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Spirolaterals
Grades 3-12

Introduction
In this activity, students will explore numbers visually and creatively. Students will be invited to find, test, and explain patterns that emerge in the visual representations.

Agenda

Activity	Time	Description/Prompt	Materials
Mindset Message	5 min	Play the mindset video	Mindset video
Launch	10 min	• Share the idea of visually representing numbers • In small groups, students discuss how to make a spirolateral using the handout • As a class, discuss how to make a spirolateral by doing an example together.	How to Make a Spirolateral handout

Explore	40 min	• Make a spirolateral
		  ▪ Pair students
		  ▪ Each student writes a list of numbers with 3 to 8 numbers in it.
		  ▪ Students swap lists and make spirolateral out of each other's list
		• Gallery walk
		  ▪ Students walk around and compare the spirolaterals
		  ▪ Invite students to find patterns
		  ▪ Discuss patterns that students found
		• In pairs, students;
		• create spirolaterals on different grid shapes.
		• continue to make spirolaterals to test patterns and conjectures.
		• PIck one pattern they found to share with the class.
			• How to Make a Spirolateral handout
			• Colored pencils or markers
			• Graph paper
			• Triangle, hexagonal, and octagonal grids
			• Optional: dice

Share	10 min	Invite students share one pattern they found..	Whiteboard or Document Camera
Debrief Mindset Messages	5 min	Debrief the mindset messages for this activity.	Maths Journal

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Activity

Watch the mindset video before class. At the beginning of the class share the video and the mindset messages.

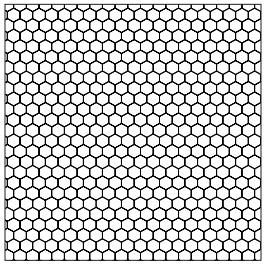
Share with the class that the idea of visually representing numbers as a spirolateral. To learn how to make a spirolateral, students will read the "How to Make a Spirolateral" handout. Encourage students to talk in pairs or small groups about each step. As a class, review how to make a spirolateral by constructing one together. Use a list with three numbers and have the students choose the numbers in the list. Make a comment about when they make their spirolaterals they can use any single digit number and put them in any order they want.

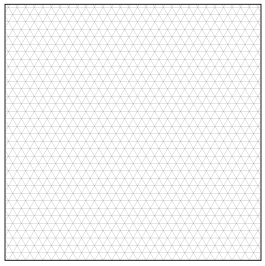
Next students will create their own spirolaterals. Each student will create a list with between 3 and 8 numbers in it. Consider haivng students roll dice to choose random numbers for their list. As students explore they might wonder if there is more than one way to create the spirolateral. The spirolaterals can be drawn in any direction however having students create them moving in the same direction makes them more comparable.

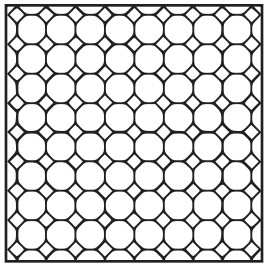
Have students swap with a partner and create a spirolateral out of their partner's list. If students finish early encourage them to discuss each other's work. Encourage themto look for patterns and make connections between the numbers in their list and the spirolateral it makes. Then have students start a new spirolateral to continue to look for patterns and connections or to be creative and see what other spirolateral designs they can create.

Once students are done, ask students to leave their spirolaterals on their desk. Students walk around the classroom and examine the spirolaterals. Encourage students to find patterns between the spirolaterals. For example, when does a spirolateral end and when does it continue forever? When they return to their seats, ask students to discuss with their partners patterns that they observed. Then, discuss as a class.

Challenge students to create spirolaterals on different grid shapes using their original list. Encourage students to work in pairs to determine how to make a spirolateral on a different grid shape.







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Invite students to continue to test patterns in spirolaterals by creating more spirolaterals with number lists and grids of their choice.

In pairs or small groups, ask students to compare all of the spirolaterals their group created throughout the class period. Encourage them to identify patterns between their spirolaterals. Ask each group to choose one curious pattern to share with the rest of the class.

For younger students

In the launch activity, read and discuss the "How to make a spirolateral" handout as a class. Students may choose to focus on creating spirolaterals on square grids. Additionally, students can create spirolaterals using colored tiles or blocks instead of by drawing.

Extensions

- Try making a spirolateral out of a list that includes negative numbers.
- Test conjectures using a Scratch program.
- Use the multiplication table to come up with a list of numbers as follows: Pick a column in the multiplication table. Turn each number in the column into a single-digit number by summing the digits. For example,

  $32 \rightarrow 3 + 2 = 5$

  $58 \rightarrow 5 + 8 = 13 \rightarrow 1 + 3 = 4$

  Make a spirolateral out of the resulting list. Explore patterns between spirolaterals you construct in this way.

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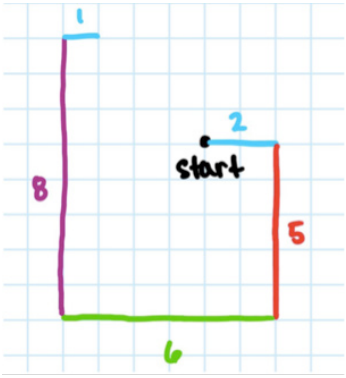
How to Make a Spirolateral

Step 1: Start with any list of numbers. For example:

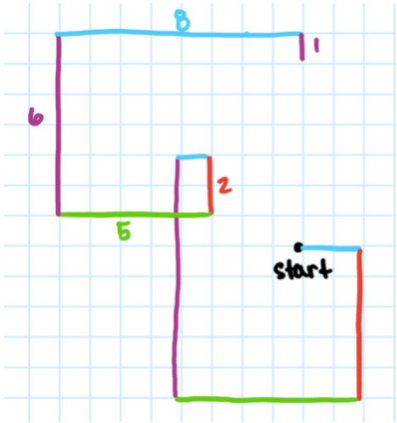
2, 5, 6, 8, 1

Step 2: Pick a color for each direction.

Step 3: Spiral through your list.



Step 4: Spiral through your list again.



Step 5: Continue until you return to the start or you are convinced that your spirolateral will never return to the start.

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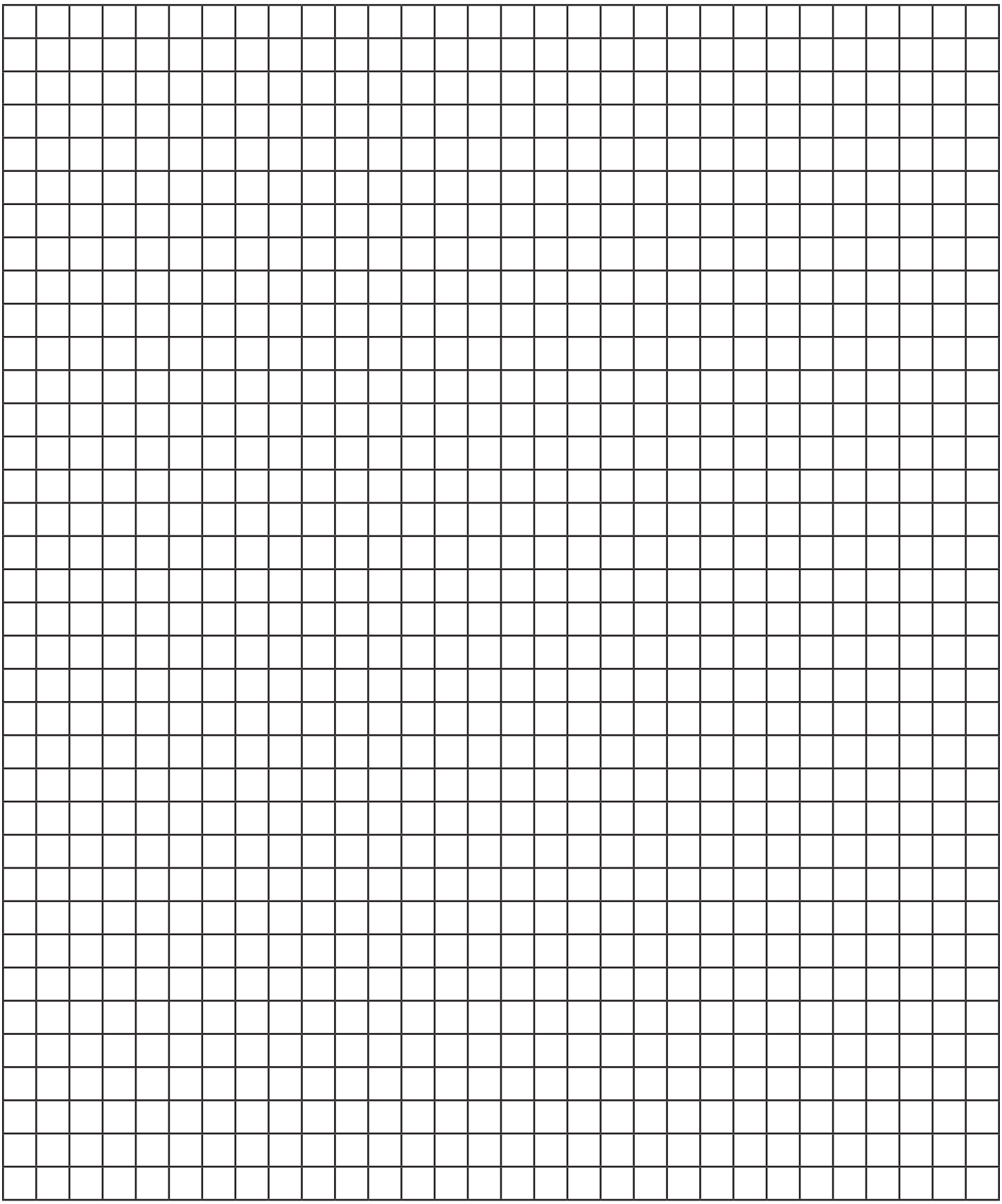

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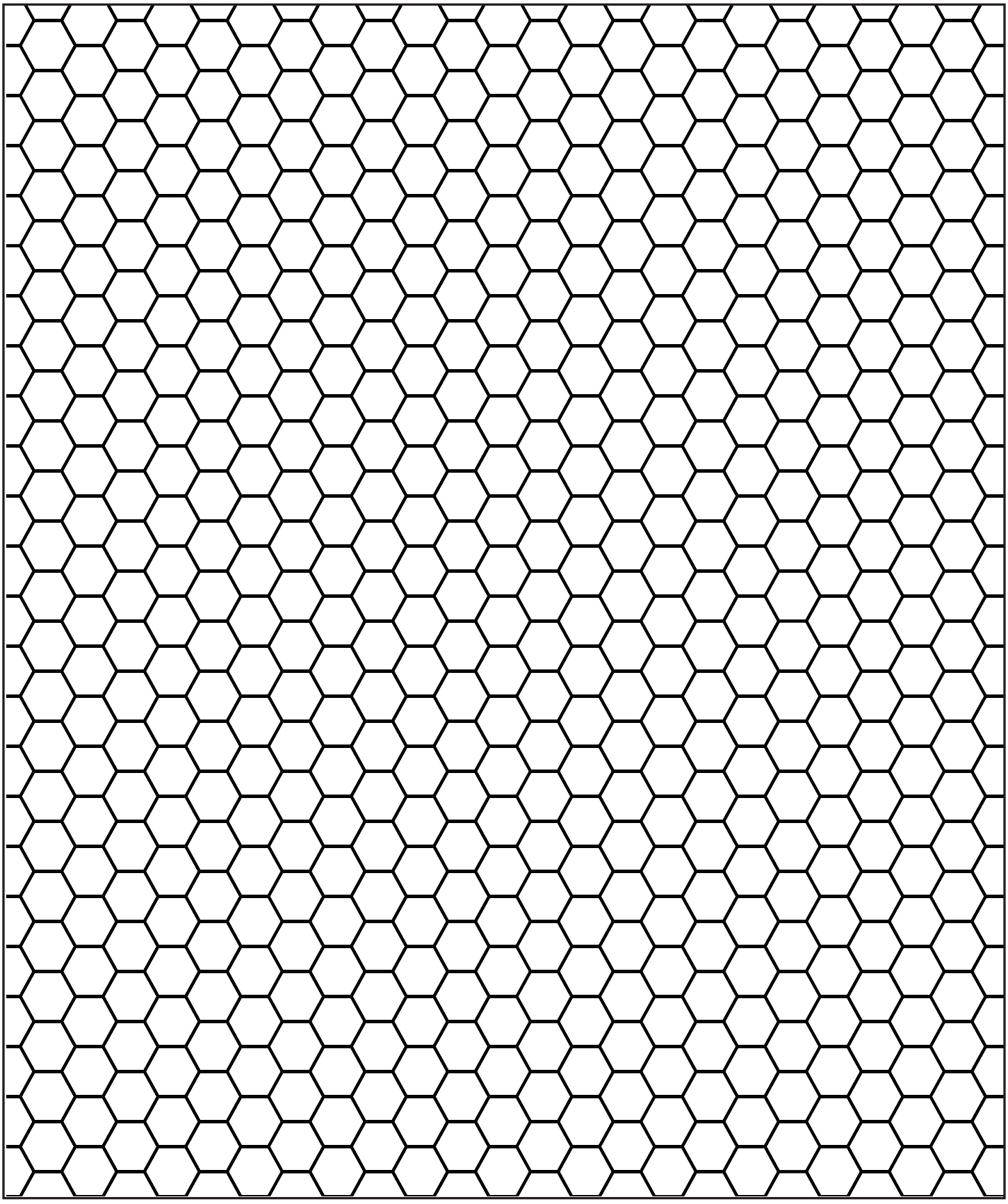

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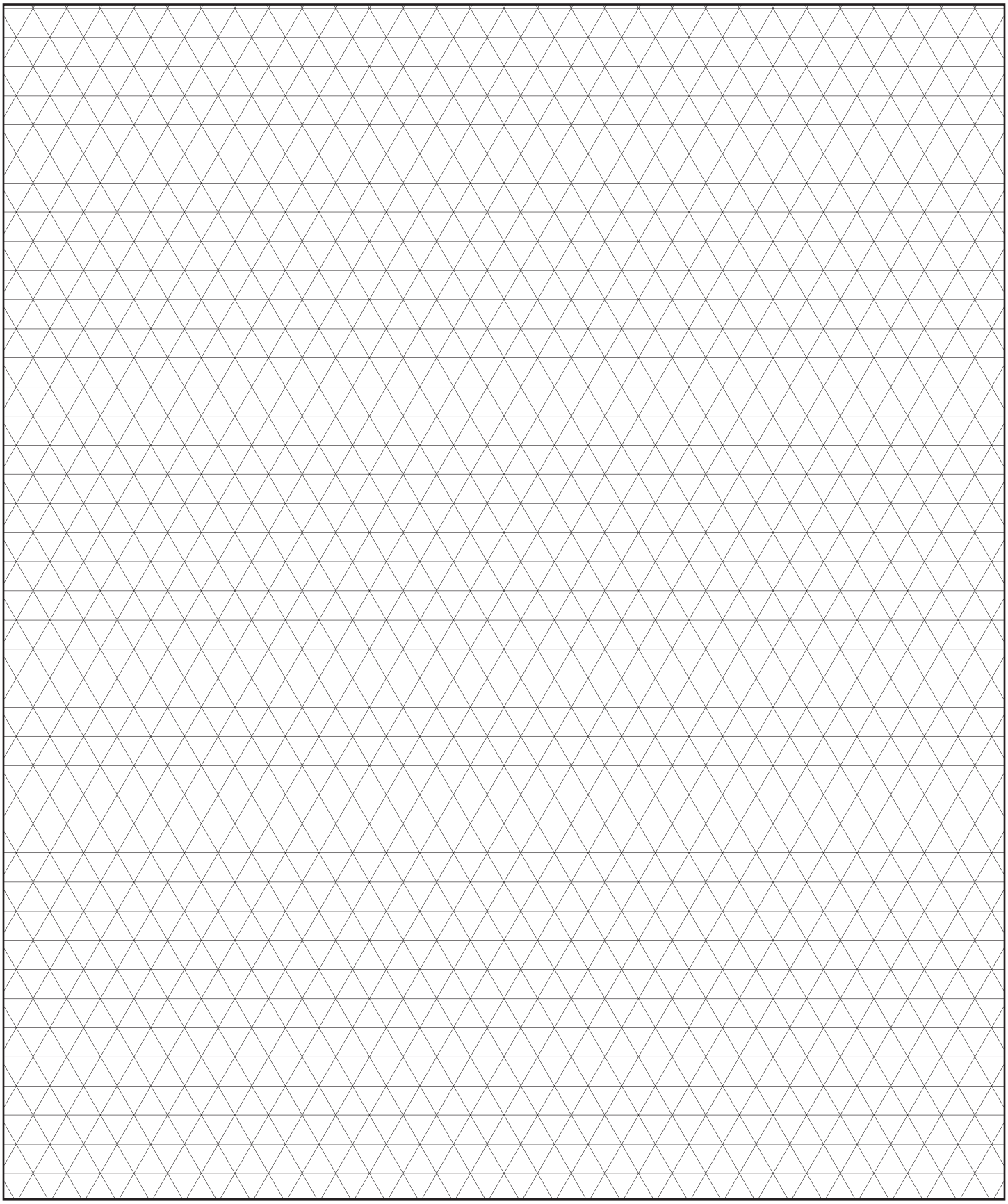

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