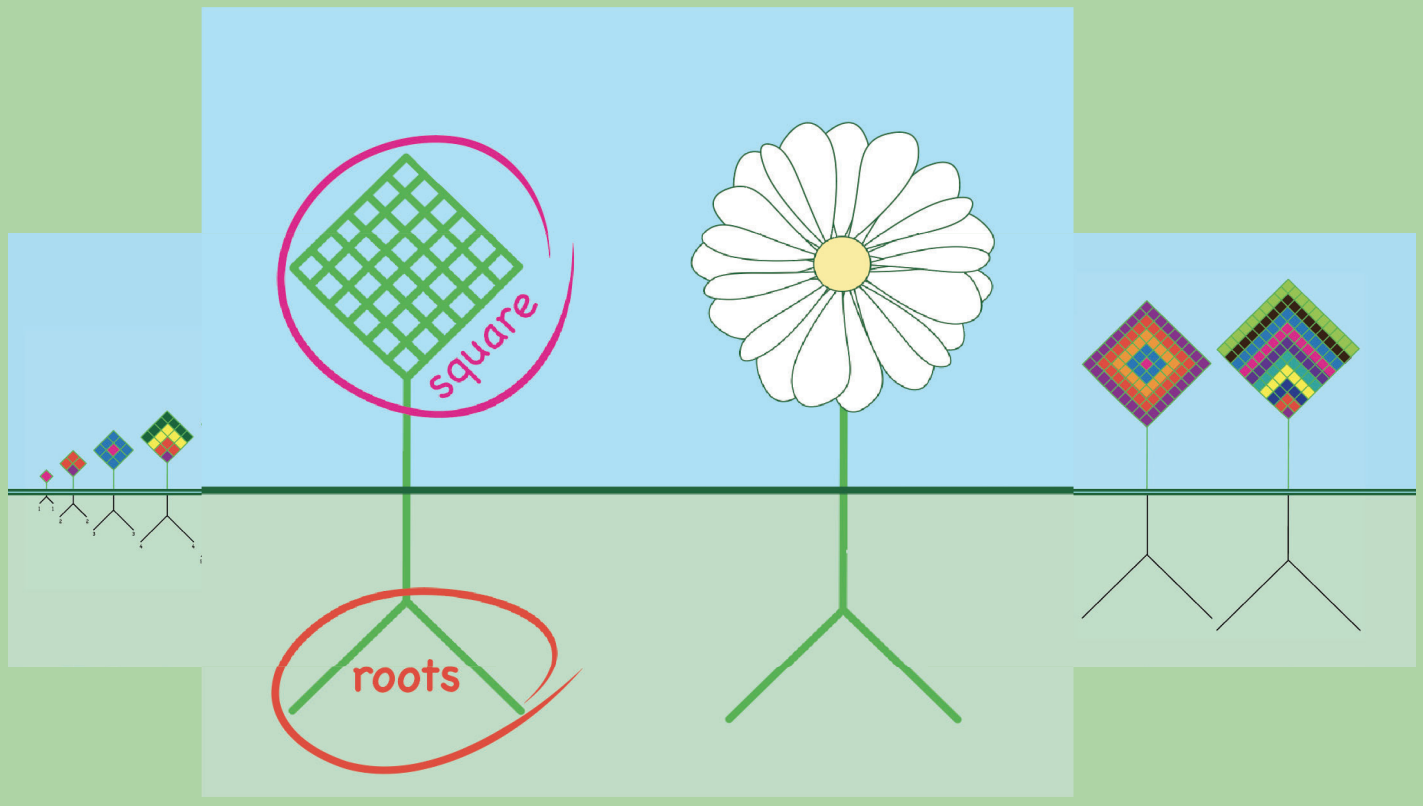
Math Garden
Squares and Roots



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In addition to **Colorful Collections**, you will receive a Wednesday morning email with teacher tips, educational ideas, or a free version of whatever I'm working on at the moment. You get to use it for free, and I benefit from your questions and comments.

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Thank you again. All the best,

Isabelle

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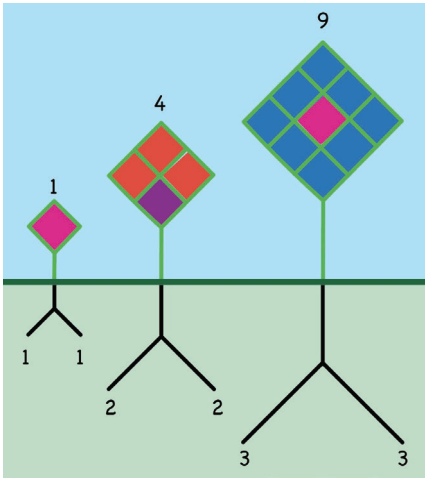
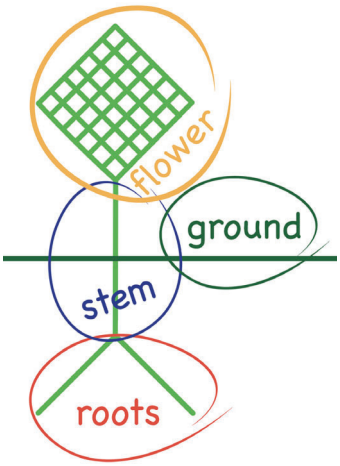
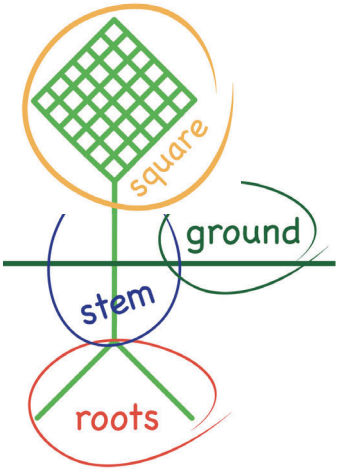
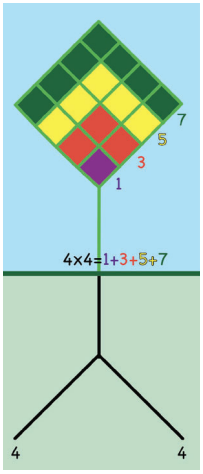
Math Garden: Squares and Roots

When a certain number of items can be arranged in the figure of a square, we call it a 'square number.' The length of each side of the square figure is called the 'root.' Let's use another meaning of the word, 'root,' and investigate the square 'flowers' that could grow from them in a Math Garden.

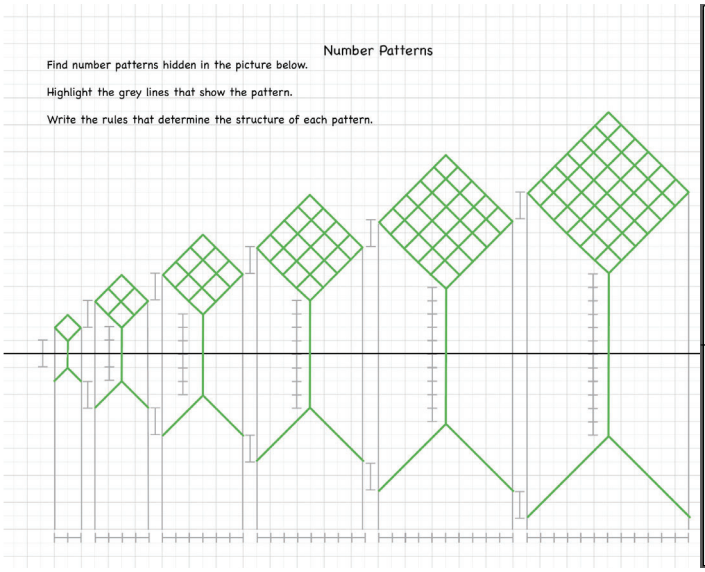


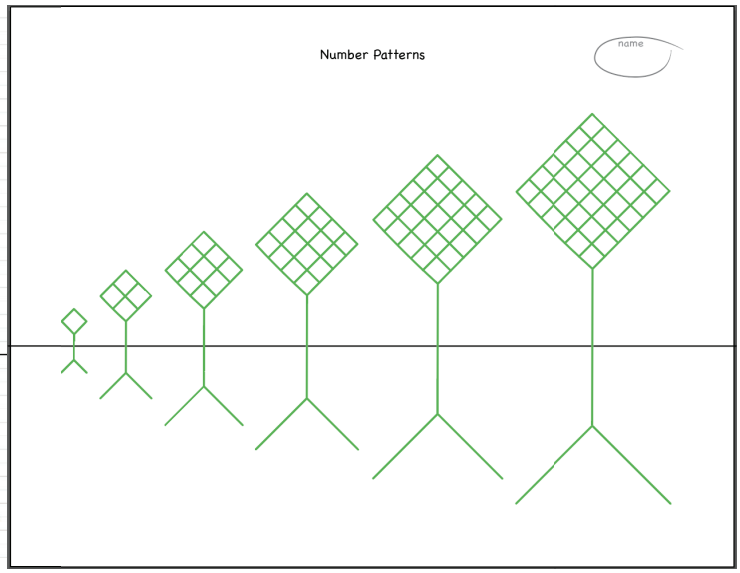






What other relationships can you discover? How is the length of the stems above ground related to the length of the stems below? If squares have an odd number of cells, where is the 'odd one out' located? Use the first page as a 'thinking copy' and when you are ready, use the second page to create your final presentation.





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Activity Ideas

You and your students can find many patterns when looking at the squares and their roots, some of which may never have been identified before. Will you find the key to solving 3N+1? Doubt it. Should you write up an article Scientific American? Well, I suppose you could. Will your students share the energizing feeling of creative discovery while messing around with math? YES!

They will also have opportunities to: use academic language in conversation and writing, make sense of information presented in graphic form, practice sharing mathematical ideas in writing, organize and present data, ask questions, find ways to answer questions they have asked, and dive into an interesting project.

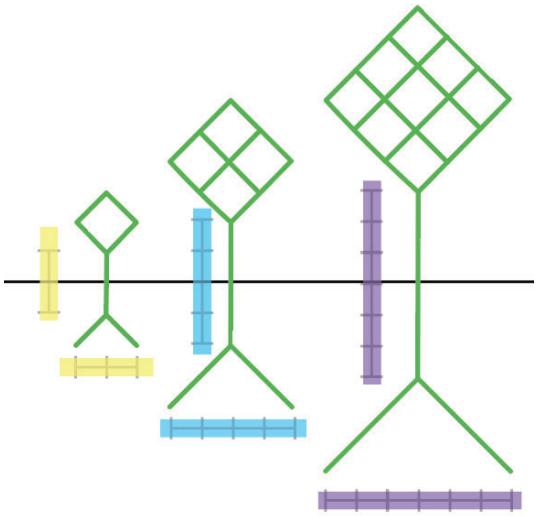
Find Number Patterns

For each question below, always ask:

- Why is this? What causes the pattern to be the way it is?
- Will this pattern continue as the numbers increase in magnitude? How do you know?
- How can this pattern be described?
- What are some other ways to share the pattern? Graph? Chart? Table? Graphic?
- How can this pattern be used to understand geometry or streamline calculations?

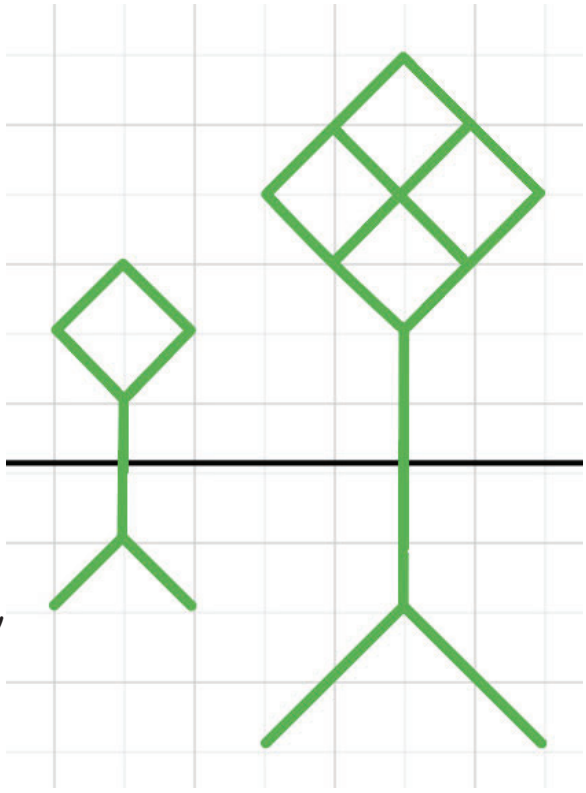
Here are a few patterns worth investigating:

- **Parity:** When the roots are even numbers, will the square also be even? Odd?
- **Consecutive Squares:** Find the difference between consecutive square numbers. How can the pattern be used to find the squares of larger and larger numbers?



- **Roots:** Is there a relationship between the length of the 'roots' and the length of the side or edge of each square?
- **Fill in the Numbers:** Invite your students to add numbers to the garden showing the value of each root and square.
- **Decorate the Garden:** Challenge students to use triangular numbers in their gardens, too. They could be wings on butterflies, weeds, or something else.

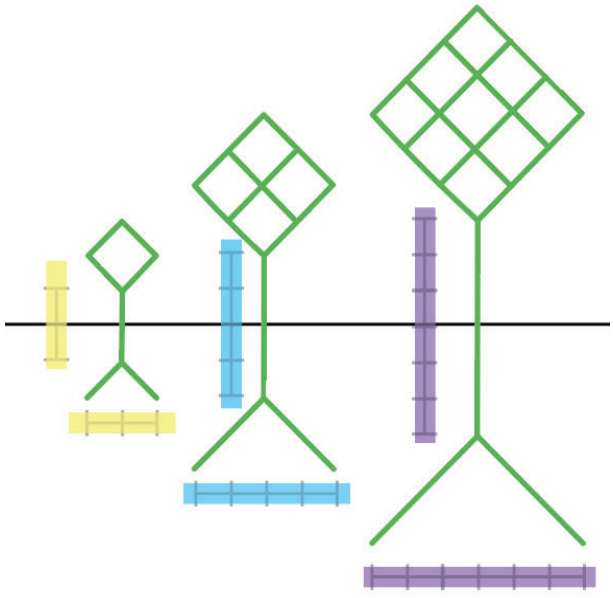
More Patterns

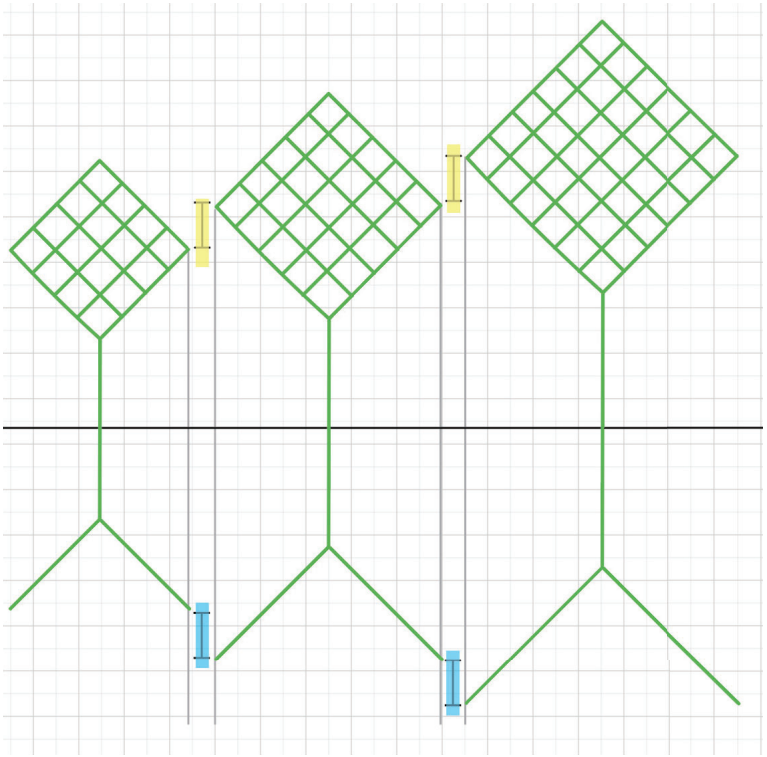


- **Spacing:** Consider the distance between each stem. If there are four units between the first and second stems, how many units are there between the other stems? Where would the stem of the square of eleven be placed?

- **DIY:** Give your students some graph paper and have them create their own garden. See if they can recreate the 'flowers' and 'roots' growing from the ground.

- **Placement:** Examine how each square is placed in relation to its next door neighbors. Which measurements change when a new square is added and which stay the same?



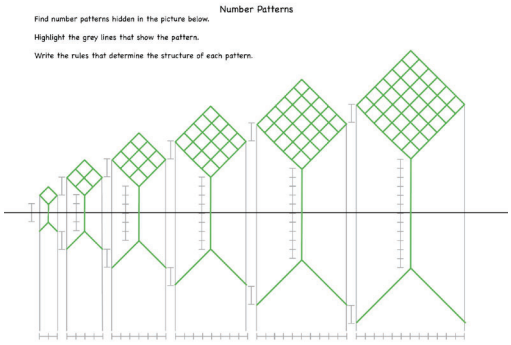


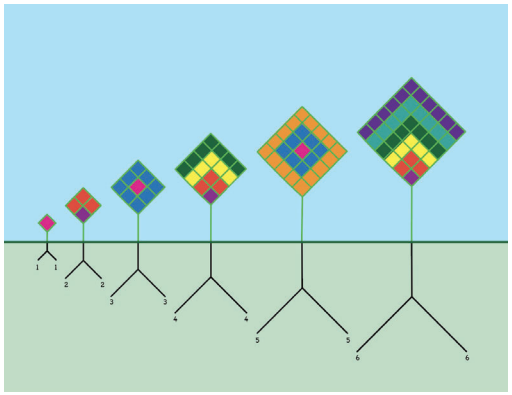
What other relationships can you discover? How is the length of the stems above ground related to the length of the stems below? If squares have an odd number of cells, where is the 'odd one out' located?

More Activity Ideas

Write Instructions

Write directions for creating another display which is exactly like this one. Have students work in teams to figure out how this display was created and then write step by step directions for any one who would like to recreate it.





Color the Garden

Encourage your students to find a unique way to:

- Show differences in squares with even numbers and squares with odd numbers.
- Show how each square adds to the square before.
- Use warm and cool colors, dark and light hues to emphasize the 3D effect of the larger squares coming forward toward the viewer.
- Ditch the garden theme and find another interesting theme to use. These shapes could be turned into trees along the edge of a lake with their reflections in the water. They could be seen as stair steps, or the journey of a satellite in space.

Bulletin Board Display

Have your class work together to make a bulletin board or wall display of the square garden. Perhaps invite the art teacher to help them scale up the drawing correctly. Place green paper below and blue paper above. Let teams of students create the square 'flowers' with roots. When everyone is ready have the teams place their flowers on the background from smallest to tallest. Leave some sticky notes by the finished product for rave reviews of the display and questions about the math.

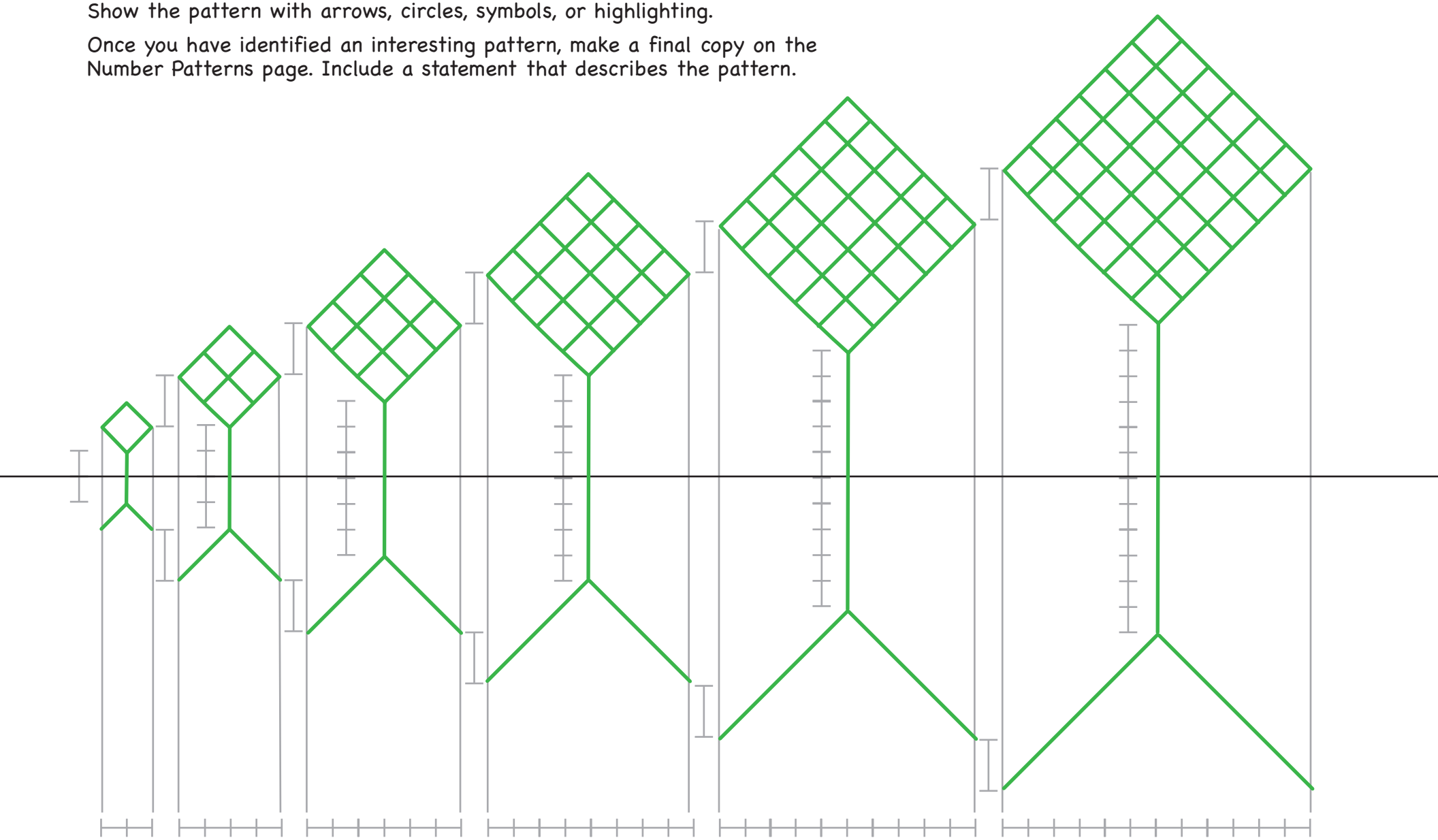
Number Patterns Practice Paper

name

Find a number pattern in the squares and roots below.

Show the pattern with arrows, circles, symbols, or highlighting.

Once you have identified an interesting pattern, make a final copy on the Number Patterns page. Include a statement that describes the pattern.



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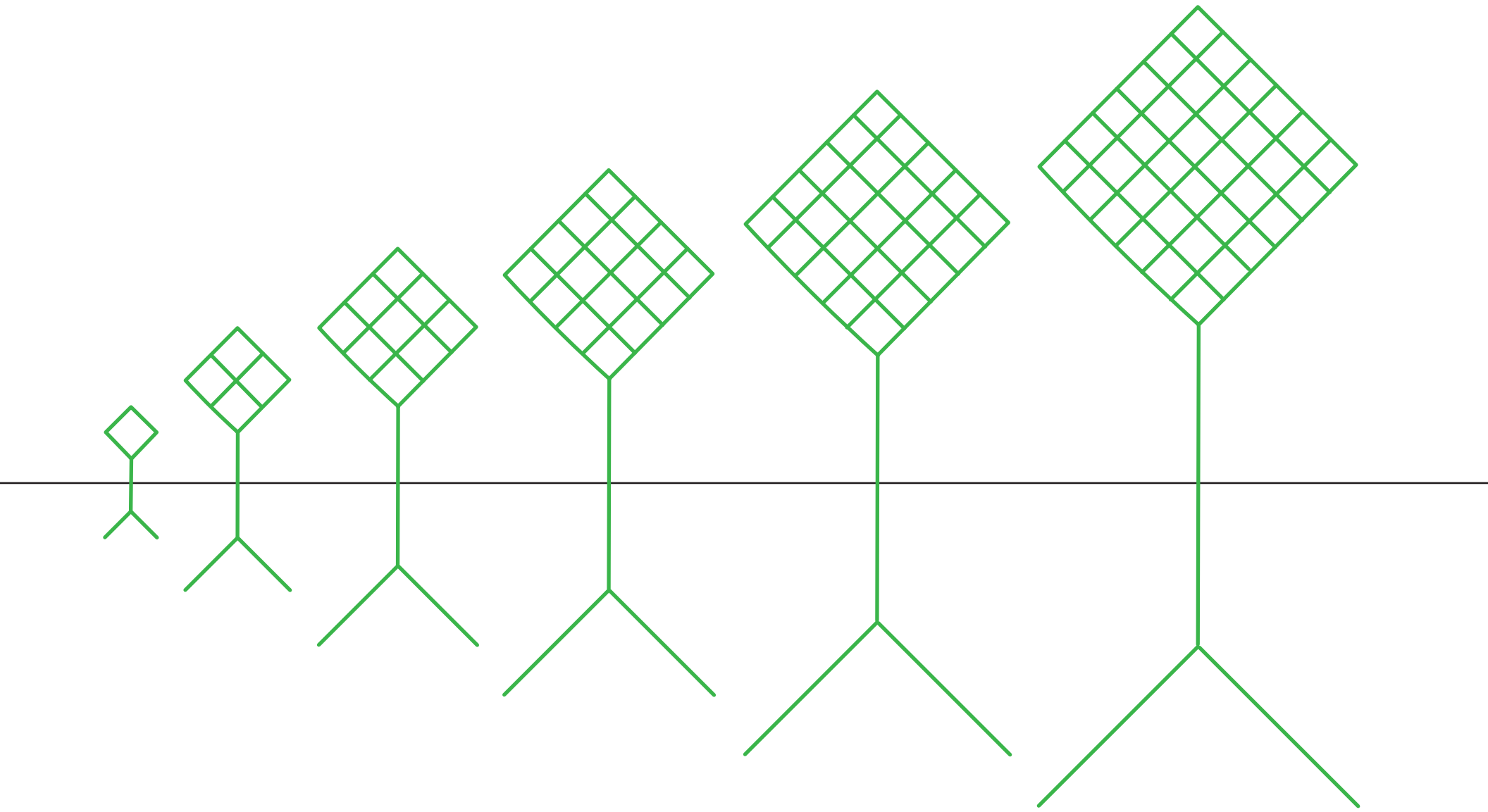
Number Patterns

name



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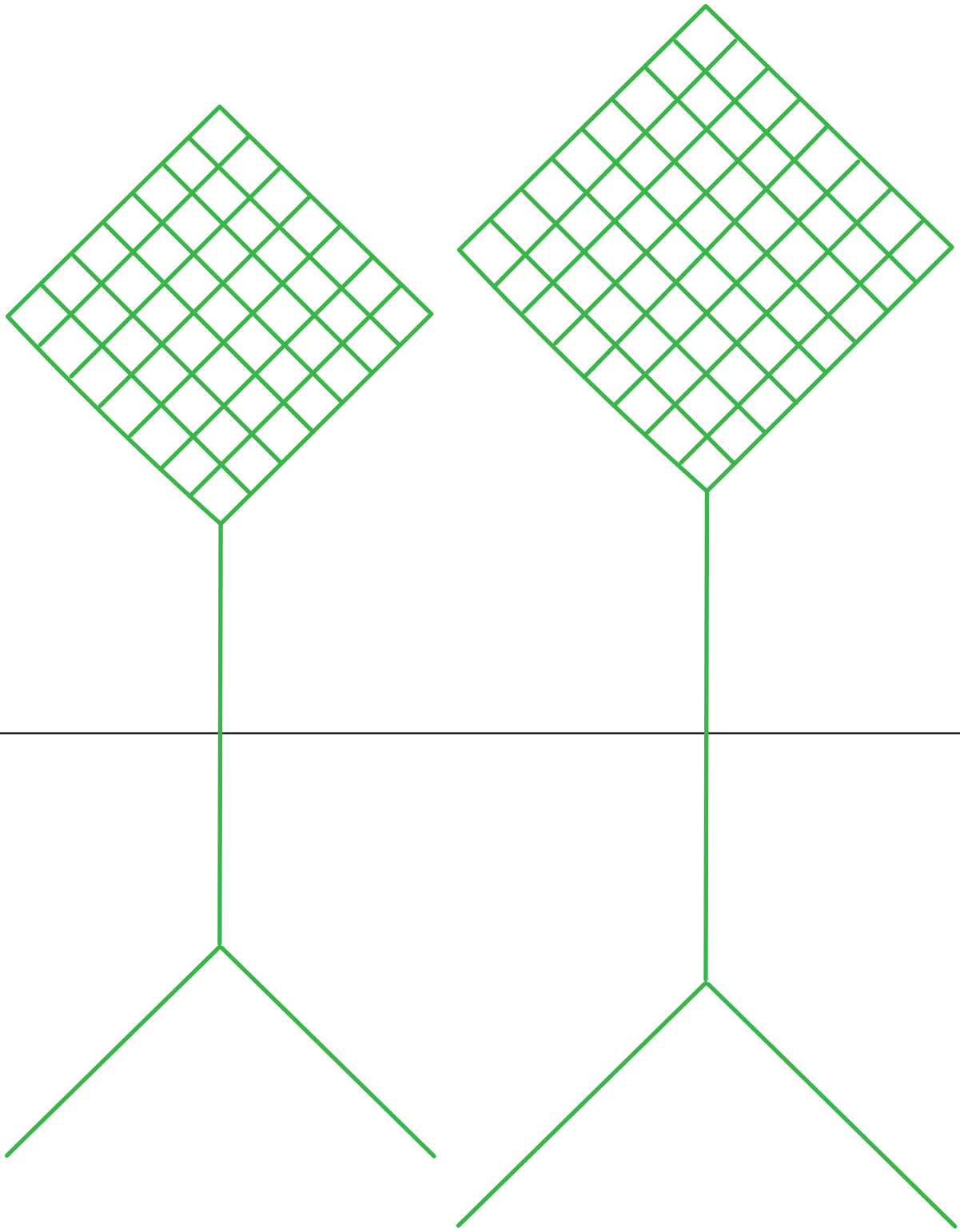

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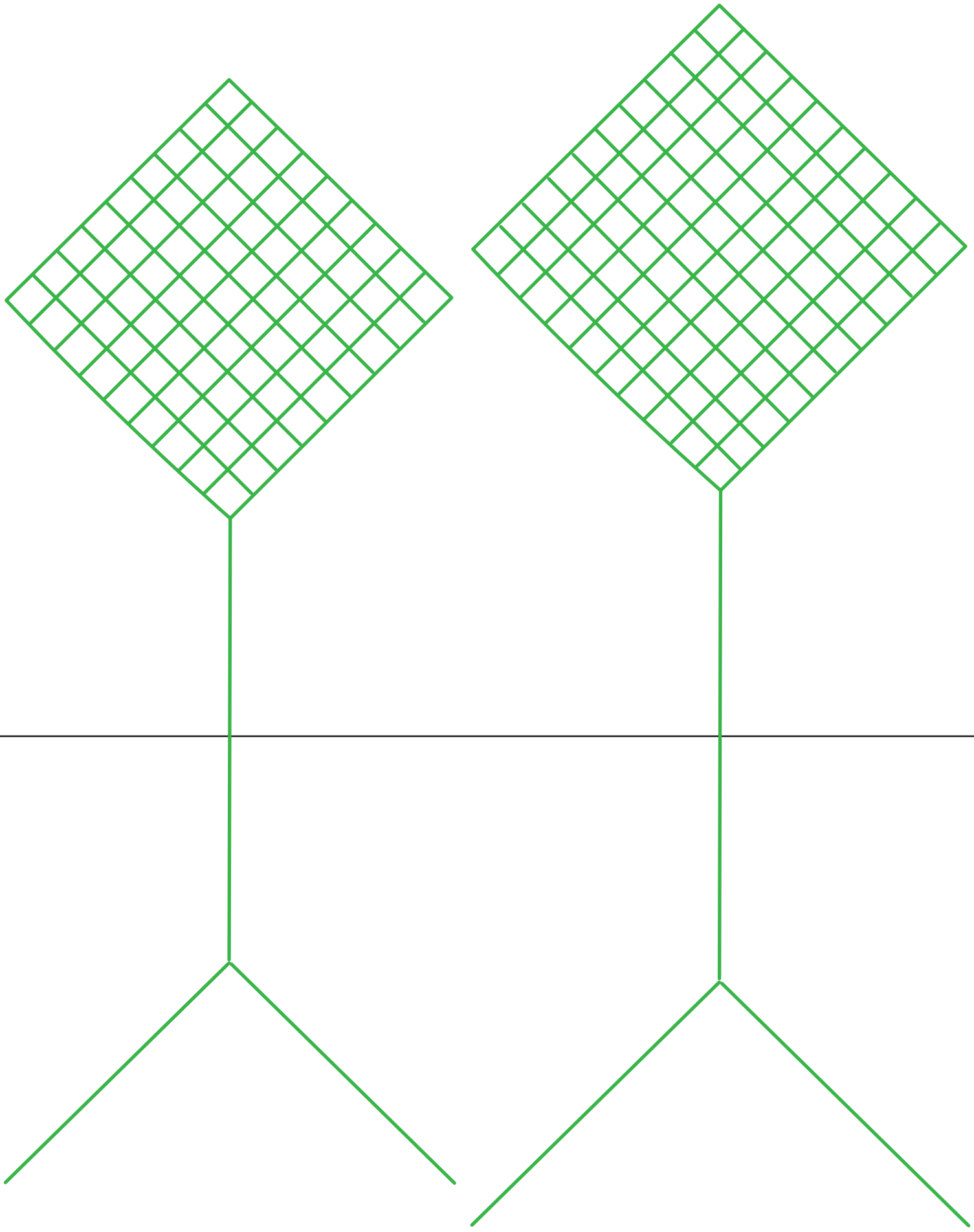

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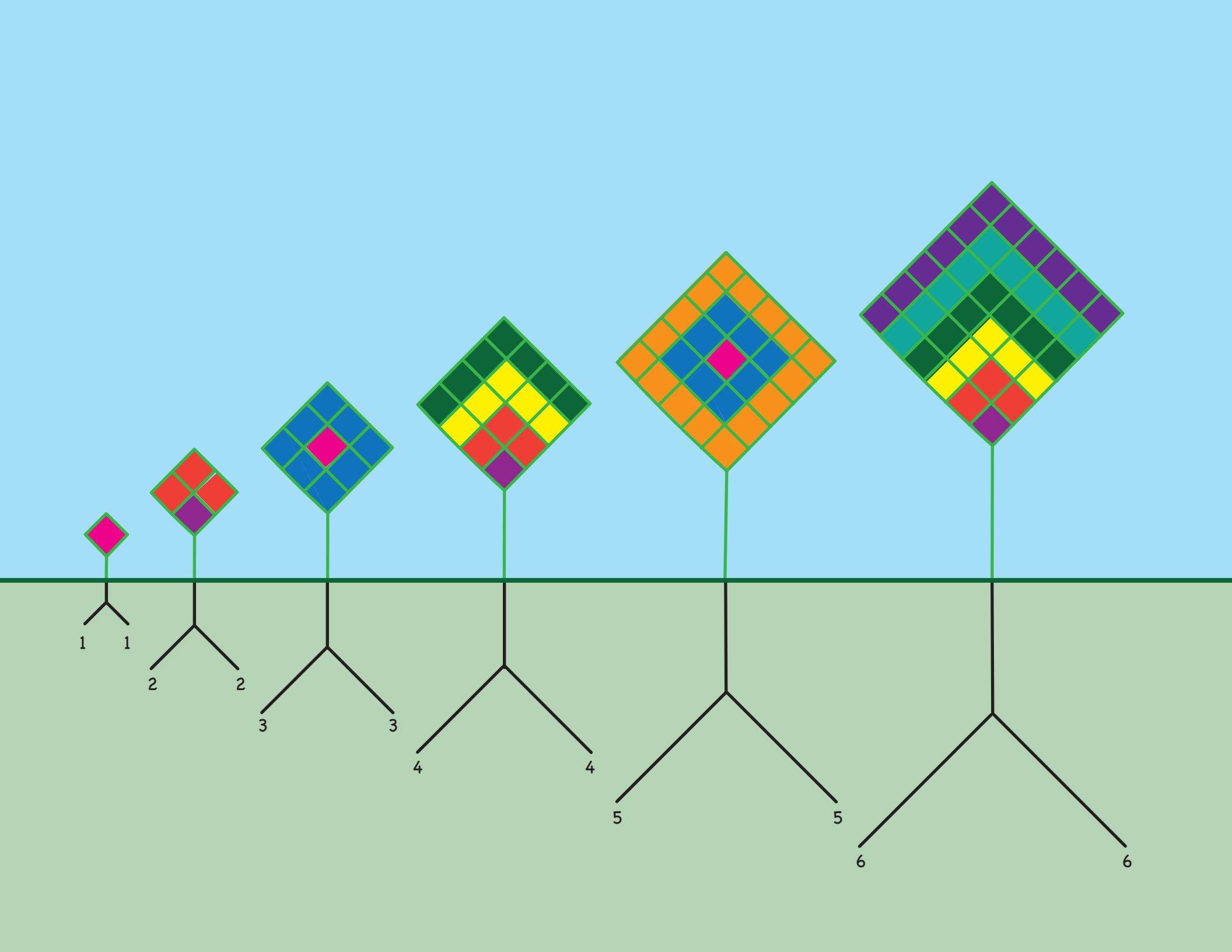
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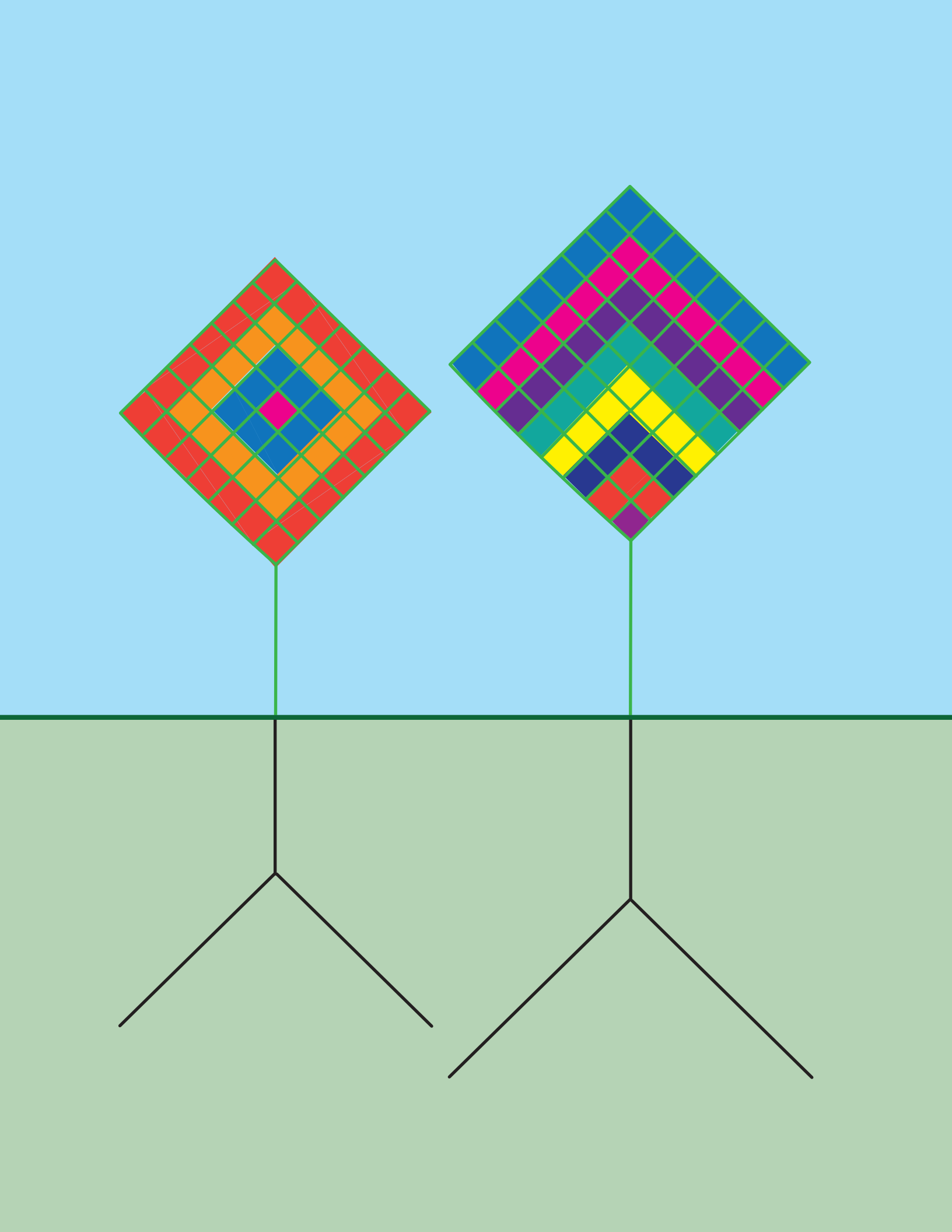
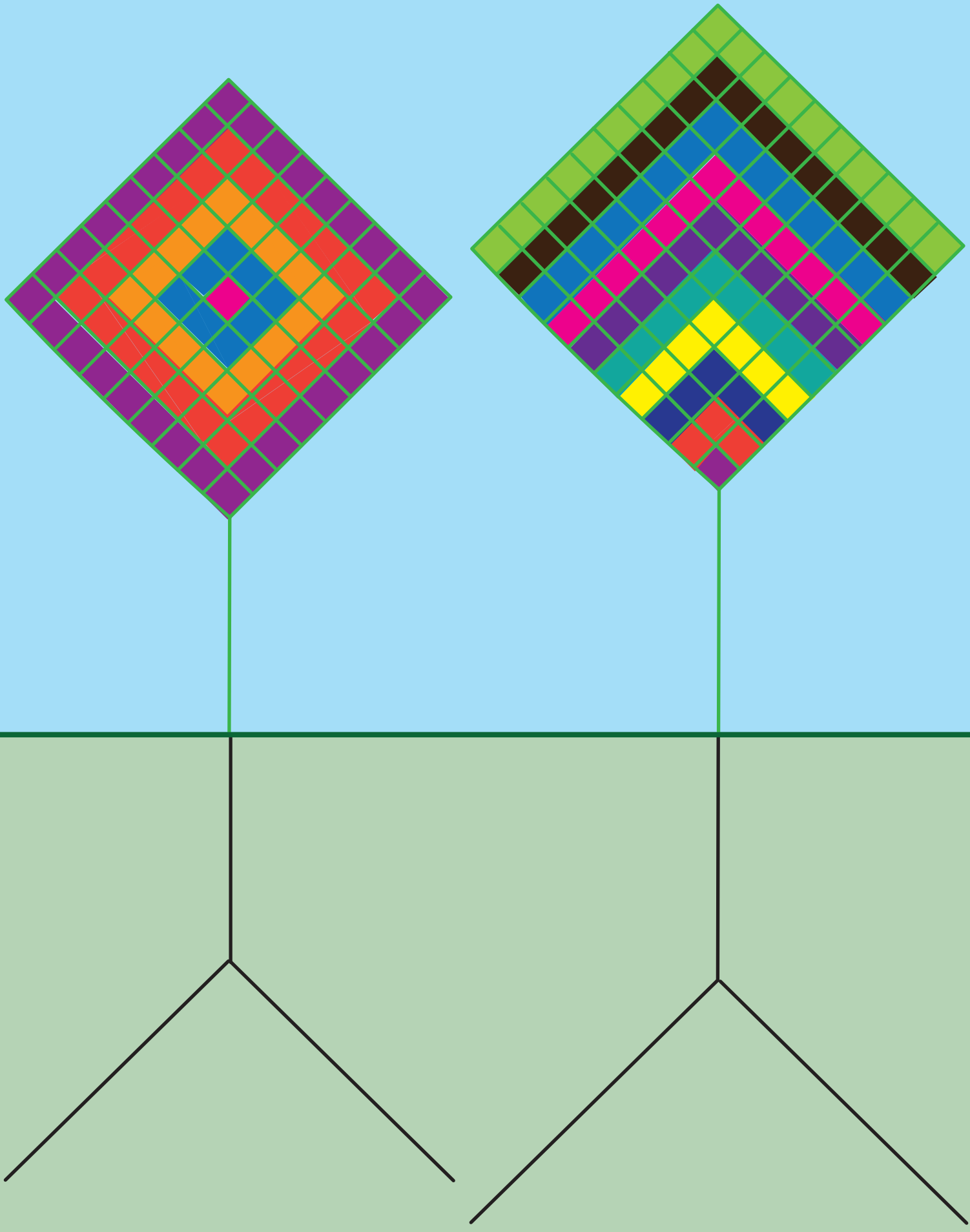
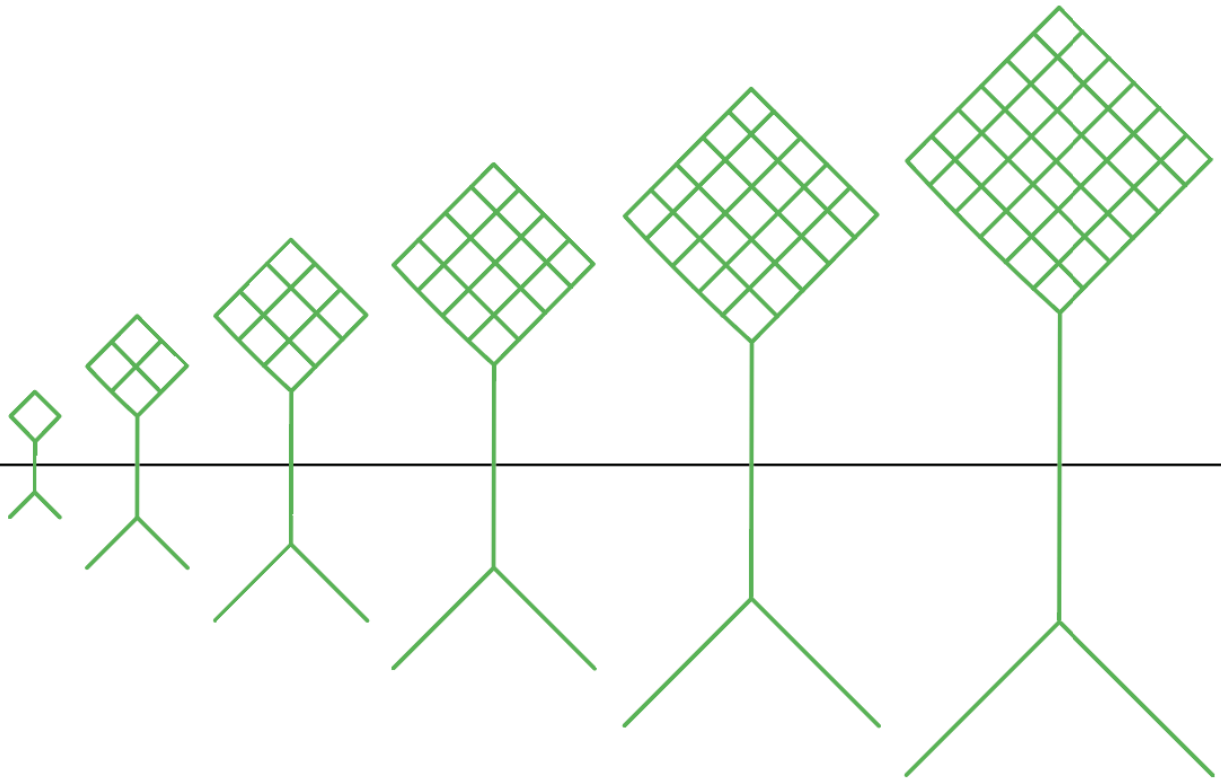




Number Patterns

name



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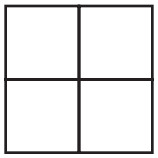
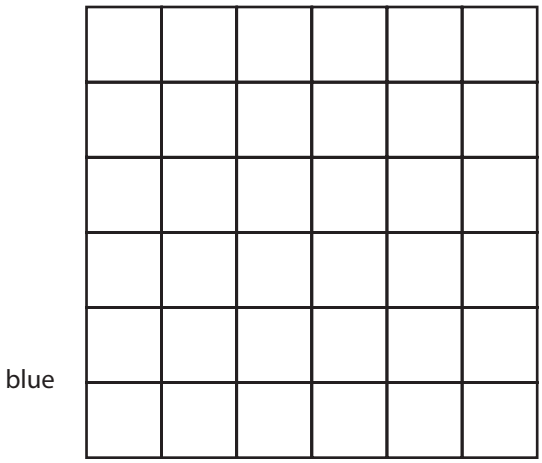
Rainbow Squares

copy sheet -just for fun!

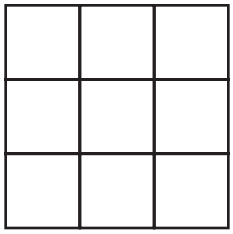
white



red

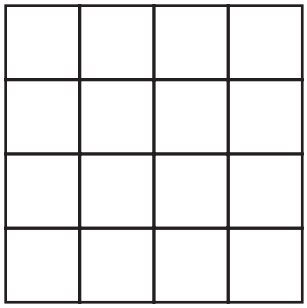


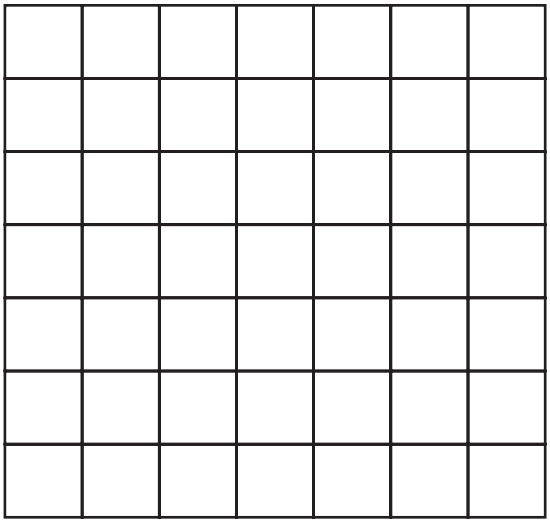
blue



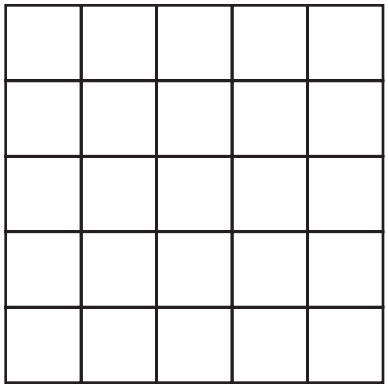
orange

yellow

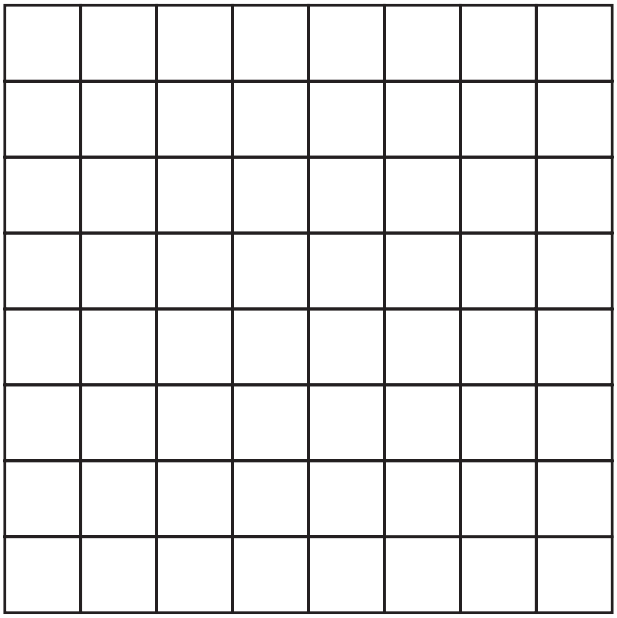




indigo



green



violet

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