**Julia Robinson
Mathematics
Festival**

Objective

Use the clues to correctly place all the skyscrapers in the grid.

Rules:
1. Each row and column in the grid can only have one skyscraper of each height.
2. The number in the arrow is a clue that tells you how many skyscrapers you see when you imagine looking down that row or column.
3. Taller skyscrapers block the shorter ones.

Introduction

Have ready to go 12 towers and the blank 3 x 3 grid and tell the students they're going to be building cities. But of course these cities have rules!

Explain
1. Demonstrate the rules by placing some of the skyscrapers on the grid.
2. Point out that as the grids get larger, they'll need more skyscrapers and taller skyscrapers.

Engage
1. Ask for suggestions for placing a few of the skyscrapers on the blank grid. Encourage the students to explain their thinking out loud.
2. Send the students in partners to complete the blank grid.

Common misconceptions
Students might think that:
- The number beside the row or column indicates the tower that they should be able to see first.

Exploration

As pairs of students complete the blank grid successfully, use it to ask them to imagine that they are very tiny and can only look down a particular row/column. Ask them how many skyscrapers they could see in this/that row. Have a volunteer physically put their finger on the skyscrapers they would be able to see. Tell them that the next puzzles have the same rules but the numbers outside the grids tells them how many skyscrapers they can see there.

Circulate and ask questions to encourage deeper thinking:

a. Which puzzles did you find the hardest so far? The easiest? Why?
b. Have you found a strategy that works for all or many of the puzzles?
c. What is the tallest/shortest possible skyscraper for this cell?
d. Where can the tallest skyscraper be placed in this row/column?
e. What possibilities are there for the first cell in this row/column?
f. What if two of the cells in a particular row can only use the same two numbers?
g. Can multiple clues interact? If so, how?
h. When a child is stuck:
    i. Encourage them to clear their grid and restart.
    ii. Encourage them to color code their towers (all height 3 are blue, height 2 are black...)
    iii. Encourage them to use one color for all skyscrapers of whose position they are certain.
i. "Tell me more." is a great basic prompt for getting a child to explain their thinking.

Extend
Encourage the students to create their own Skyscraper puzzles.

Discussion

As a group, have students share something about their experience with Skyscrapers. Try to have at least 3 students share out. Variations of the questions asked earlier are great for generating discussion, such as:
a. How do you start a puzzle? What do you do first?
b. What strategies did you come up with? Did they always work?
c. What did you do when you had to choose between different options? How did you decide?
d. Did you keep track of places you could or couldn't place a skyscraper?

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Materials

Unifix or multi-link cubes
Skyscrapers task sheets pp. 5-12

Optional: Skyscrapers extensions blank grids pp. 13-14

To explore the activity yourself, you can try our digital version here:
jrmf.org/activities/skyscrapers

Assessment

Evidence of student learning during problem-solving activities can be obtained from three sources: observations, conversations, and products.

Observation involves actually observing students while they perform tasks and demonstrate skills and may take the form of a checklist or quick note.

Conversation involves engaging students in discussion that encourages them to articulate what they are thinking and then capturing that with a quick note.

Products are student-created records that capture not only their answer, but some of the process that led them to the answer.

Standards

1. Make sense of problems and persevere in solving them.
   CCSS.MP1
2. Construct viable arguments and critique the reasoning of others.
   CCSS.MP3
3. Model with mathematics.
   CCSS.MP4
4. Attend to precision.
   CCSS.MP6

The number in a square tells you the height of the skyscraper in that square. Skyscraper #1 has multiple possible solutions, but all of the other puzzles have unique solutions.

Puzzle Solutions:

The number in a square tells you the height of the skyscraper in that square.

Skyscraper #1 has multiple possible solutions, but all of the other puzzles have unique solutions.

Skyscrapers #1

3	2	1
1	3	2
2	1	3

Skyscrapers #2

3	1	2
1	2	3
2	3	1

Skyscrapers #3

1	2	3
2	3	1
3	1	2

Skyscrapers #4

1	2	3
3	1	2
2	3	1

Skyscrapers #5

1	2	4	3
2	1	3	4
3	4	1	2
4	3	2	1

Skyscrapers #6

3	4	1	2
1	2	3	4
2	3	4	1
4	1	2	3

Skyscrapers #7

1	4	3	2
3	2	1	4
2	1	4	3
4	3	2	1

Skyscrapers #8

2	4	1	3
1	3	2	4
4	1	3	2
3	2	4	1

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Skyscrapers #1

Rule 1

You'll be using these nine skyscrapers:
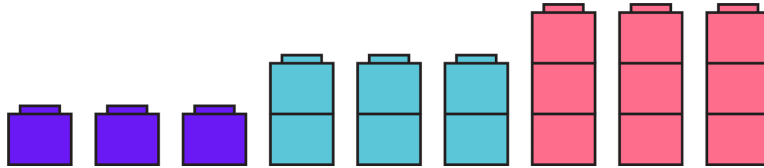
Rule 2

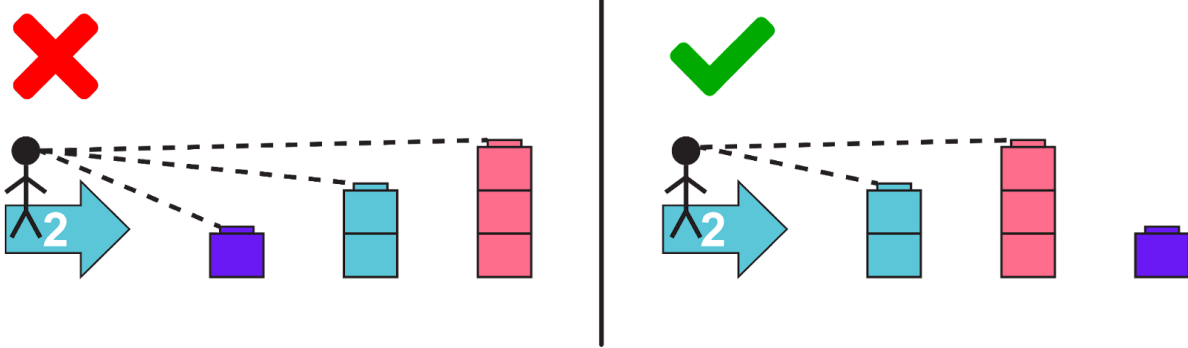Skyscrapers in each row and column must all be different heights.
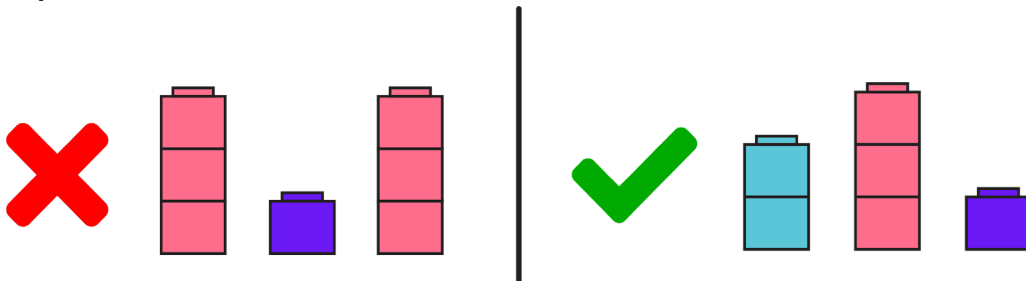
Can you place all 9 skyscrapers so that every row and column follows Rule 2?
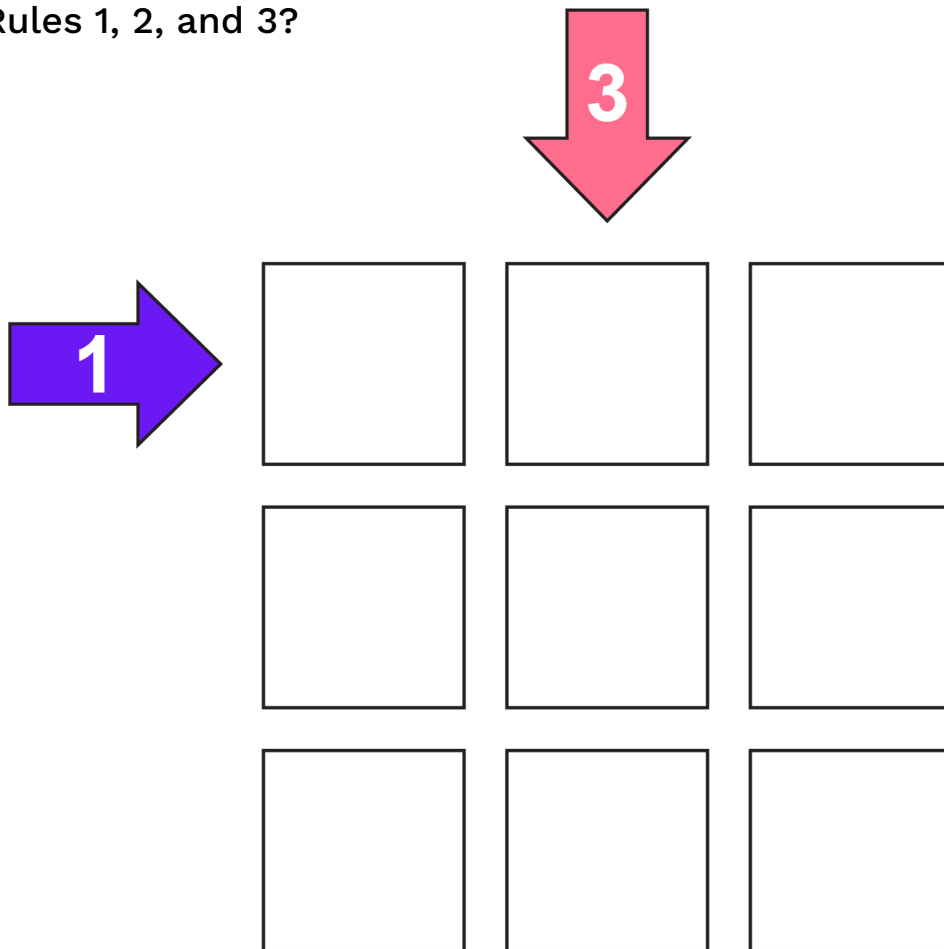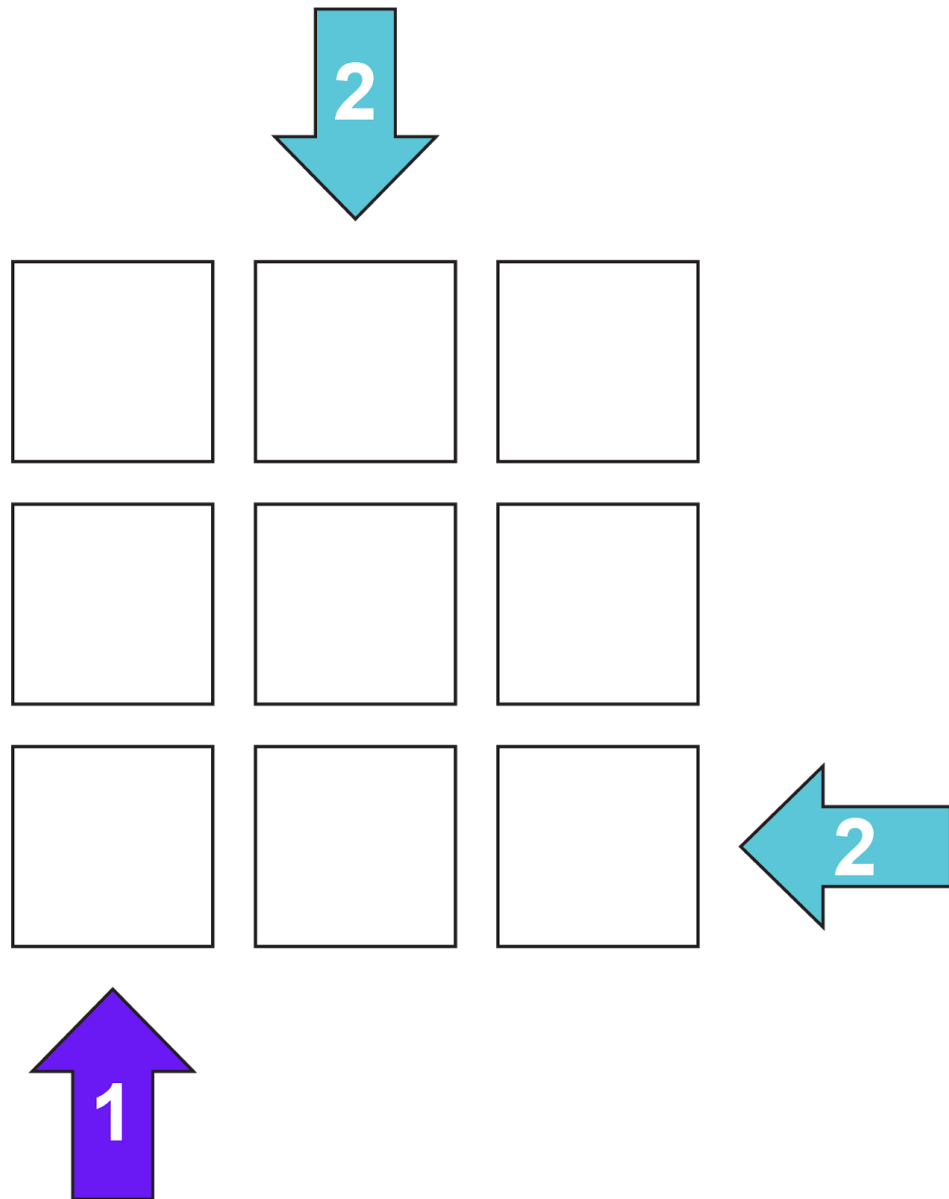
Skyscrapers #2

Rule 3

The number in an arrow tells you how many skyscrapers you should see if you were standing on that arrow.
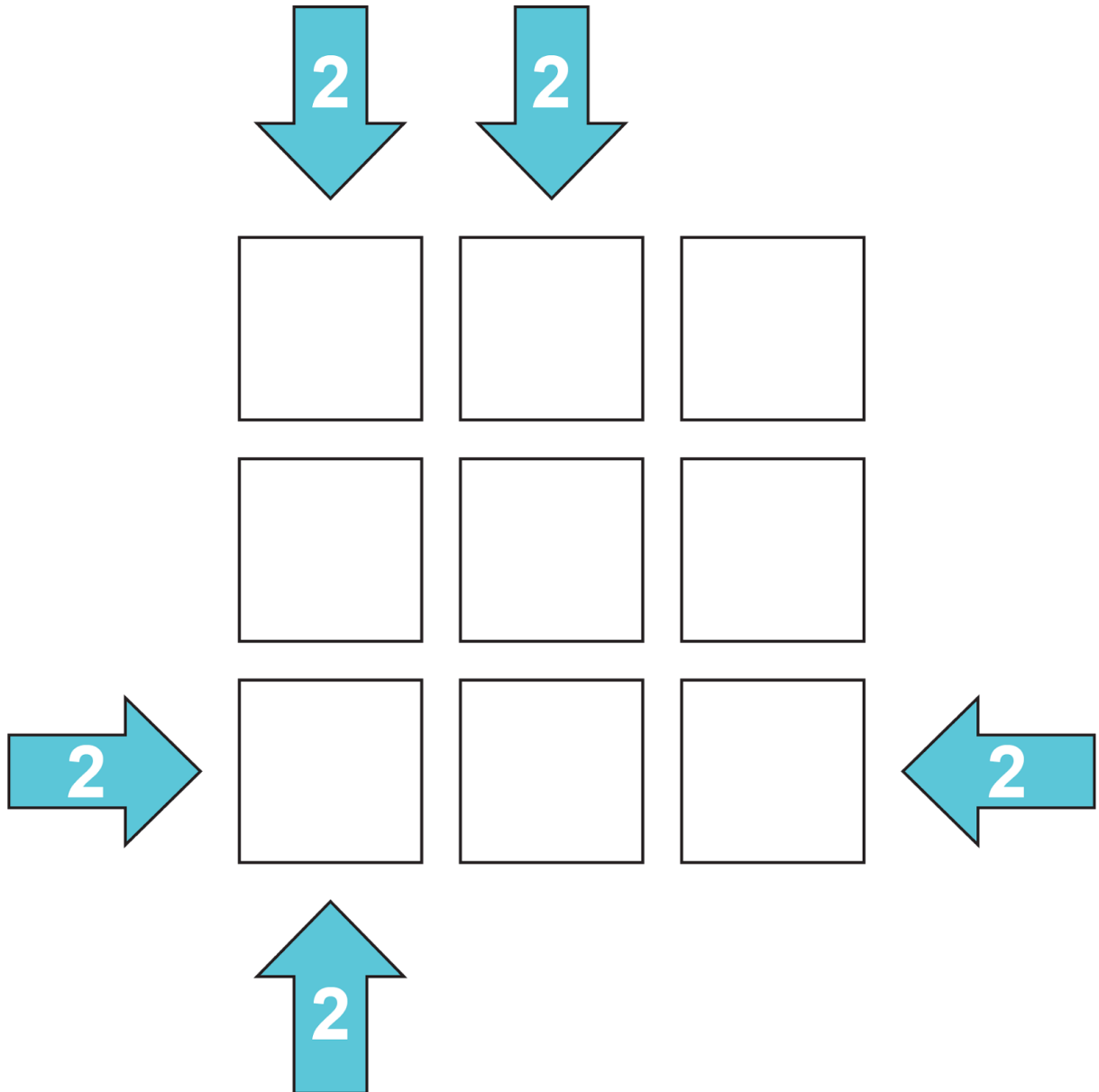

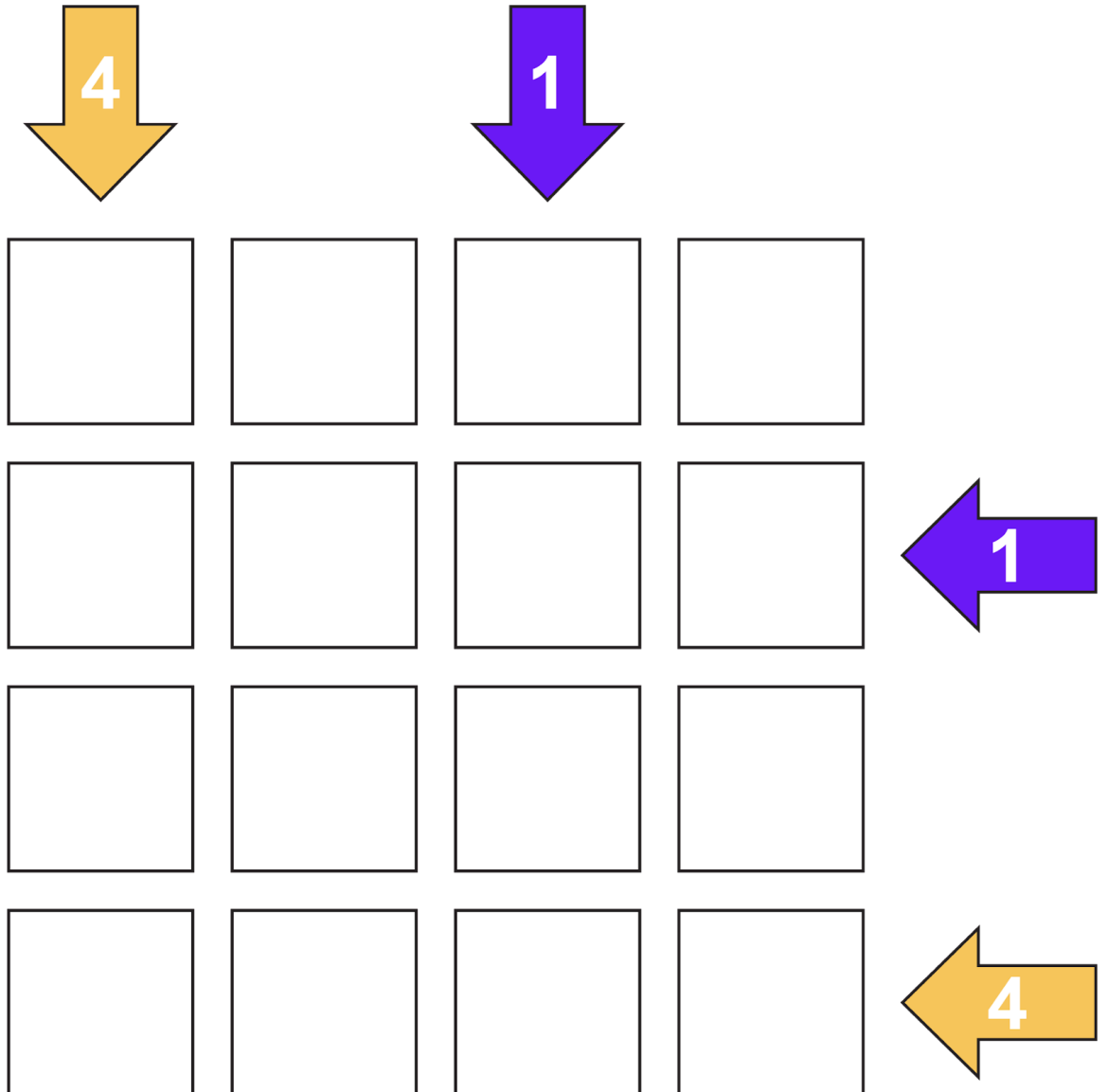Can you place the skyscrapers in the grid below so that they follow Rules 1, 2, and 3?
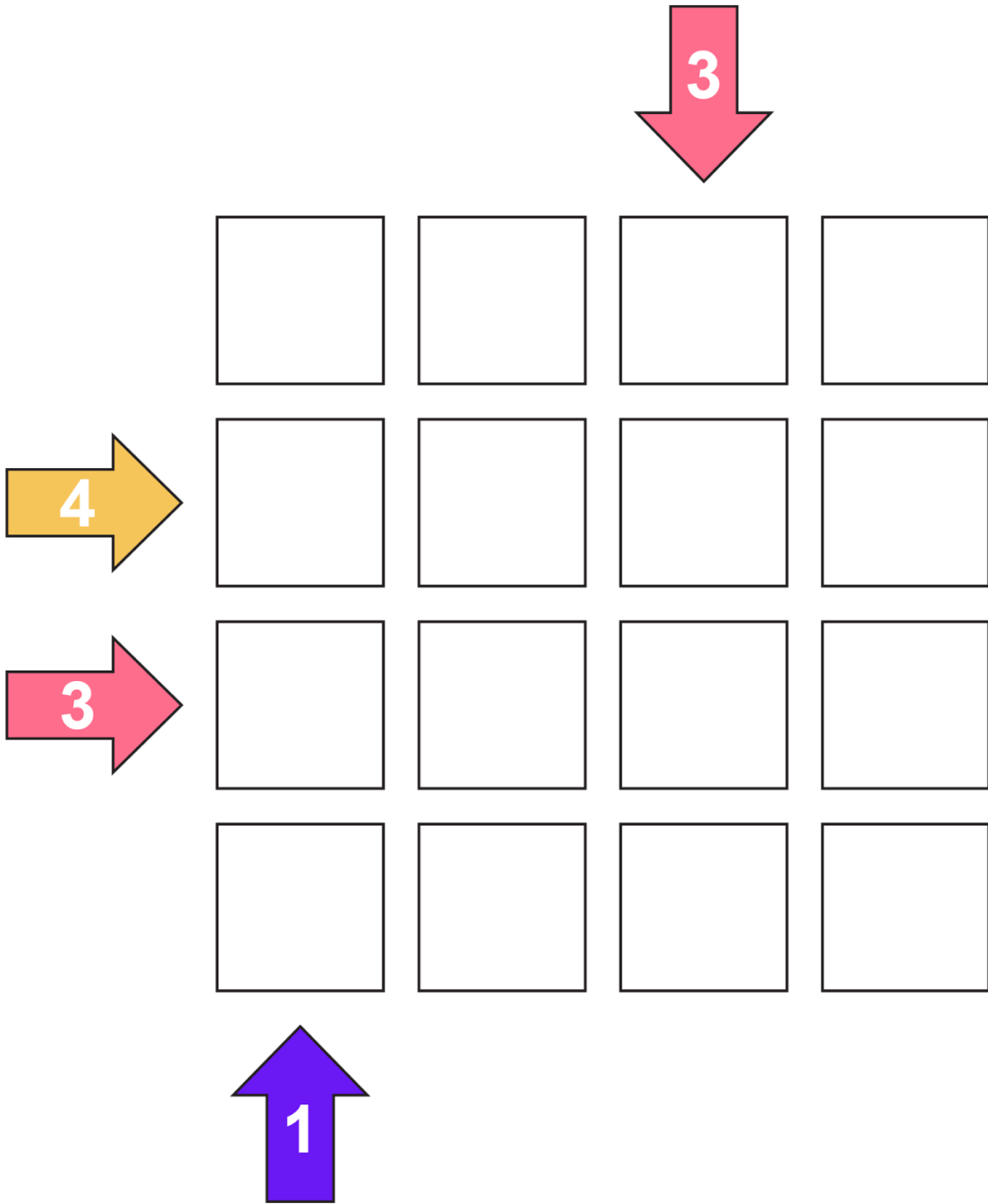
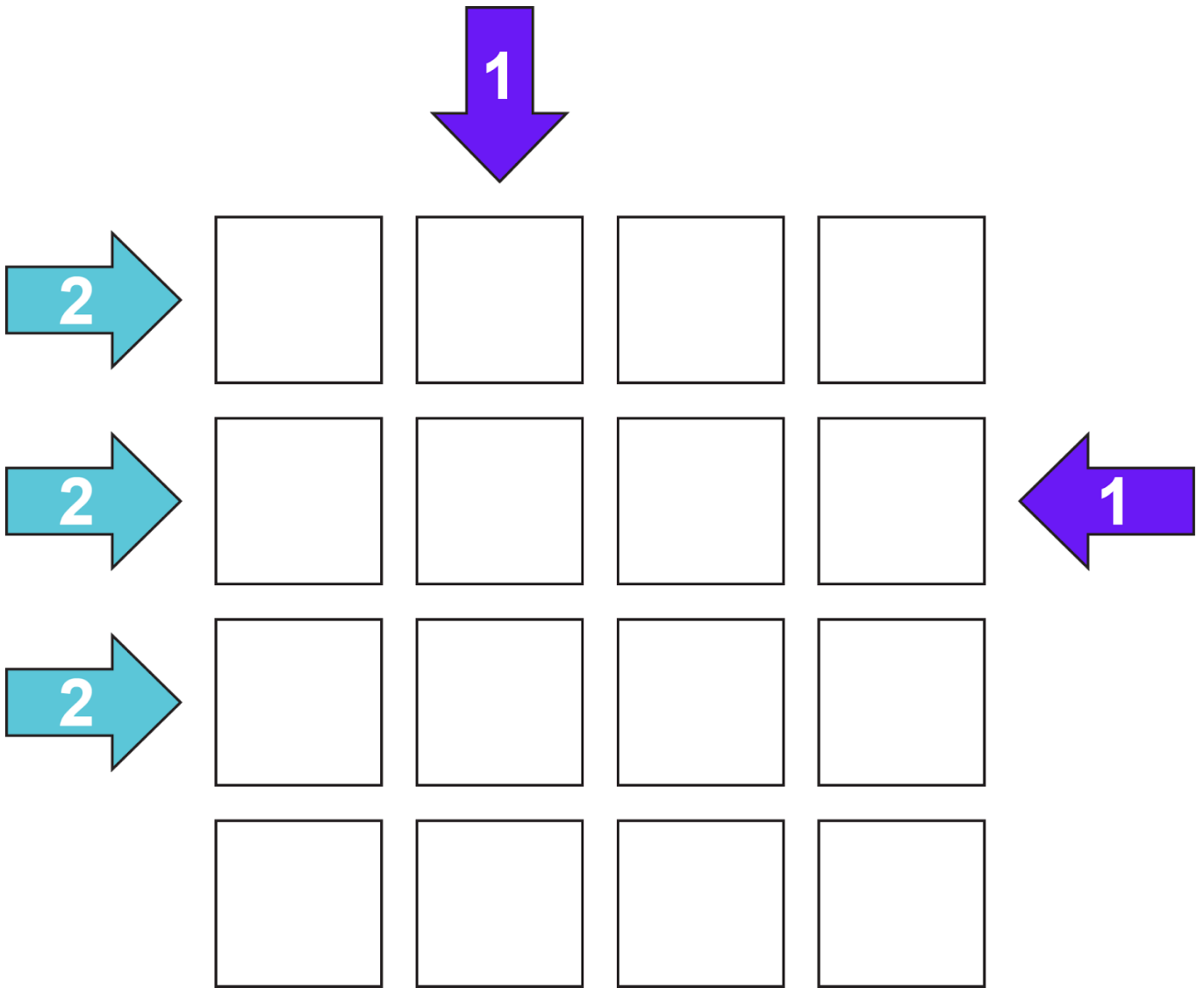# Skyscrapers #3

Skyscrapers #4

Skyscrapers #5

Before you solve these next 4 puzzles, you will need some more skyscrapers! How many more do you need?
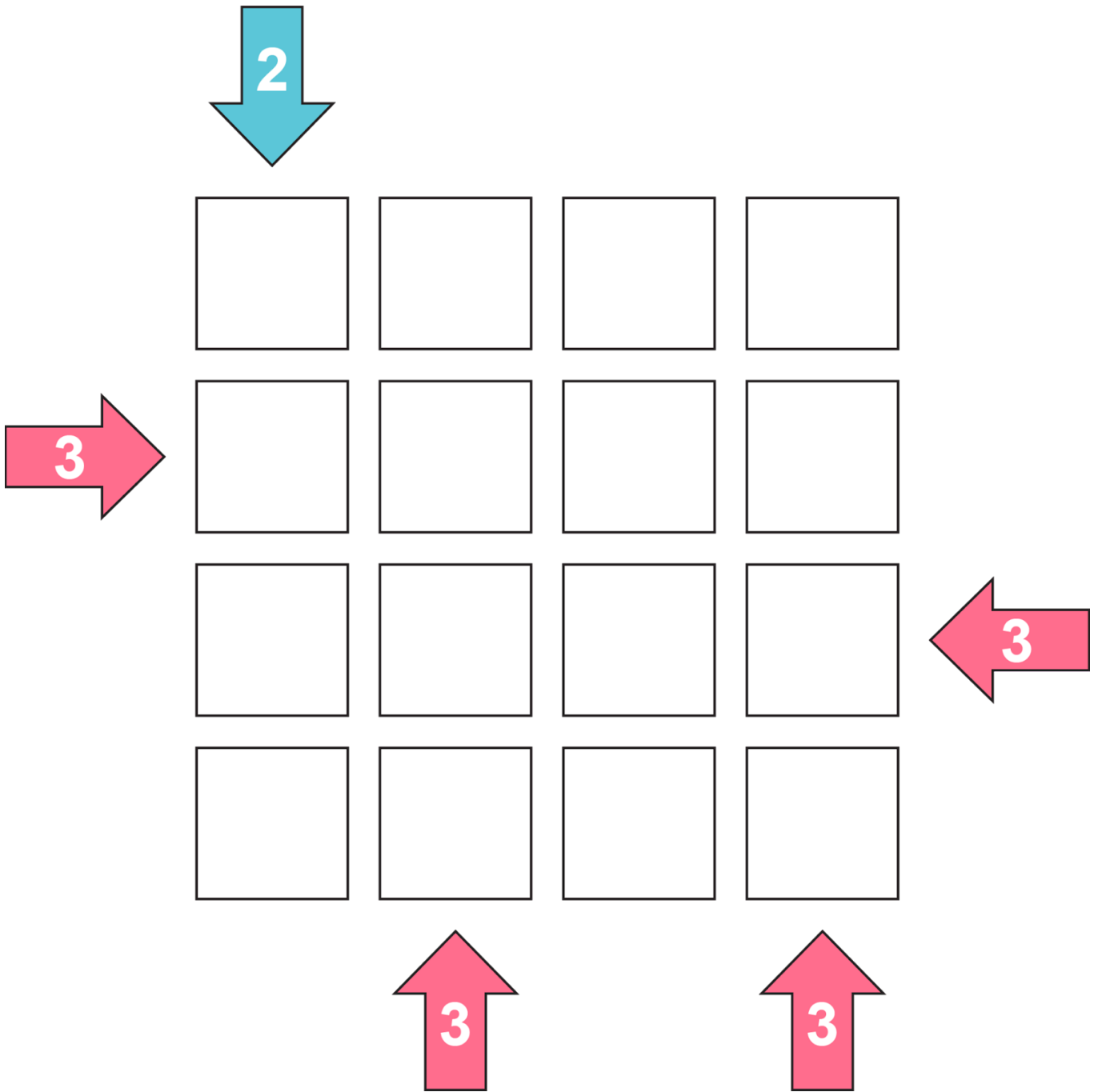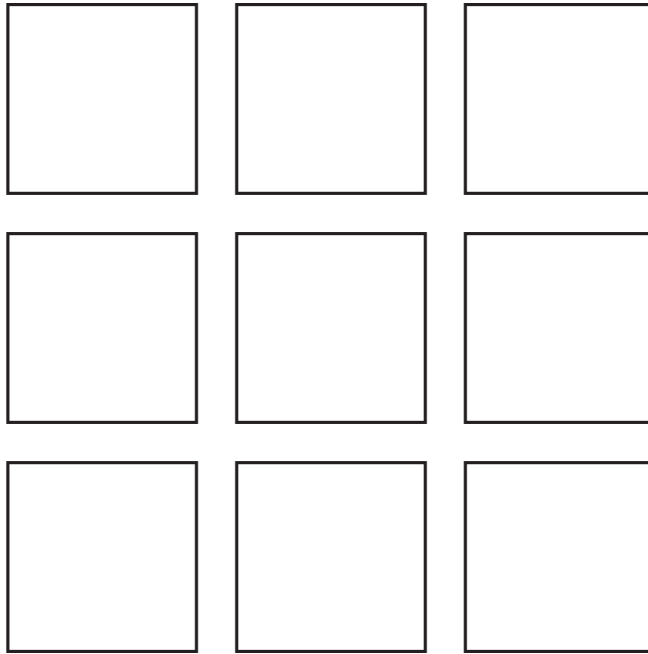
Skyscrapers #6

Skyscrapers #7

Skyscrapers #8

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Make Your Own 3x3 Skyscrapers Puzzle

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Make Your Own 4x4 Skyscrapers Puzzle