90*.

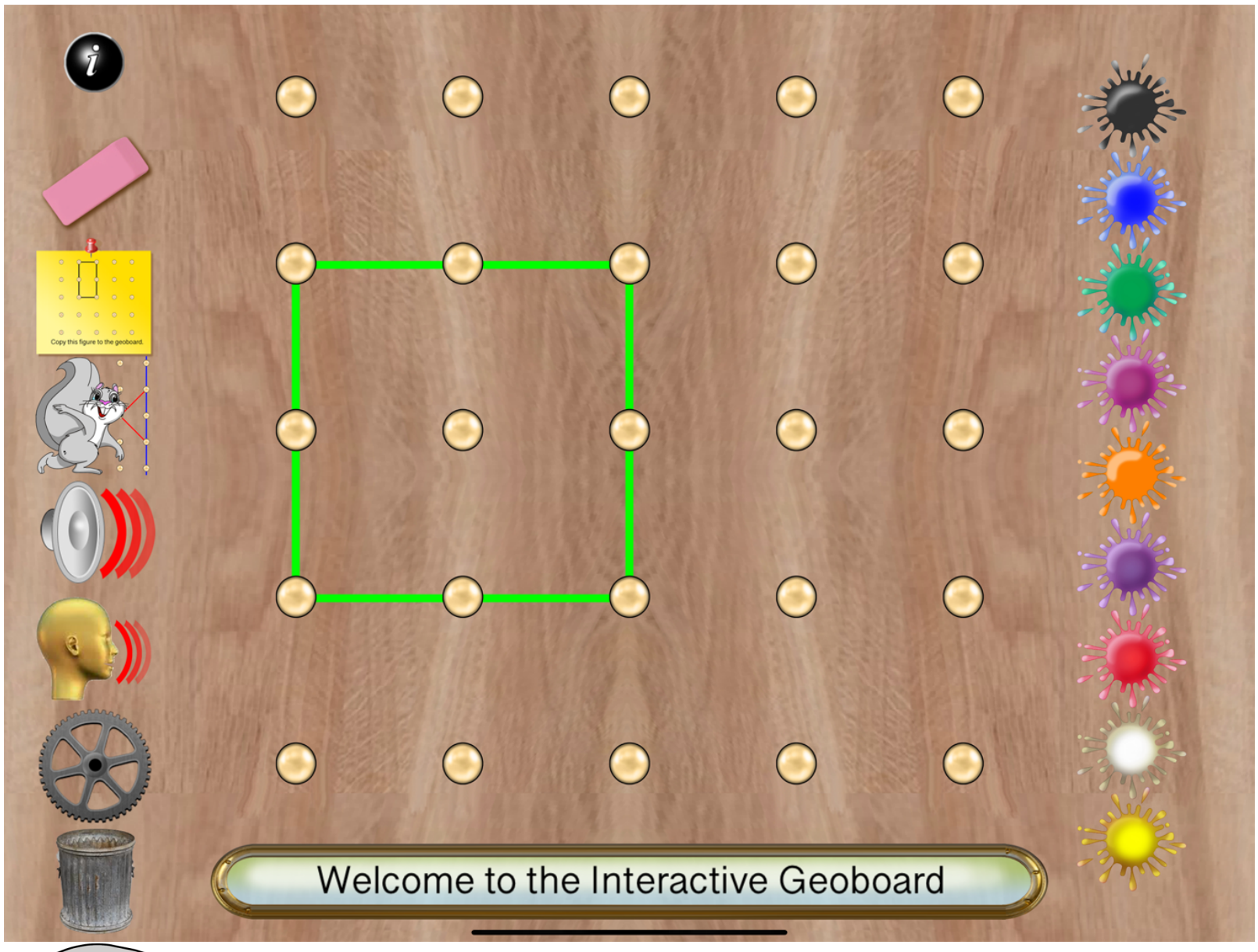
Perimeter: _____

Activity #18

Interactive Geoboard Exploration: Practice Finding Area

Copy this figure to the geoboard. Each side of the figure is 3 unit. Each vertex is 90°. The figure is a square. The area of the square is 9 units. This formula is used to find the area of a square. Draw three squares using different colors and find the area of each.

$$A = s^2$$



Self Check:

1. The area of a square is found by multiplying a side times a side.
2. The area of a square is the side squared.

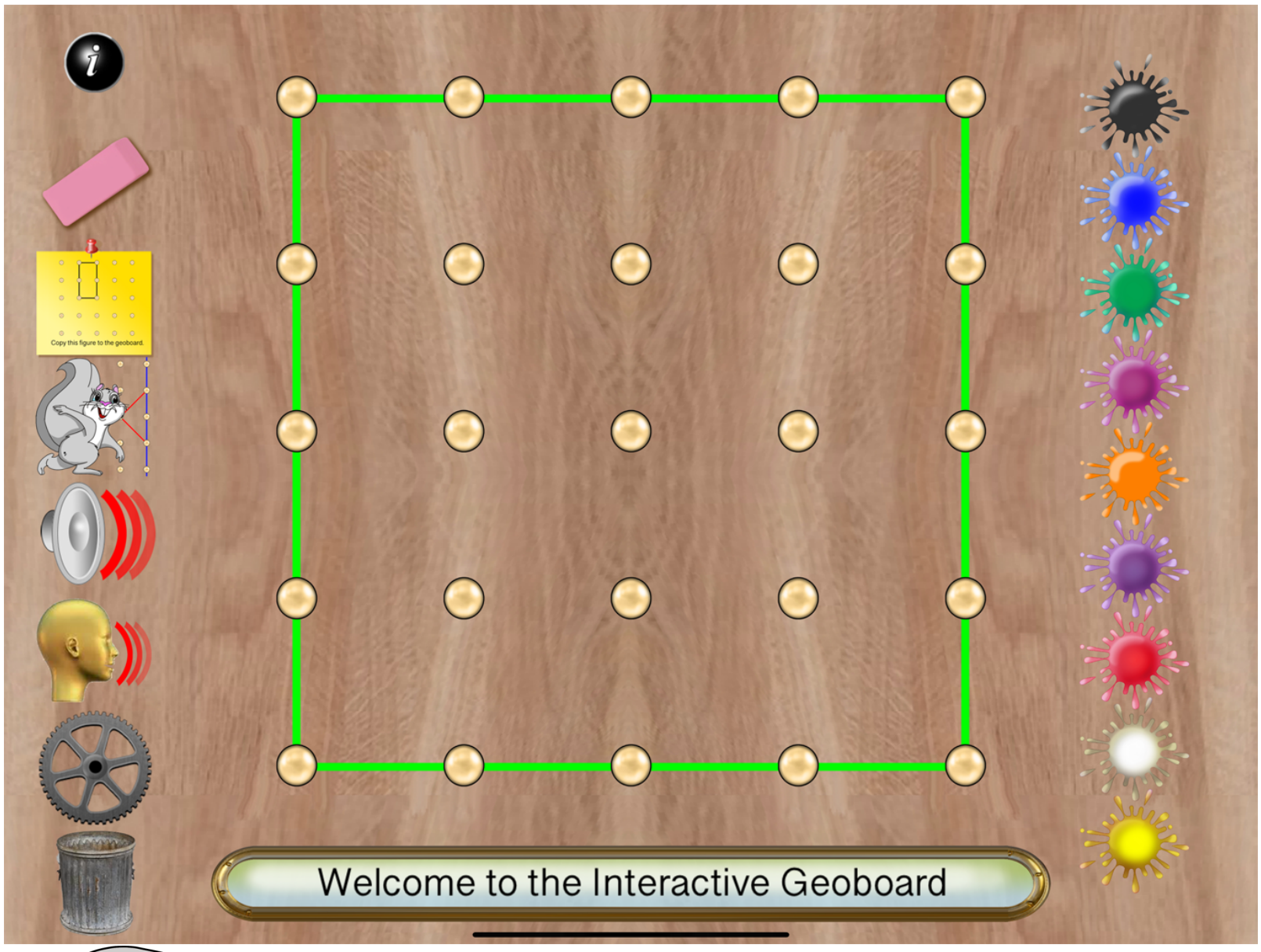
Area: _____

Activity #19

Interactive Geoboard Exploration: Practice Finding Area

Copy this figure to the geoboard. Each side of the figure is 3 unit. Each vertex is 90°. The figure is a square. The area of the square is 9 units. This formula is used to find the area of a square. Draw three squares using different colors and find the area of each.

$$A = s^2$$



Self Check:

1. The area of a square is found by multiplying a side times a side.
2. The area of a square is the side squared.

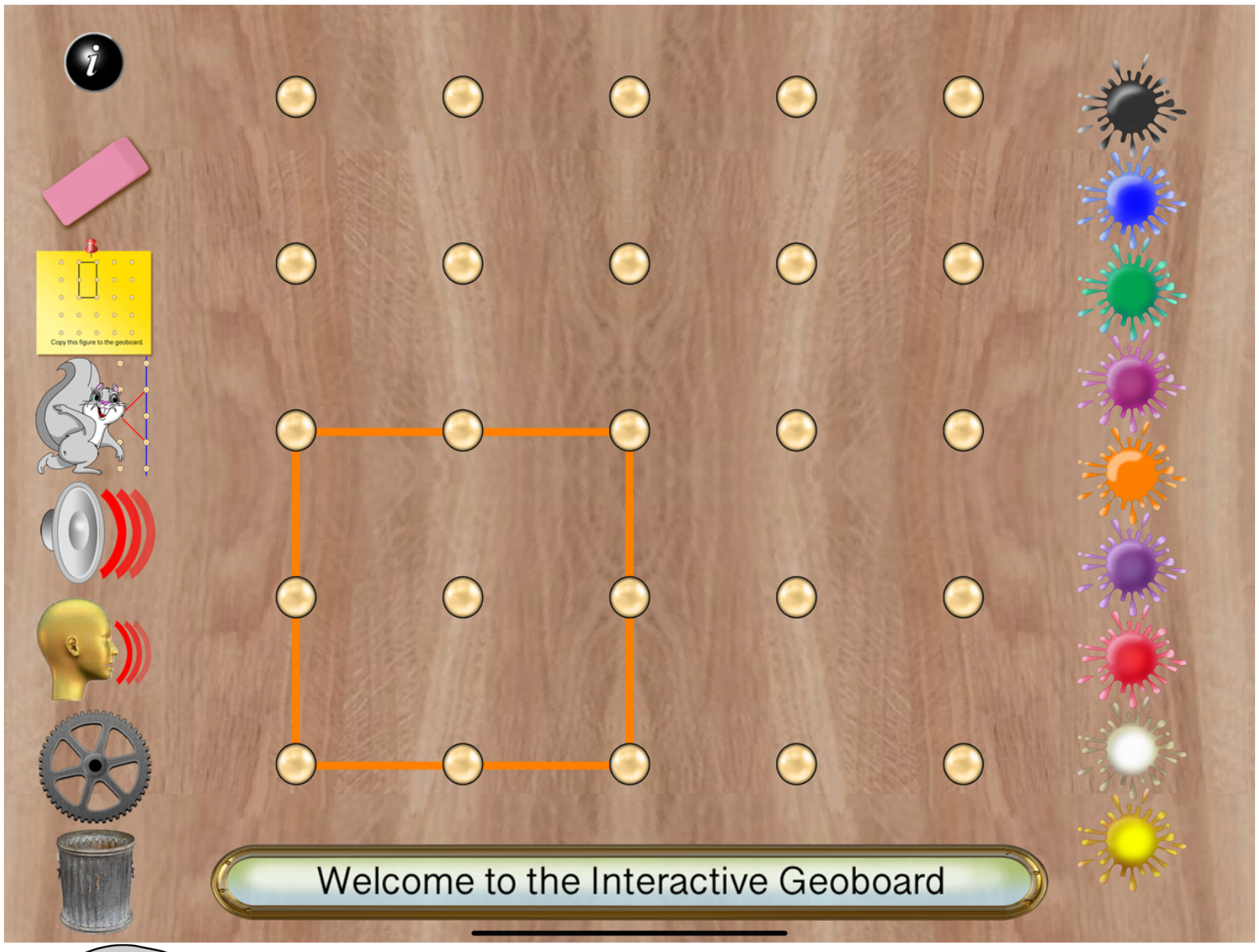
Area: _____

Activity #20

Interactive Geoboard Exploration: Practice Finding Area

Copy this figure to the geoboard. Each side of the figure is 3 unit. Each vertex is 90°. The figure is a square. The area of the square is 9 units. This formula is used to find the area of a square. Draw three squares using different colors and find the area of each.

$$A = s^2$$



Self Check:

1. The area of a square is found by multiplying a side times a side.
2. The area of a square is the side squared.

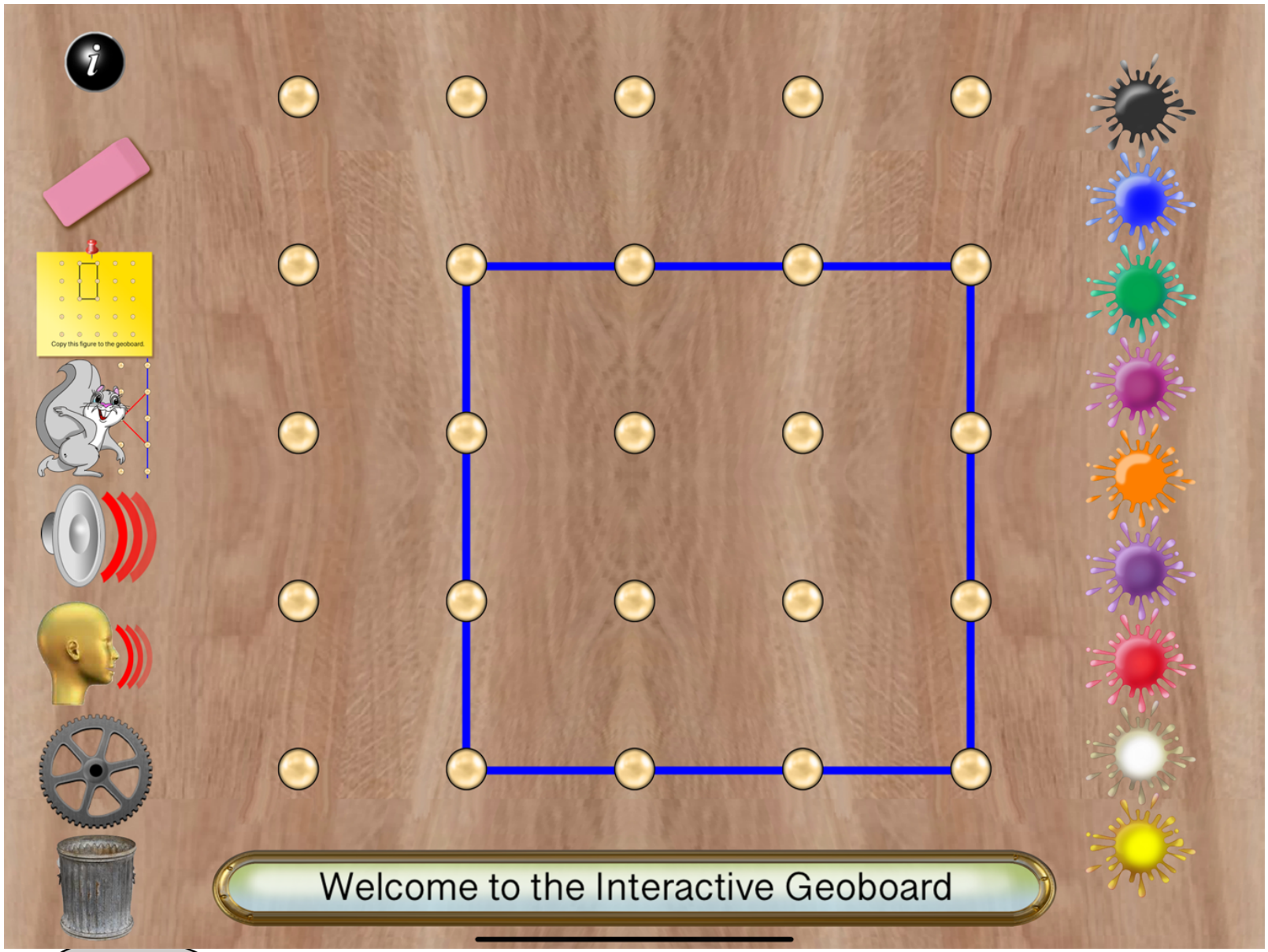
Area: _____

Activity #21

Interactive Geoboard Exploration: Practice Finding Area

Copy this figure to the geoboard. Each side of the figure is 3 unit. Each vertex is 90°. The figure is a square. The area of the square is 9 units. This formula is used to find the area of a square. Draw three squares using different colors and find the area of each.

$$A = s^2$$



Self Check:

1. The area of a square is found by multiplying a side times a side.
2. The area of a square is the side squared.

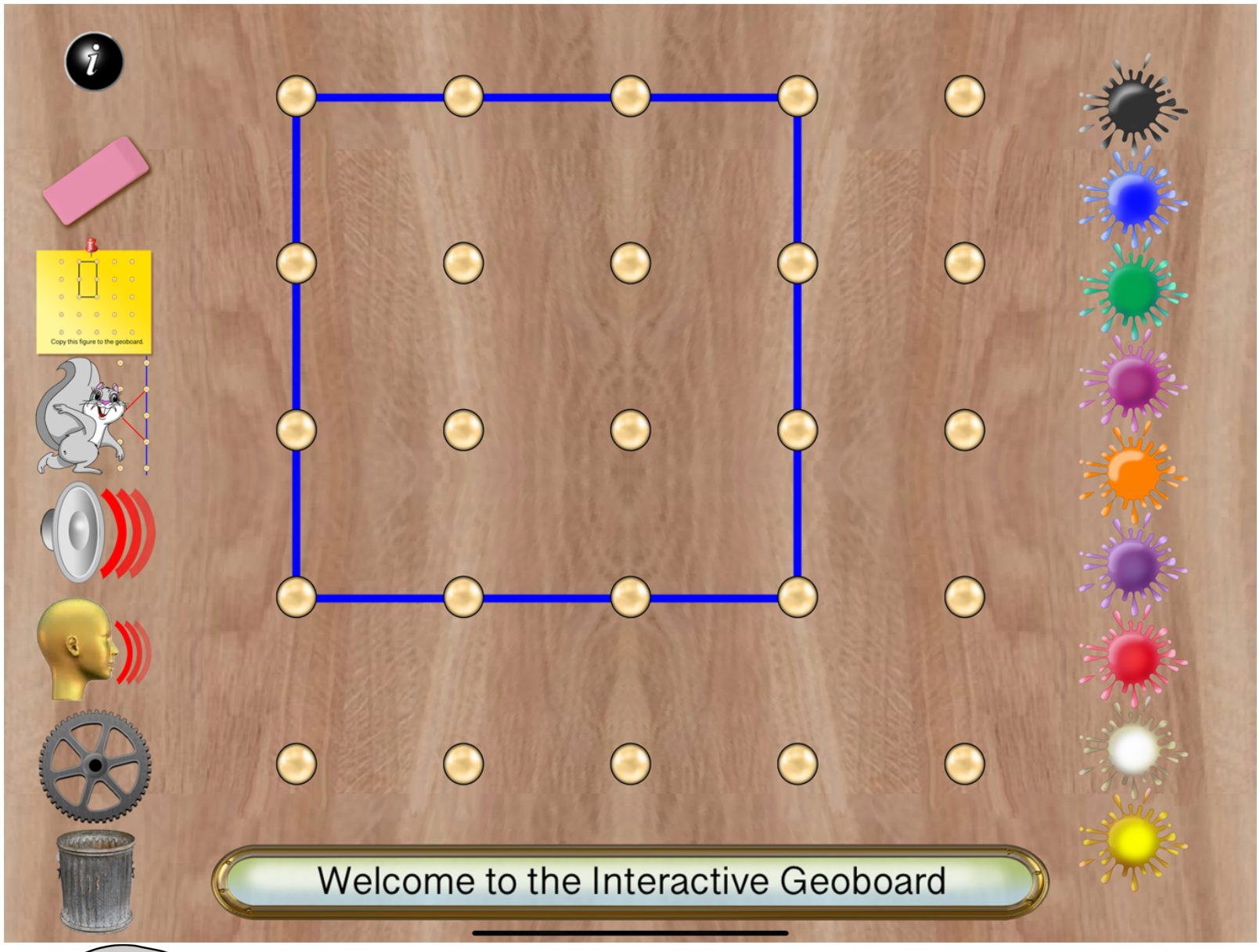
Area: _____

Activity #22

Interactive Geoboard Exploration: Practice Finding Area

Copy this figure to the geoboard. Each side of the figure is 3 unit. Each vertex is 90°. The figure is a square. The area of the square is 9 units. This formula is used to find the area of a square. Draw three squares using different colors and find the area of each.

$$A = s^2$$



Self Check:

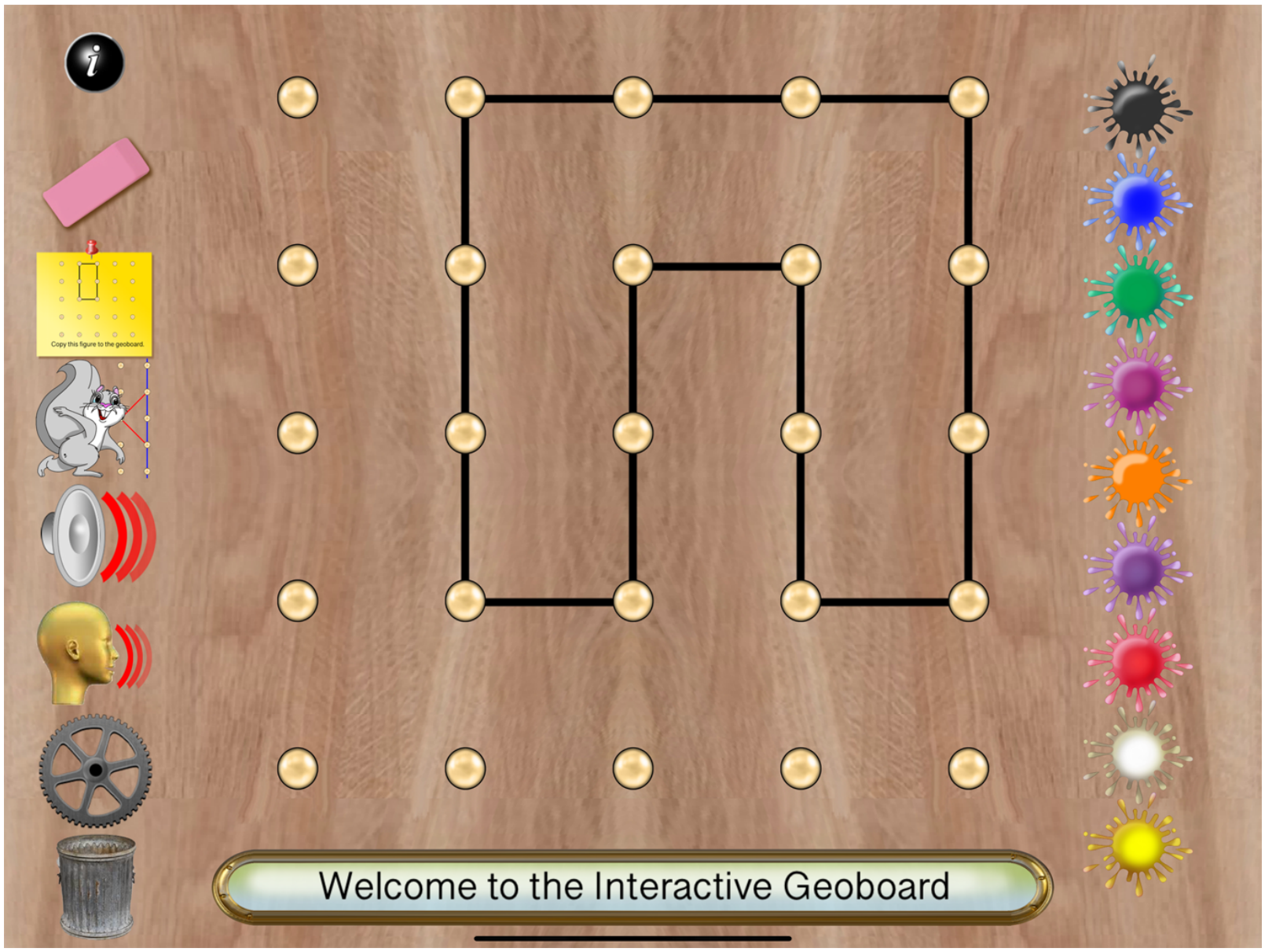
1. The area of a square is found by multiplying a side times a side.
2. The area of a square is the side squared.

Area: _____

Activity #22

Interactive Geoboard Exploration: Perimeter and Area of Irregular Polygons

An irregular polygon is a 2D shape that has straight sides that are not equal to each other and possibly angles that are not equal to each other. Copy this irregular polygon to the geoboard. The perimeter is the sum of all the sides. The area is the



Self Check:

1. Add the length of each side to find the perimeter.

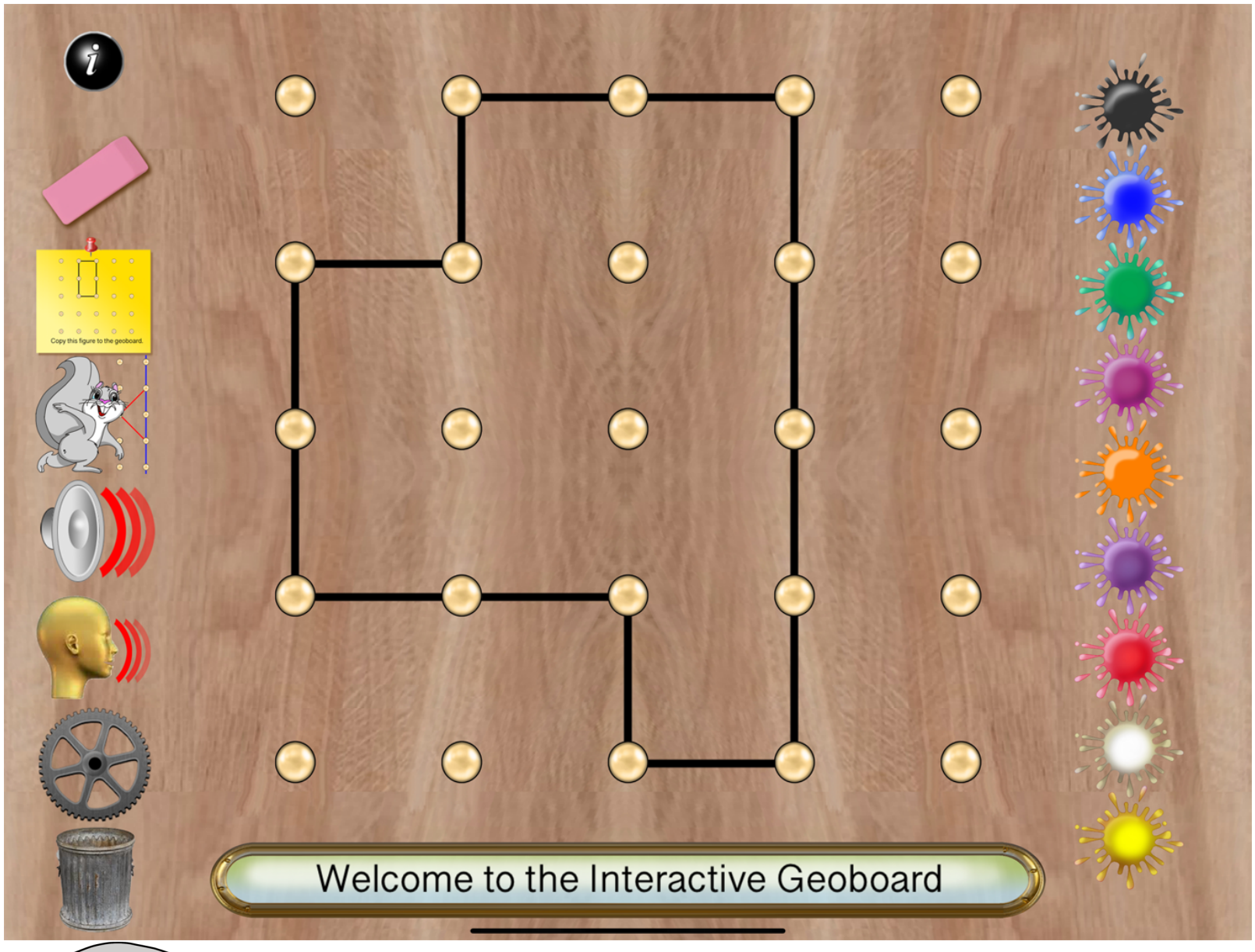
Perimeter: _____

Area: _____

Activity #23

Interactive Geoboard Exploration: Perimeter and Area of Irregular Polygons

An irregular polygon is a 2D shape that has straight sides that are not equal to each other and possibly angles that are not equal to each other. Copy this irregular polygon to the geoboard. The perimeter is the sum of all the sides. The area is the number of square units within the shape. Find the perimeter and area of this figure.



Self Check:

1. Add the length of each side to find the perimeter.

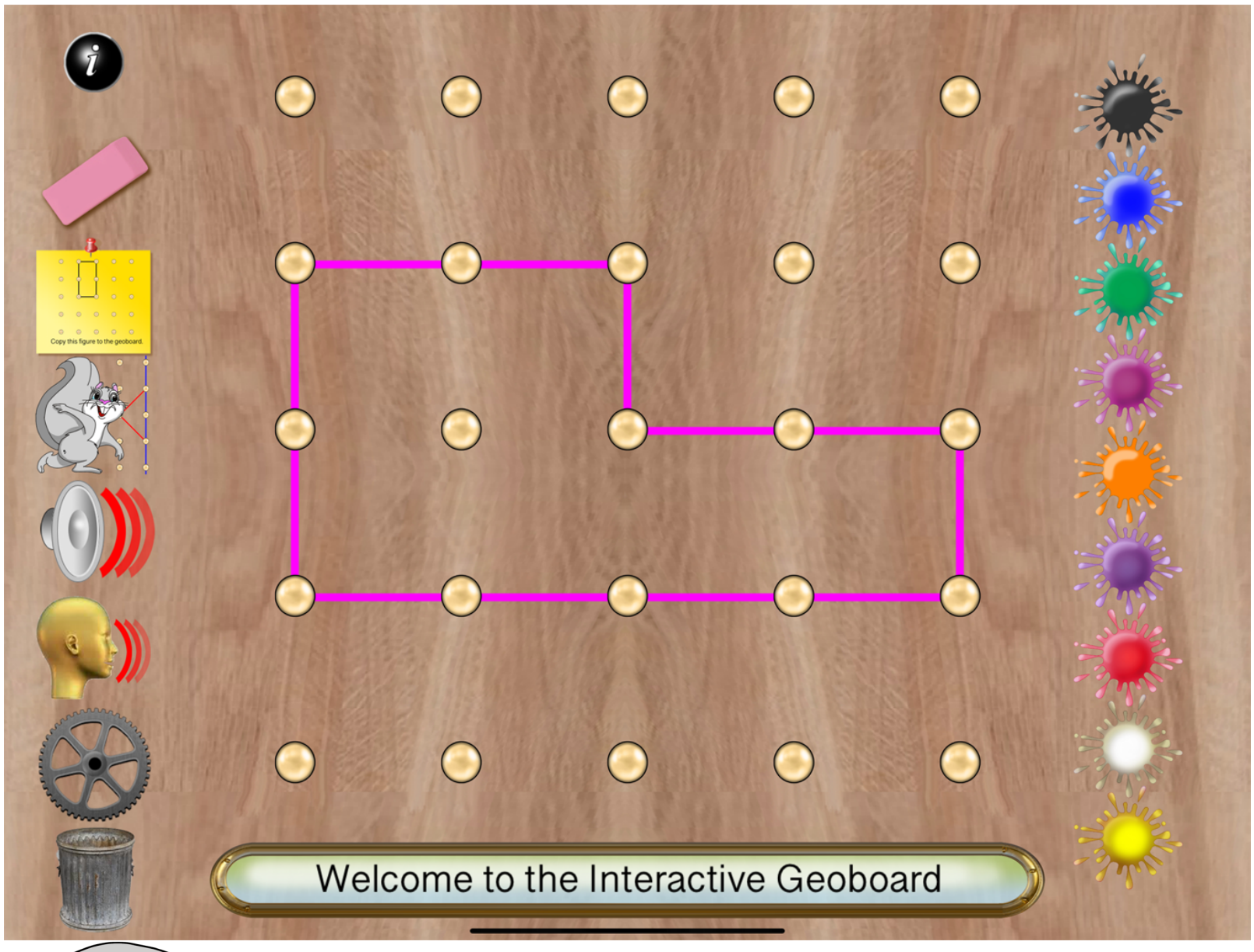
Perimeter: _____

Area: _____

Activity #24

Interactive Geoboard Exploration: Perimeter and Area of Irregular Polygons

An irregular polygon is a 2D shape that has straight sides that are not equal to each other and possibly angles that are not equal to each other. Copy this irregular polygon to the geoboard. The perimeter is the sum of all the sides. The area is the number of square units within the shape. Find the perimeter and area of this figure.



Self Check:

1. Add the length of each side to find the perimeter.

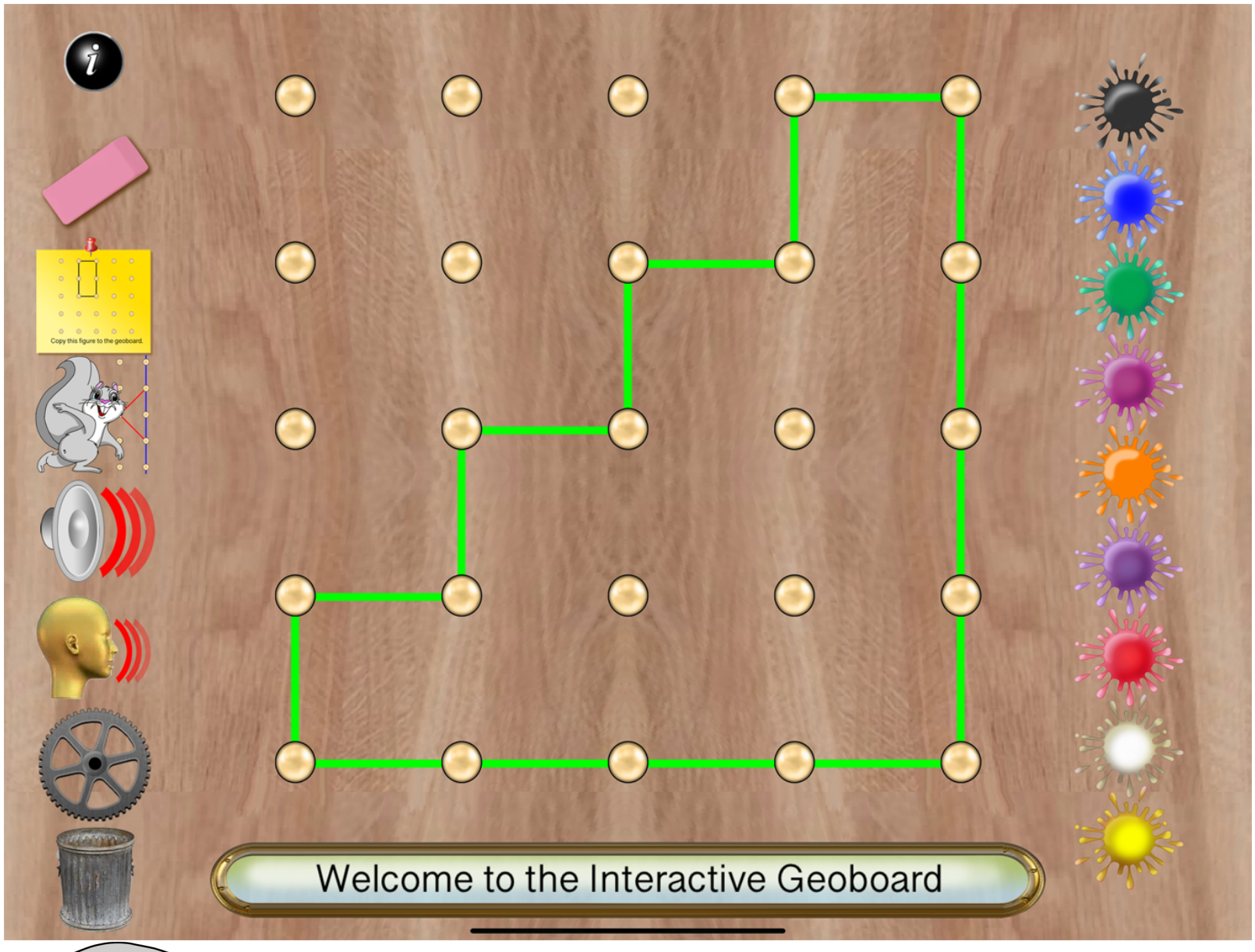
Perimeter: _____

Area: _____

Activity #25

Interactive Geoboard Exploration: Perimeter and Area of Irregular Polygons

An irregular polygon is a 2D shape that has straight sides that are not equal to each other and possibly angles that are not equal to each other. Copy this irregular polygon to the geoboard. The perimeter is the sum of all the sides. The area is the number of square units within the shape. Find the perimeter and area of this figure.



Self Check:

1. Add the length of each side to find the perimeter.

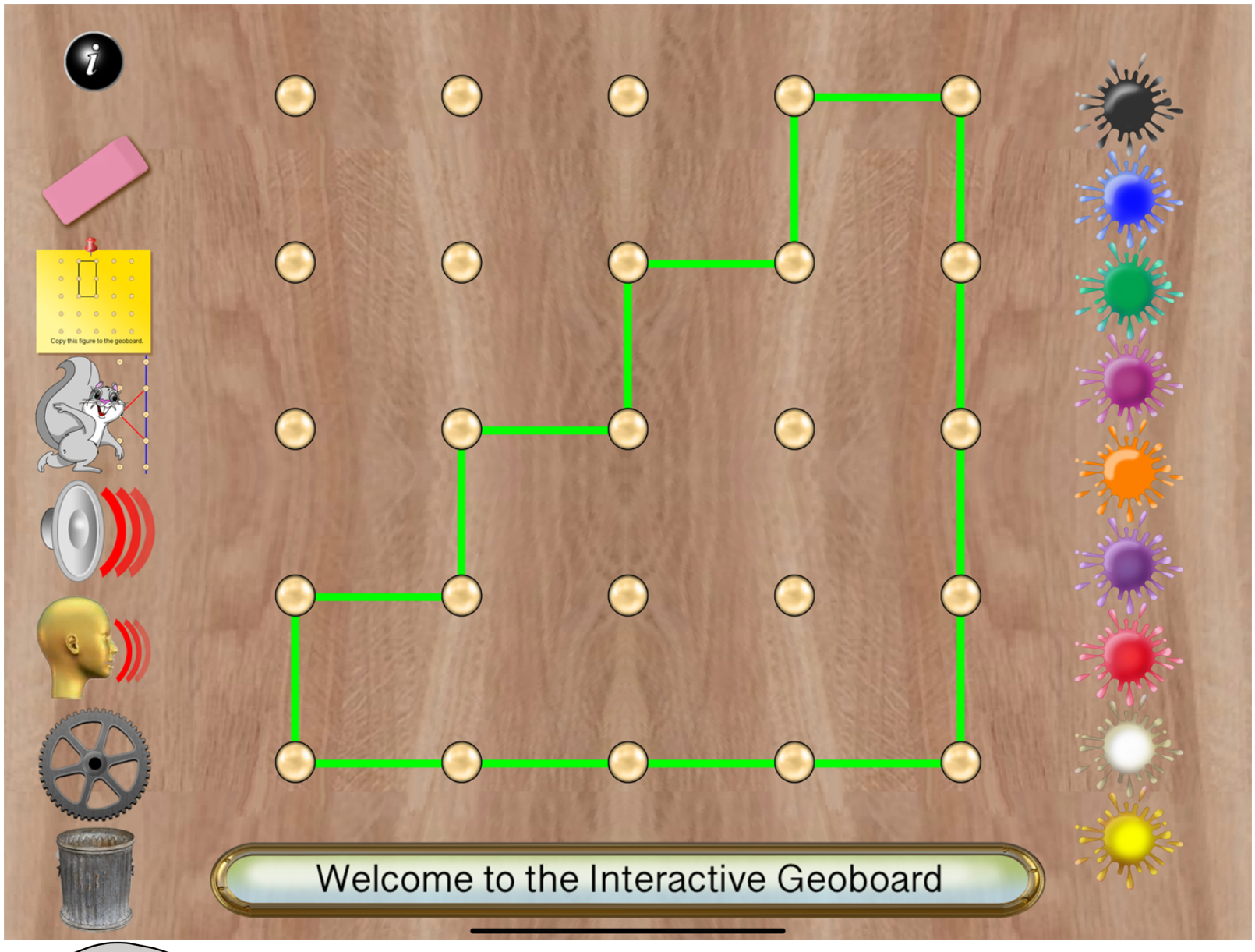
Perimeter: _____

Area: _____

Activity #26

Interactive Geoboard Exploration: Perimeter and Area of Irregular Polygons

An irregular polygon is a 2D shape that has straight sides that are not equal to each other and possibly angles that are not equal to each other. Copy this irregular polygon to the geoboard. The perimeter is the sum of all the sides. The area is the number of square units within the shape. Find the perimeter and area of this figure.



Self Check:

1. Add the length of each side to find the perimeter.

Perimeter: _____

Area: _____

Activity #26

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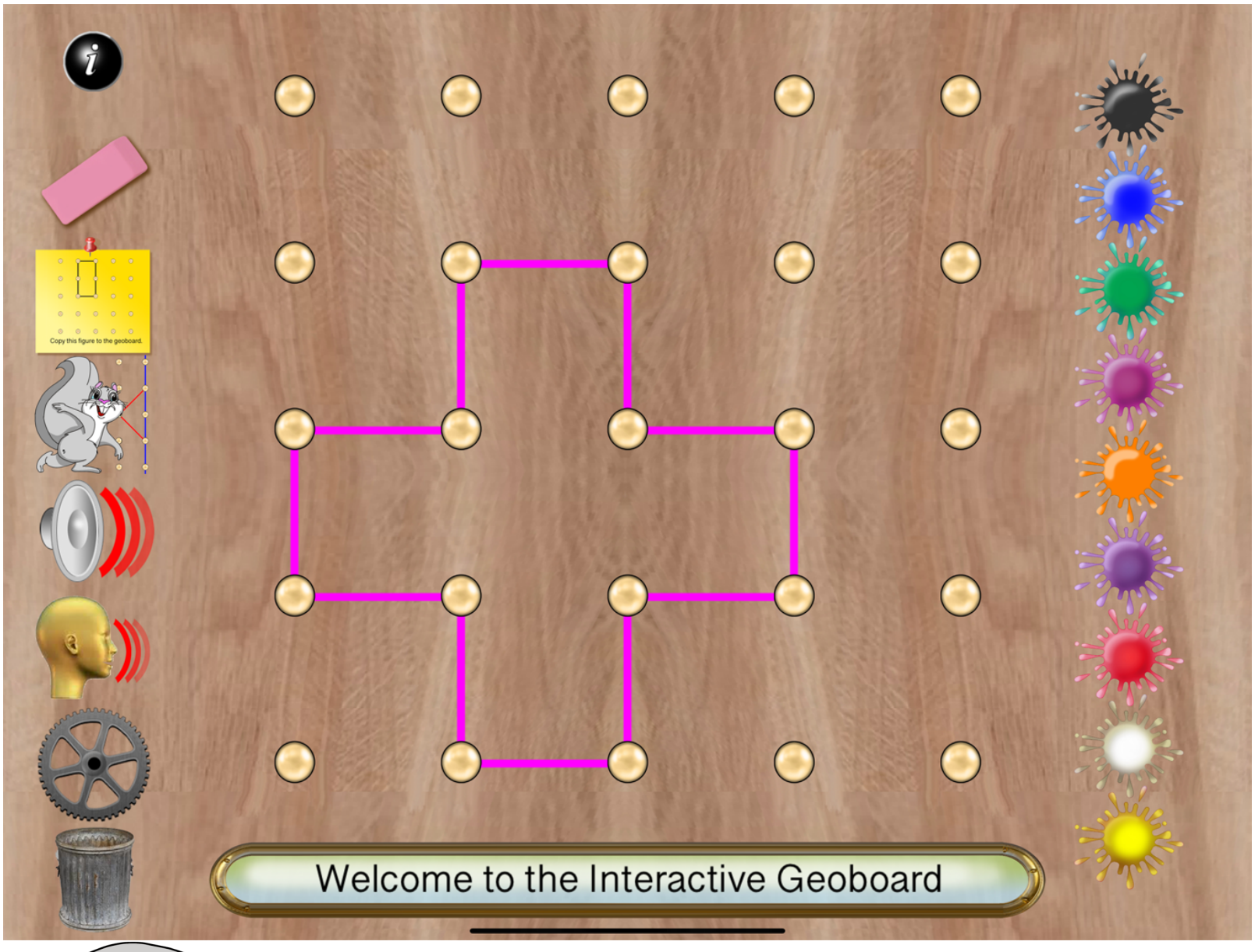


Self Check:

1. Add the length of each side to find the perimeter.

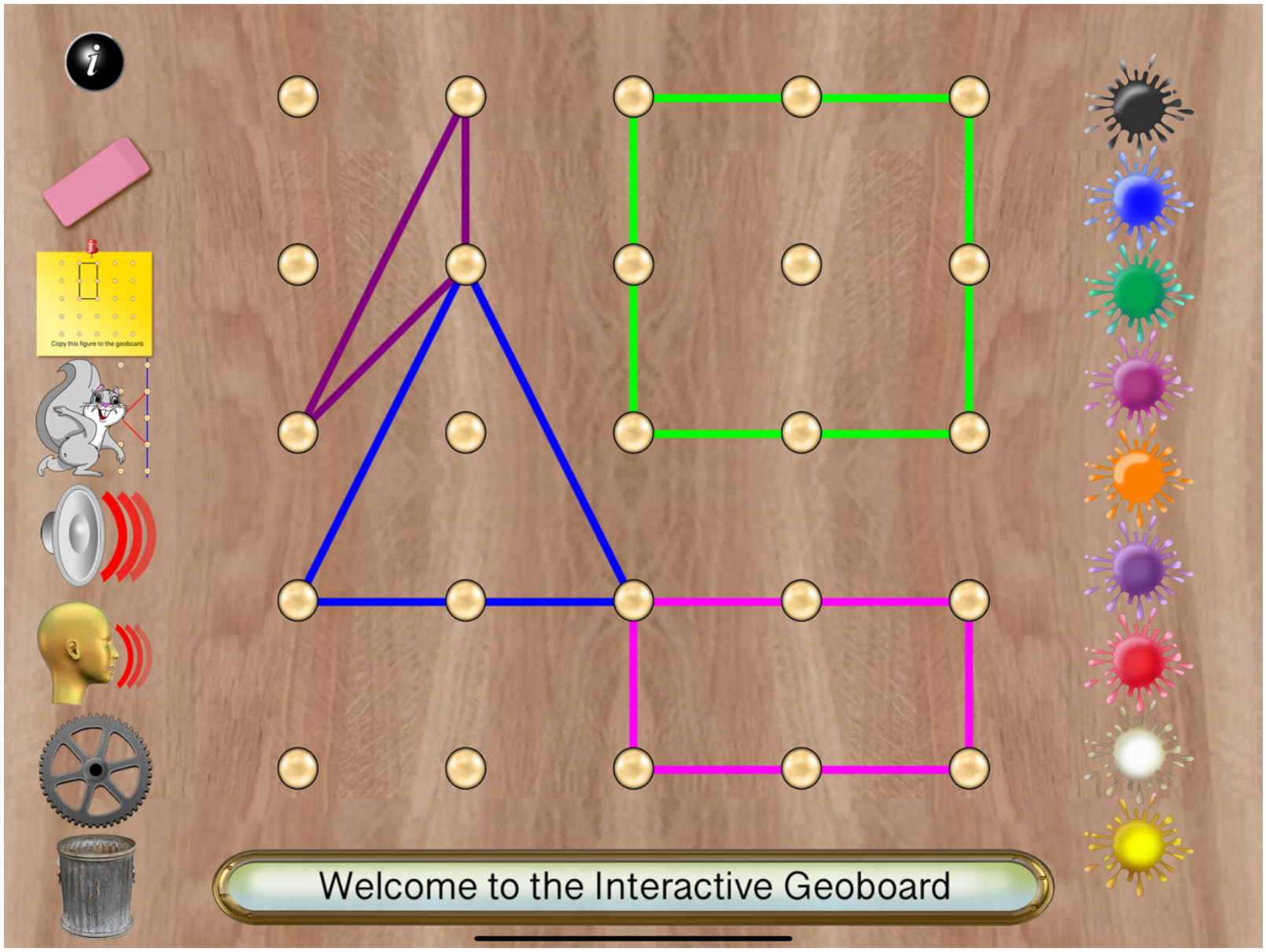
Perimeter: _____

Area: _____

Activity #27

Interactive Geoboard Exploration: Names of Geometric Figures

A closed figure with three sides is a triangle. If two of the sides are congruent, the figure is an isosceles triangle. If none of the sides are the same the figure is a scalene triangle. A square is closed figure with four congruent sides and four 90° angles. A rectangle has four 90° vertices and two sets of parallel sides.



For each color, write the name of the shape:

Blue: _____

Green: _____

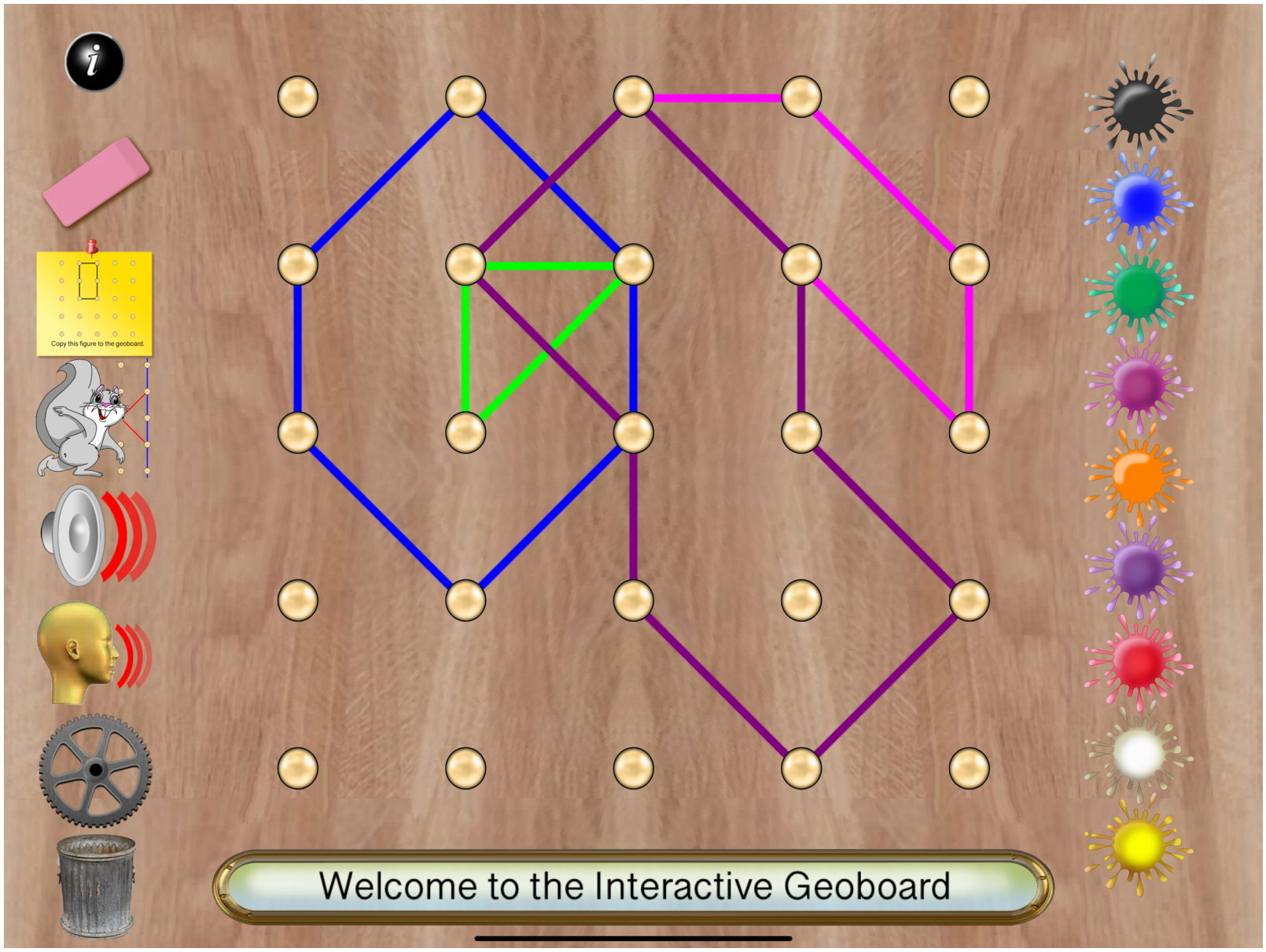
Magenta: _____

Purple: _____

Activity #28

Interactive Geoboard Exploration: Names of Geometric Figures

A closed figure with six sides is a hexagon. Closed figures with eight sides are octagons. A closed figure with two parallel sides and to non-parallel sides is a trapezoid.



For each color, write the name of the shape:

Blue: _____

Green: _____

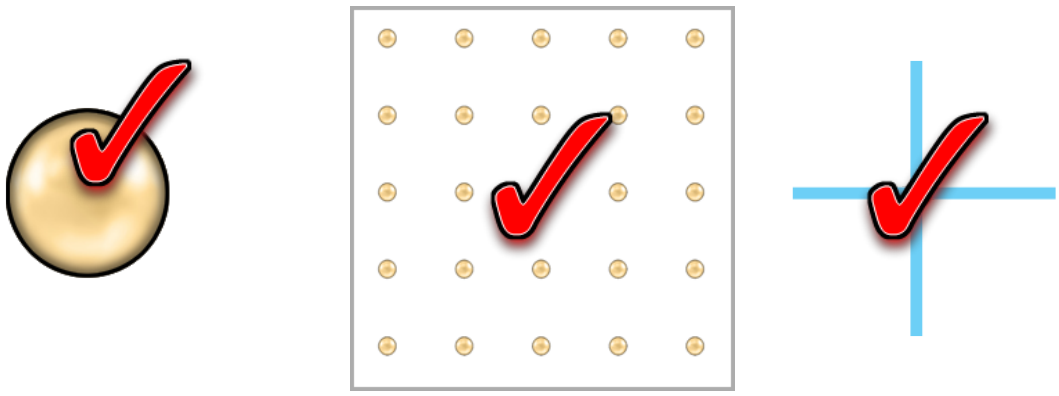
Magenta: _____

Purple: _____

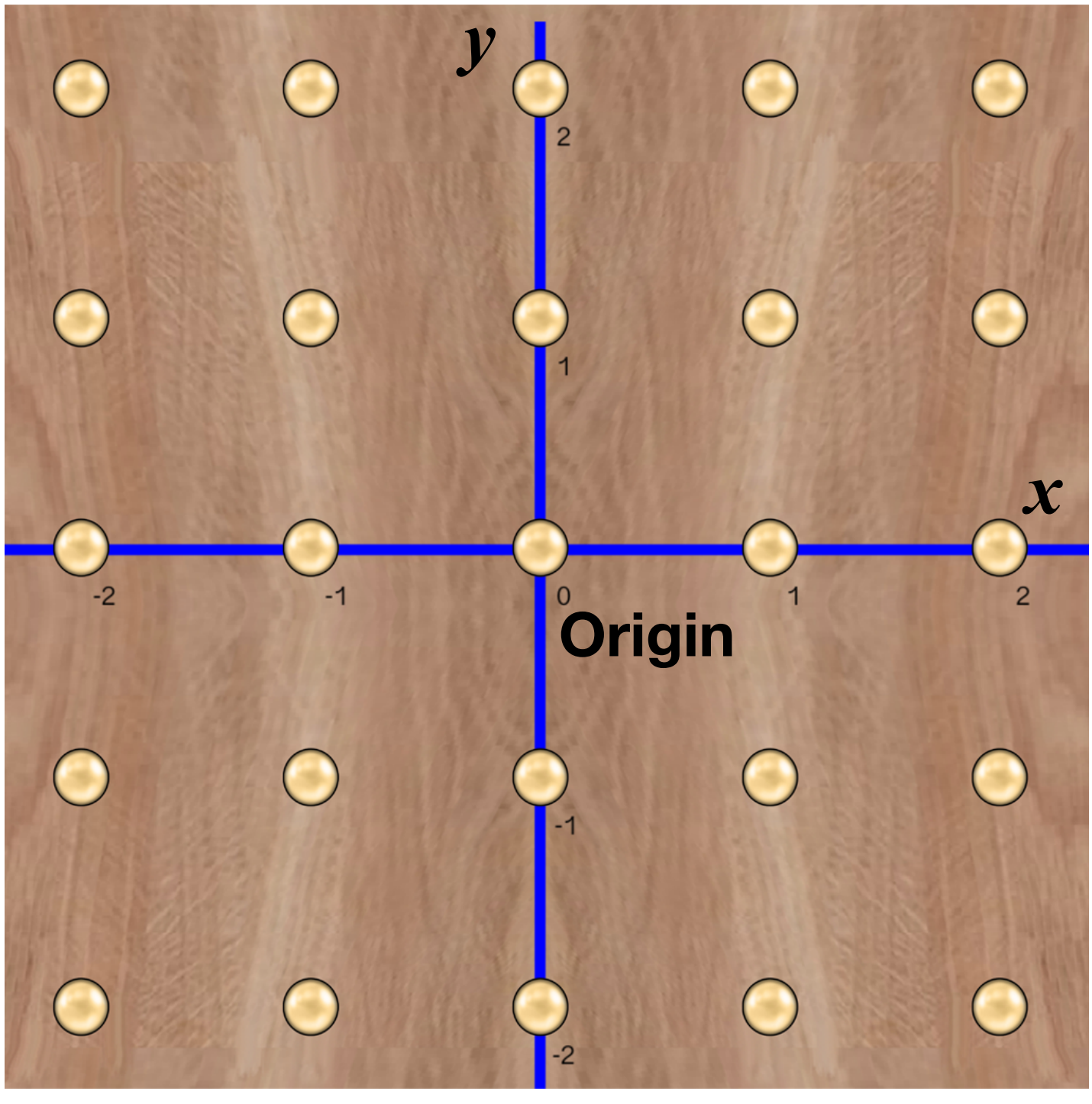
Activity #29

Interactive Geoboard Exploration: Coordinate Pairs

Set the geoboard to a labelled, 5x5 grid and set the grid with positive and negative coordinates.



Coordinate pairs are used to locate points on a grid. The first number in a coordinate pair is called the x-coordinate. It tells how far to the left or right a point is from the origin. The second coordinate is called the y-coordinate. It tells



Activity #30

Interactive Geoboard Exploration: Using Coordinate Pairs

Set the geoboard to a labelled, 5x5 grid and set the grid with positive and negative coordinates as shown in Activity #29.

Locate these sets of points using the given coordinate pairs. Draw a line segment to connect the points in each set. Write the name of the shape.

(1,1) - (1,-1)

(1,-1) - (2,-1)

(2,-1) - (1,1)

1. _____

(1,2) - (2,0)

(2,0) - (1,0)

(1,0) - (0,2)

(0,2) - (1,2)

2. _____

(-2,2) - (2,0)

(2,0) - (0,-1)

(0,-1) - (-2,0)

(-2,0) - (-2,2)

3. _____

(1,1) - (1,-1)

(1,-1) - (-1,-1)

(-1,-1) - (-1,1)

(-1,1) - (1,1)

4. _____