THE GREAT DIVIDE: A FRACTION CHALLENGE

PREPARED FOR OZOBOT BY
MARK DZULA ED.D. & ARDINA GRECO ED.D. (ABD)

Summary

The Ozobot robot is bored of traveling on a simple square track; in this lesson we will divide squares to create new tracks for Ozobot to travel on!

To start, the class will shade gridded squares to explore various fractions. This motivation will exercise students' capacity to visualize spatial relationships and prepare them for the lesson's main activity, dividing a square to make a track for Ozobot.

In the main activity, students are given a square grid as a framework for creating a new, more complex track. Students are prompted to divide the square into equal areas, remembering the traveling limitations of the Ozobot robot. Then, using Ozobot commands, students are challenged to code the tracks to lead Ozobot around particular paths within the larger complex track.

Duration

1 or multiple class meeting.

Ozobot skill level

Intermediate

Age

3rd grade

How & when to use this lesson

This lesson is best used with students who have already been introduced to the following tasks and concepts:

- Ozobot calibration (see page 7)

- Basic Ozobot robot coding: How to traverse drawn lines or "tracks" and how to color code for direction using Ozocodes (see "Tips" sheet)
- Introductory knowledge of fractions

We encourage educators to use this lesson as a resource and to adapt it for successful use in their classrooms. We also recognize that educators have different time constraints. This lesson is not meant for one class meeting. Its presentation could span multiple class meetings.

Common core connections

CCSS.MATH.CONTENT.3.G.A.2
Partition shapes into parts with equal areas. Express the area of each part as a unit fraction of the whole. For example, partition a shape into 4 parts with equal area, and describe the area of each part as 1/4 of the area of the shape.

CCSS.MATH.CONTENT.3.NF.A.3
Explain equivalence of fractions in special cases, and compare fractions by reasoning about their size.

CCSS.MATH.CONTENT.3.NF.A.3.A
Understand two fractions as equivalent (equal) if they are the same size, or the same point on a number line.

CCSS.MATH.CONTENT.3.NF.A.3.B
Recognize and generate simple equivalent fractions, e.g., 1/2 = 2/4, 4/6 = 2/3. Explain why the fractions are equivalent, e.g., by using a visual fraction model.

Objectives

- Students will be able to divide squares into equal parts by shading in areas of a gridded square
- Students will be able to determine equivalent fractions by creating and comparing visual representations
- Students will be able to program Ozobot to travel on paths representing a specifically divided portion of a square

Vocabulary

Area: the size of a surface

Divide: to split into parts or groups

Equivalent: equal in value

Fraction: part of a whole

Polygon: a 2-dimensional shape with 3 or more sides

Quadrilateral: a four-sided polygon

Rectangle: a four-sided, 2-d shape. All interior angles are right angles. Also, opposite sides are parallel and of equal length.

Square: a four-sided, 2-d shape with sides of equal length. Every interior angle is a right angle.

Materials

- Medium format gridded square for digital and/or print format (page 8), 1 printout per student and 1 for presentation purposes
- Gridded squares worksheet (page 9), 3 per student
- Pencils, 1 per student
- Printout of Ozobot calibration page (page 7), 1 per student
- Bold markers [Ozobot markers, Crayola or Sharpie – Black, Red, Green, and Blue], 1 pack per four students
- Ozobot robots, 1 per student

If you are using code stickers (recommended), you will also need:

- Large format gridded square, if you can print on 11x17 paper, use page 10, otherwise use page 11 and 12 and cut and tape together, 3 per student
- Ozocode Sticker Set, 1 per student
- Clear Play Sleeve, 2 per student

If you are using markers instead of code stickers, you will also need:

- Large format gridded square, if you can print on 11x17 paper, use page 13, otherwise use page 14 and 15 and tape together, 3 per student
- Printout of OzoCodes (http://www.ozobot.com/gamezone/color-language/), 1 per student

Motivation

Provide a 6 X 6 gridded square w/ a bold black outline and a pencil to each student (page 8).

Can you shade in half of this entire square?

Students shade in half of the square (18 boxes). Few to no bounds should be put on students' outcomes, even if they choose the simplest solution. Teacher can circulate around the room to observe and/or conference with groups to see how it is going, noting ideas and developments.

Transition

Compare and share your outcomes with a classmate. How many boxes needed to be shaded in to get half?

This motivation can be used as a more extended lesson or as a brief exploration as it is presented here.

Discussion

What shapes resulted when you shaded in half of the square? Let's make a list and draw each one on the board.

Note shapes and compare 1/2 and 18/36 as equivalent fractions. As students share their responses use this opportunity to introduce vocabulary when it relates to what the students are sharing. Students may recognize equivalences, but still need help making connections to understand how seemingly different amounts are equal to each other.

Activity

Consider new and unique ways we might shade in 1/2 of the square, or 18 out of the 36 total boxes. What possibilities haven't we tried?

Present a large 6 X 6 gridded square track to the students using your preferred presentation format (page 8).

Let's look at a gridded square together and think about how we could divide it. How might I divide a square in half? What exciting shapes could I make? Guide me through the process of dividing the square.

As the students suggest shapes to divide the gridded square draw the shapes they suggest into the grid. Use a different color line to differentiate each outcome.

Now it's your turn. How many different ways could you divide a square in half, thirds, and fourths?

Students will experiment dividing a square in halves, thirds, and fourths on three separate worksheets. The worksheets challenge the students to create four different outcomes for each fraction problem. Specifically the students are asked to shade in the areas they are using to divide a square in halves, thirds, and fourths (page 9).

Finally, using your worksheets as reference you are going to design three larger Ozobot tracks. One of your tracks will allow Ozobot to transverse one half of a square and the other tracks will allow Ozobot to transverse one third, and one fourth of a square.

Provide each student three printouts of the large gridded square (see "Materials" section at the beginning of the lesson for more details).

As you create your tracks, consider:

- What complex shapes will you use to divide your square gridded track?
- How will you be sure your shape divides the square into equal portions? What tools will you use?
- How will you code your track to make sure Ozobot makes the correct turns and only travels on the correct fraction of the track? What Ozobot programming codes will you need to use? Consult your Code Sticker Sheet or the OzoCodes printout.

Remember:

- You will have to plan your track well, especially to be able to code correctly. Be sure to use the appropriate code in the appropriate place.
- If you are using stickers, you will have to use two Clear Play Sleeves to insert the large gridded square printout into. You can use some of the white path segment stickers to keep the two sleeves together.
- If you are using markers instead of code stickers, you will have to draw the outline of the square with a black marker yourself. Be sure to leave space to draw the codes in the appropriate places.
- Make sure to calibrate your Ozobot before trying out your tracks. Consult the calibration page (page 7) to make sure Ozobot is ready to go.
- Also, make sure your lines are thick enough. See the "Tips" sheet for help and ideas.

Reflection

Test your track with an Ozobot. What happened? How does the Ozobot move differently on different tracks? What does the way the Ozobot move tell you about the properties of the track's divisions and the shapes used to divide them?

Extension

- Students may be challenged to enlarge their tracks using rulers.
- Educators can also challenge students to investigate timing:
  How long does it take for Ozobot to transverse the perimeter of a square?
  How long does it take for Ozobot to transverse the perimeter of a fraction of a square?
- Students may be challenged to represent their fractions three dimensionally using cubes or blocks

Ideas for adaptation

To adapt this lesson for students with special needs educators could:

- Provide pre-printed maps with the square already divided into distinct polygons
- Provide squares with peel-away sections. When segments are peeled away, a fraction is revealed. Educators help students identify which fraction was uncovered.

Resources

Books

A Fraction's Goal - Parts of a Whole (Math Is Categorical), Aug 1, 2013, by Brian P. Cleary and Brian Gable

Fraction Action Paperback, March 1, 1996, by Loreen Leedy (Author)

Funny & Fabulous Fraction Stories: 30 Reproducible Math Tales and Problems to Reinforce Important Fraction Skills...,1999, by Dan Greenberg and Jared Lee

Visual Fractions: A Beginning Fractions Book, May 28, 2011, by Dr. Pi Squared

Whole-y Cow!: Fractions Are Fun, Aug 24, 2010, by Taryn Souders and Tatjana Mai-Wyss

Websites

http://www.mathplayground.com/thinkingblocks.html

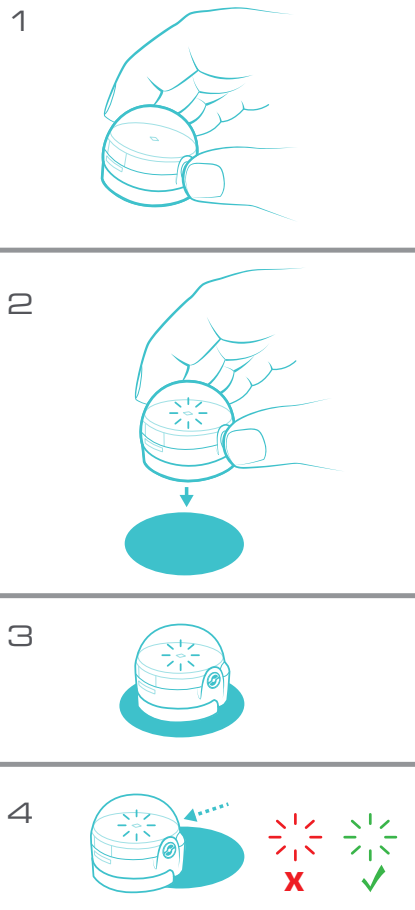
http://crewtonramoneshouseofmath.blogspot.com/2014/07/base-ten-blocks-for-fractions-success.html

https://www.illustrativemathematics.org/content-standards/tasks/1502

https://www.khanacademy.org/math/cc-third-grade-math/cc-3rd-fractions-topic/cc-3rd-fractions-intro/v/fraction-basics

Paper Calibration

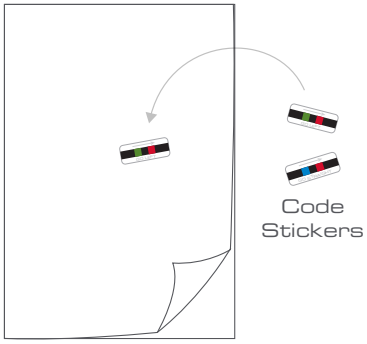
Before you begin, you need to calibrate your Ozobot! You should calibrate often, especially if Ozobot starts acting odd. When in doubt, calibrate!



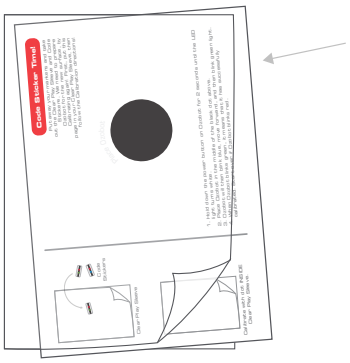
1. Hold down the power button on Ozobot for 2 seconds until the LED light turns white.
2. Place Ozobot in the middle of the black dot above.
3. Ozobot will then blink blue, move forward, and then blink green.
4. When Ozobot blinks green, it means that it has successfully calibrated. Start over if Ozobot blinks red.

Code Sticker Calibration

Place this sheet inside the Clear Play Sleeve and Re-Calibrate before playing with the Code Stickers. We always need to prepare Ozobot when we change play surfaces. First, put this page in your Clear Play Sleeve, then follow the Calibration directions!

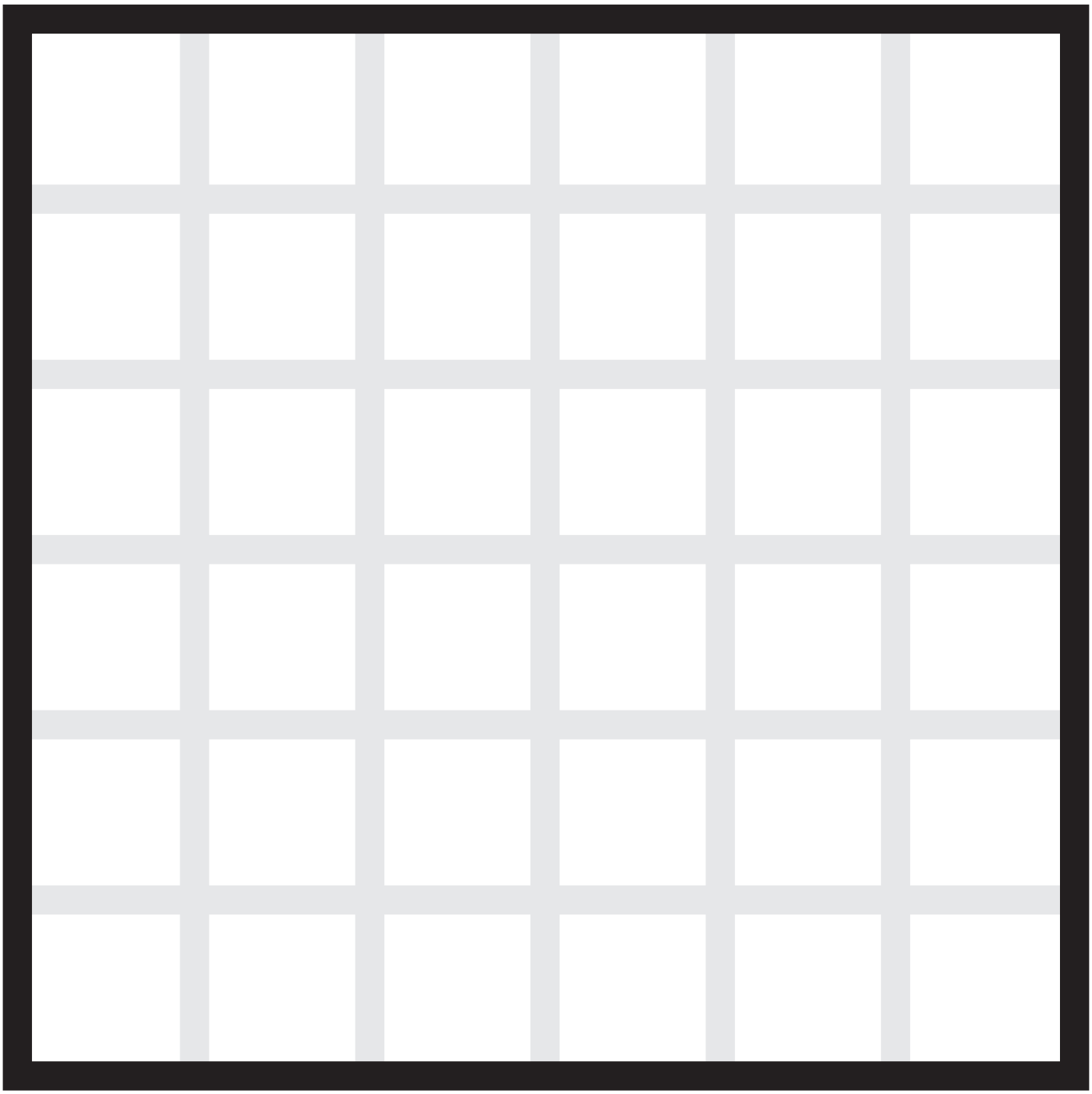


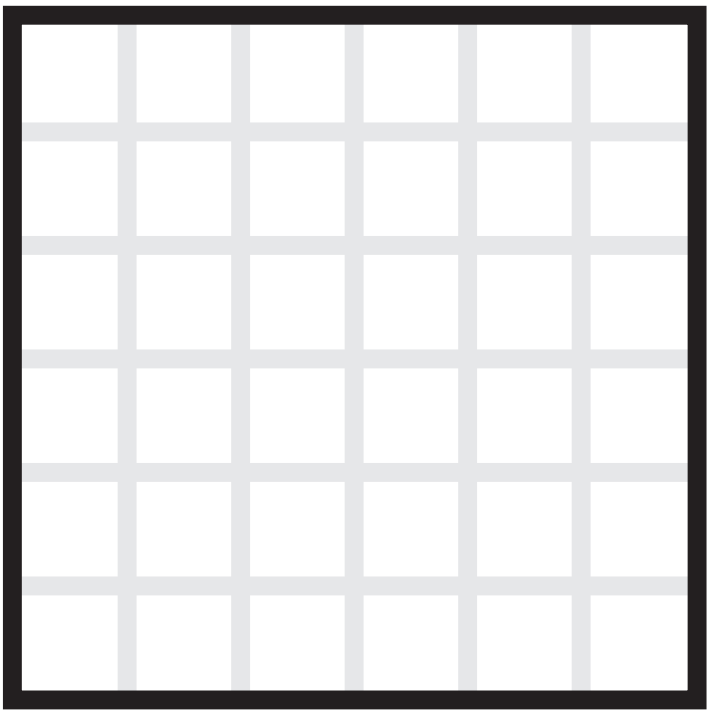
Clear Play Sleeve

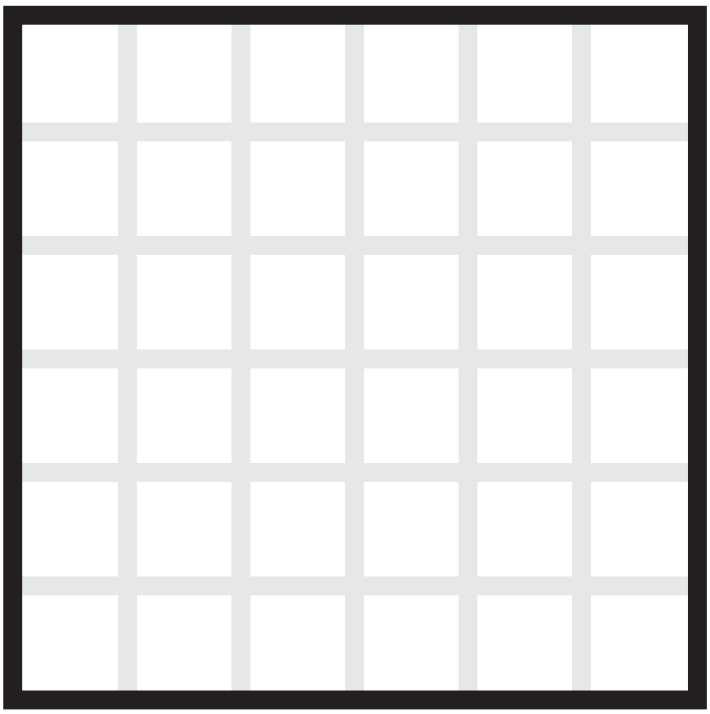


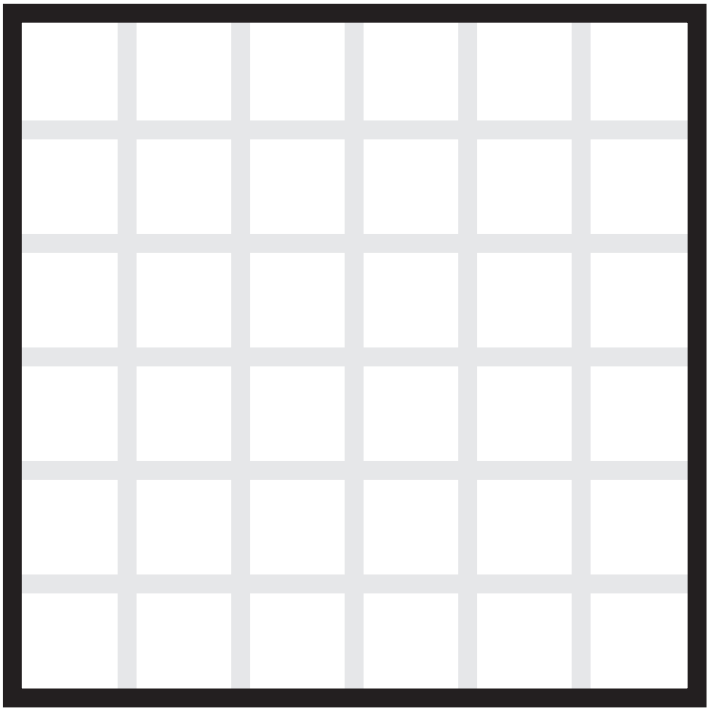
Calibrate with page INSIDE Clear Play Sleeve.

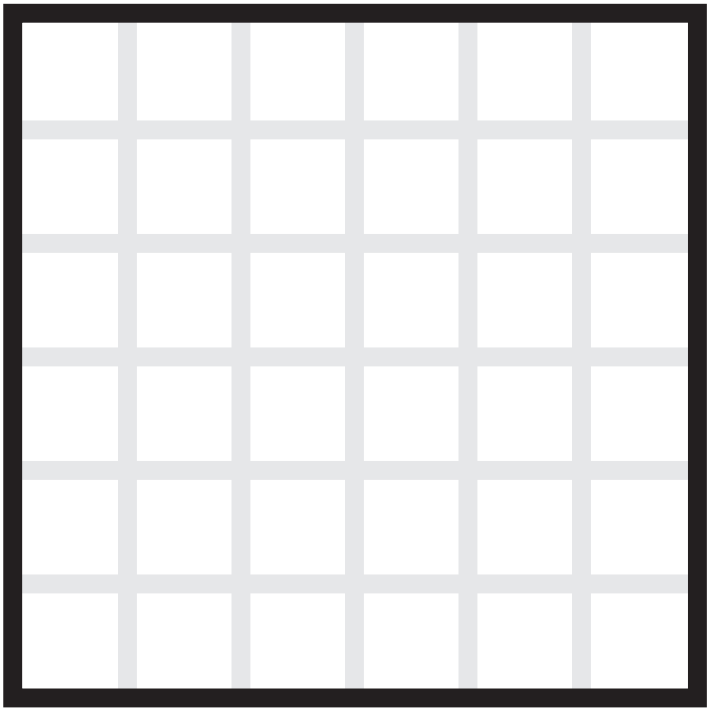
1. Place this calibration sheet inside the Clear Play Sleeve.
2. Hold down the power button on Ozobot for 2 seconds until the LED light turns white.
3. Place Ozobot in the middle of the black dot above. Ozobot will calibrate through the clear play sleeve.
4. Ozobot will then blink blue, move forward, and then blink green.
5. When Ozobot blinks green, it means that it has successfully calibrated. Start over if Ozobot blinks red.

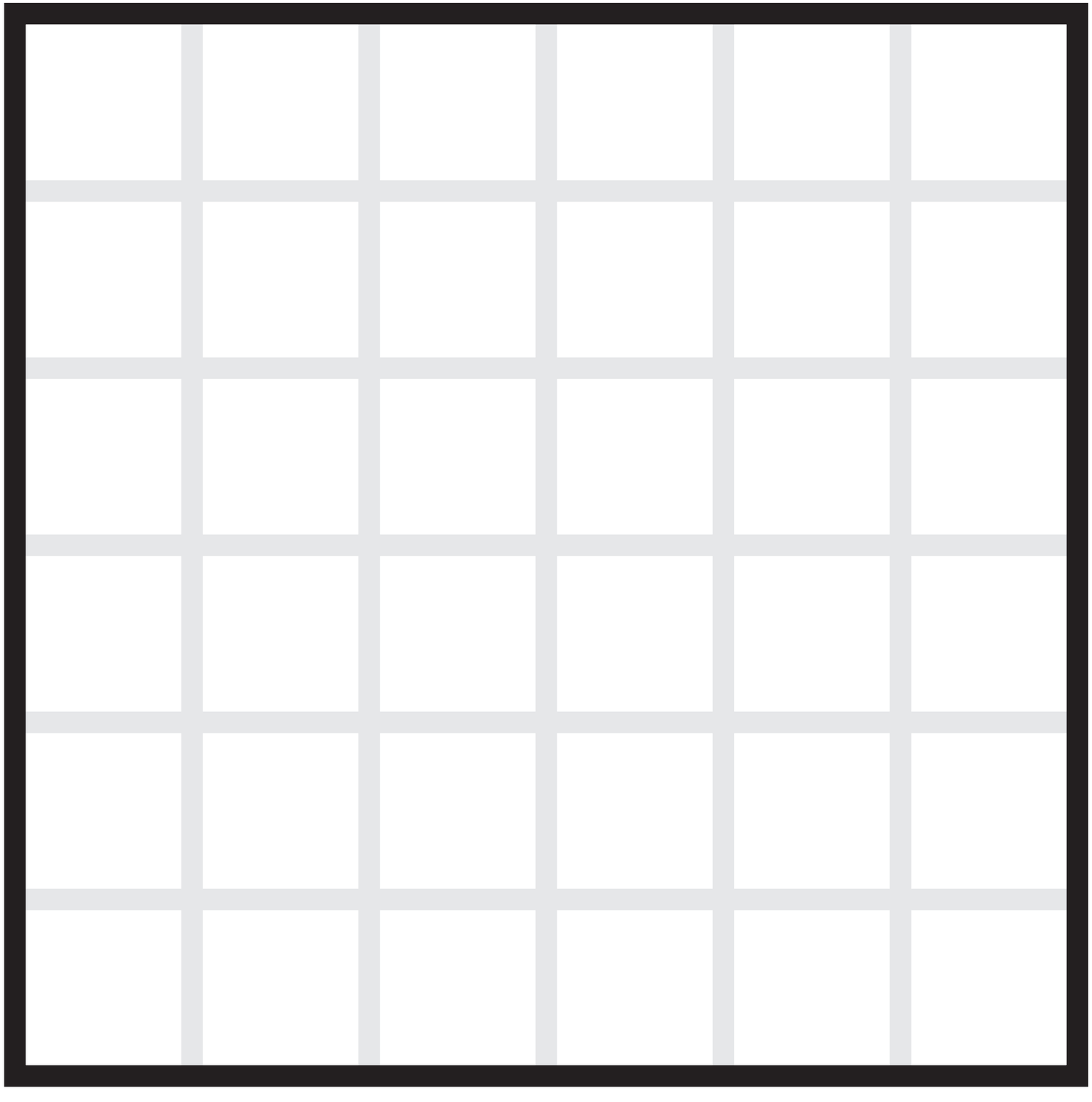




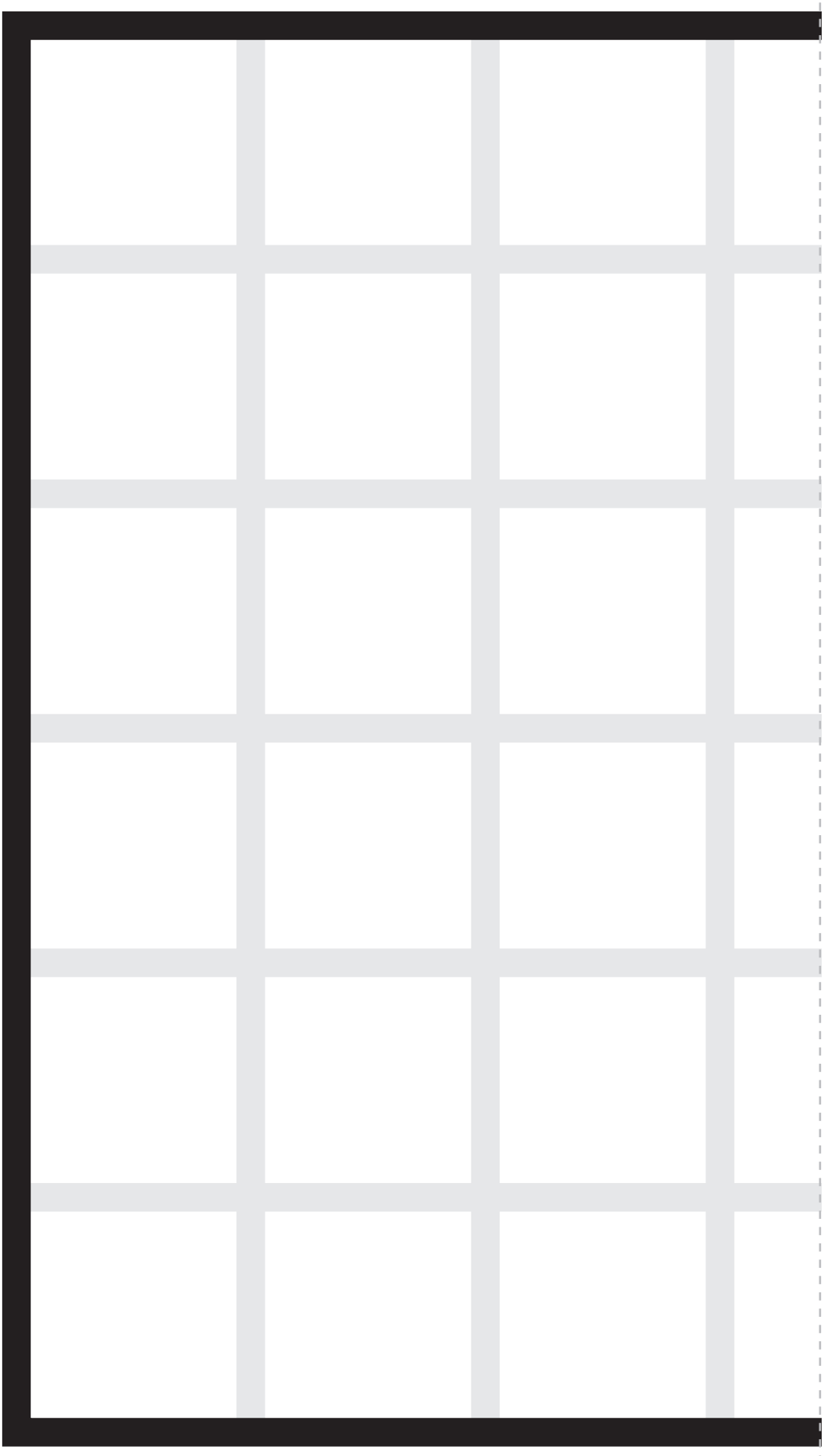




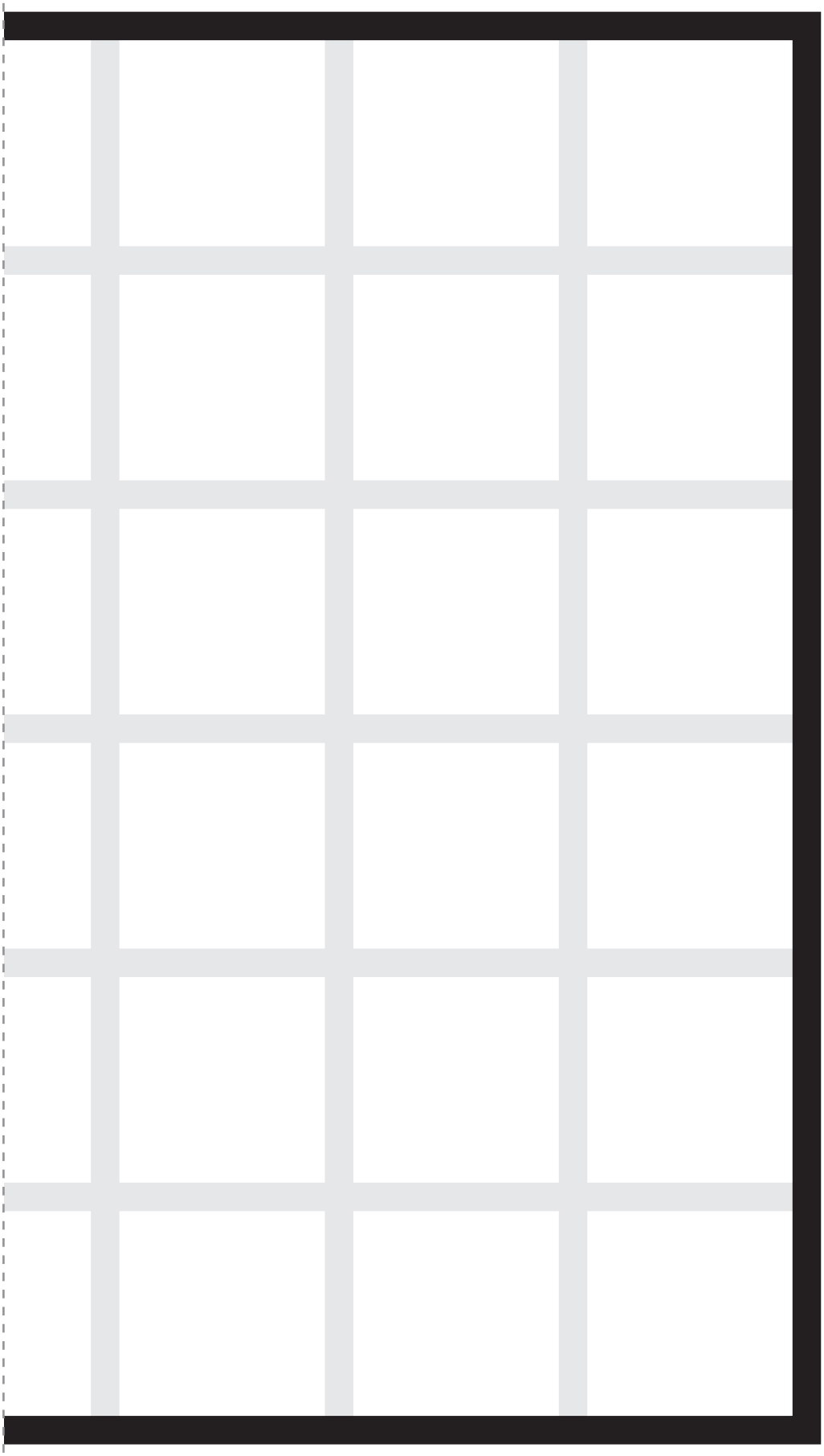


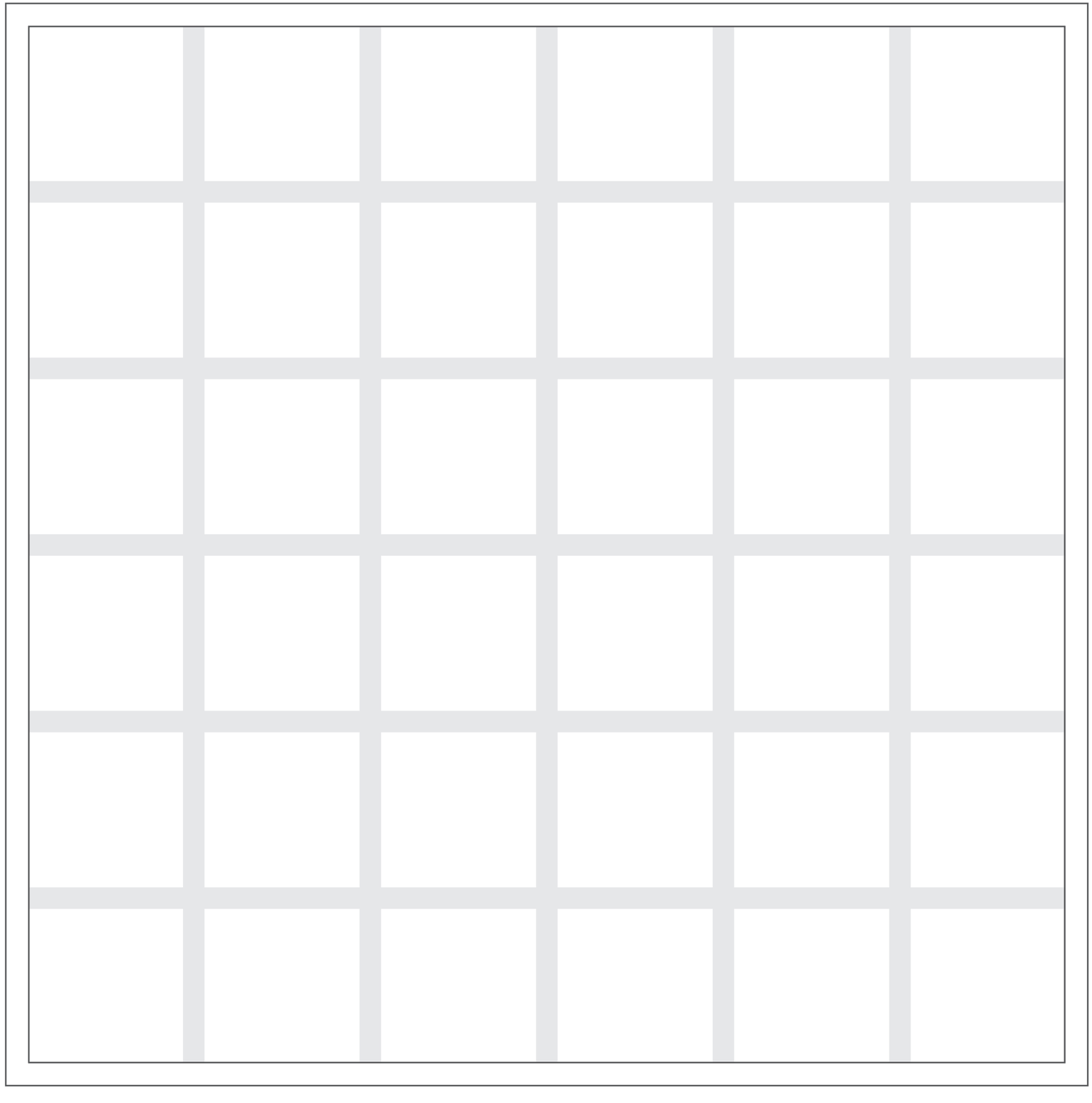


If you are using code stickers and can print on 11x 17 paper, use this page.

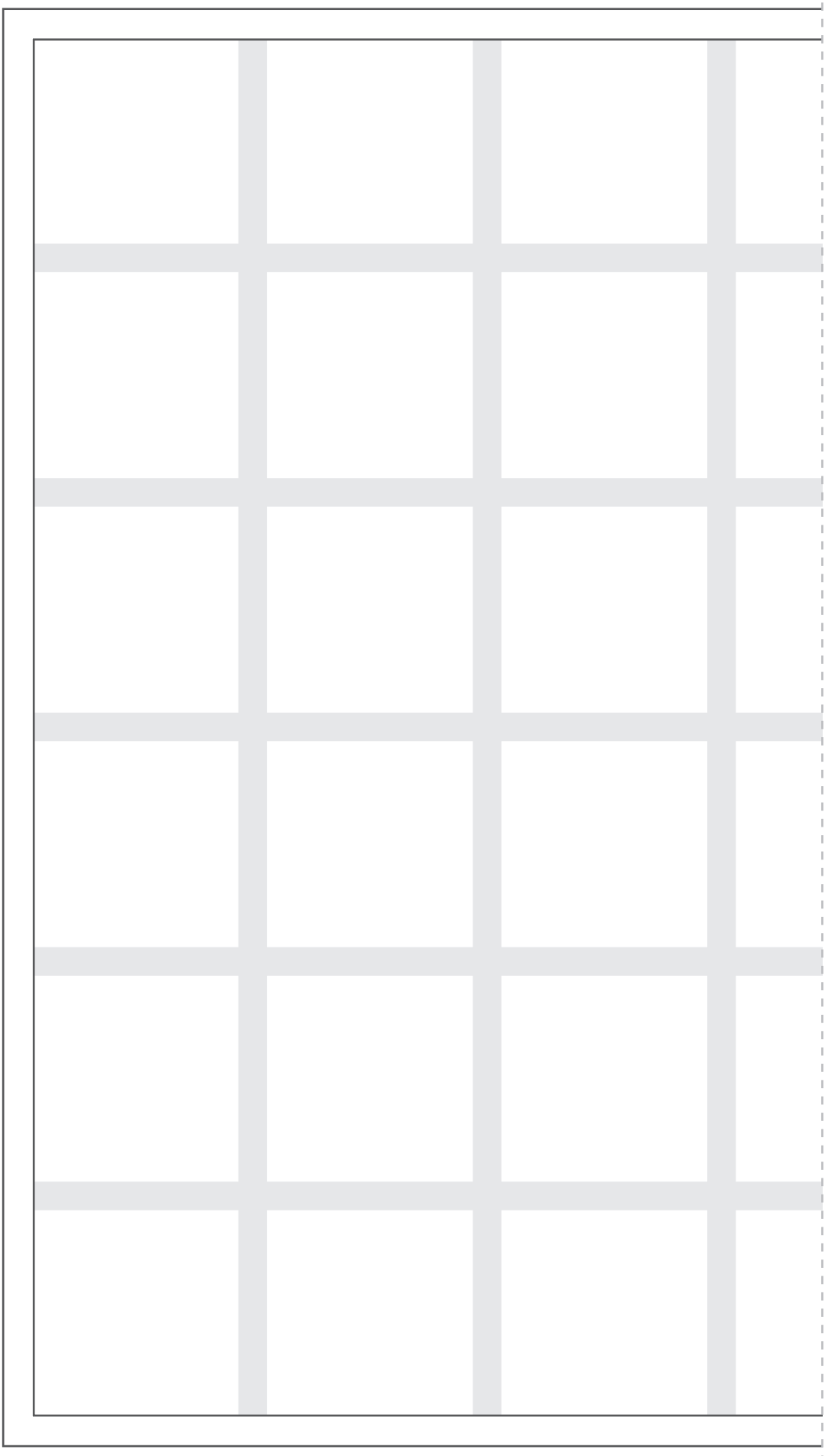


If you are using stickers, but can't print on large-size paper, use this page and page 12, then cut and tape together to make a square.





If you are using markers and can print on 11x 17 paper, use this page.



if you are using markers, but can't print on large-size paper, use this page and page 15, then cut and tape together to make a square.