Julia Robinson Mathematics Festival®

Puzzling with Squares
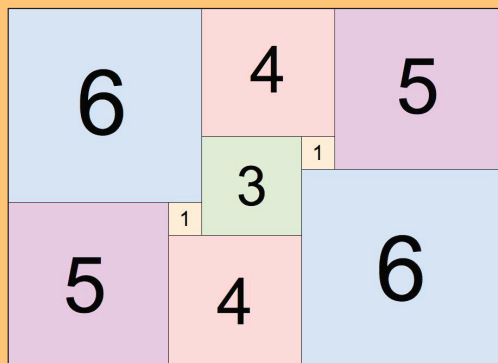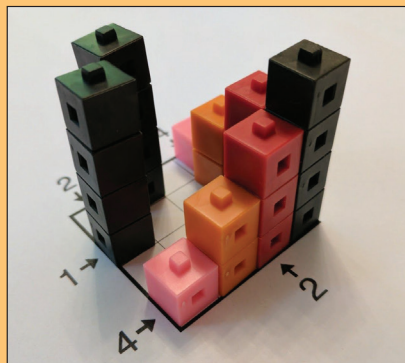
Julia Robinson
(1919 - 1985)

Squaring Puzzles
by Gord Hamilton, MathPickle.com

Skyscrapers
by Conceptis and Peter Liljedahl

"The JRMF really gets it right. Usually the best parts of mathematics are kept away from the public, as if you needed to be a mathematician to get to the fun stuff! It's refreshing to see a festival that brings this stuff to light, and in such a relaxed atmosphere. If you're lucky enough to have a JRMF near you, don't miss it! It's the best math party around."

– Vi Hart, Mathemusician, youtube.com/user/ViHart

"I'm not that good in math class, but this got me excited. I tried something really difficult. I saw an adult stuck at the same problem. "

– Lindsey, Grade 6

"I liked working together with my friends. The teacher at the table didn't help us much. We did this ourselves."

– Connor, Grade 3

Festival activities are designed to open doors to higher mathematics for students in grades K–12. Visit **www.JRMF.org** for more information about Julia Robinson Mathematics Festivals.

Squaring Puzzles
by Gord Hamilton, Math Pickle

"These abstract squaring puzzles offer you an opportunity to practice addition and subtraction with numbers. They also link these numerical activities to geometry. What a beautiful way to practice subtraction!"

—Gord Hamilton, MathPickle.com

The number inside a square represents the length of each side of that square. Using this information, find the lengths of the sides of each square and record the number inside the square.

Note: Assume that all interior rectangles are squares in this booklet. However, the outermost rectangle may not be a square.
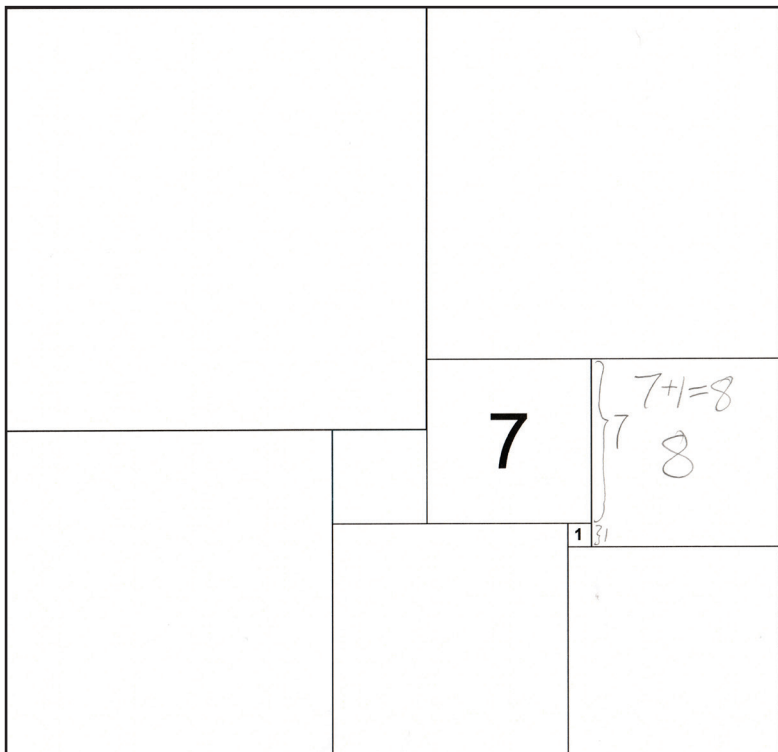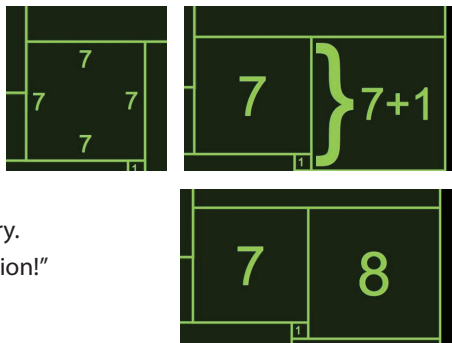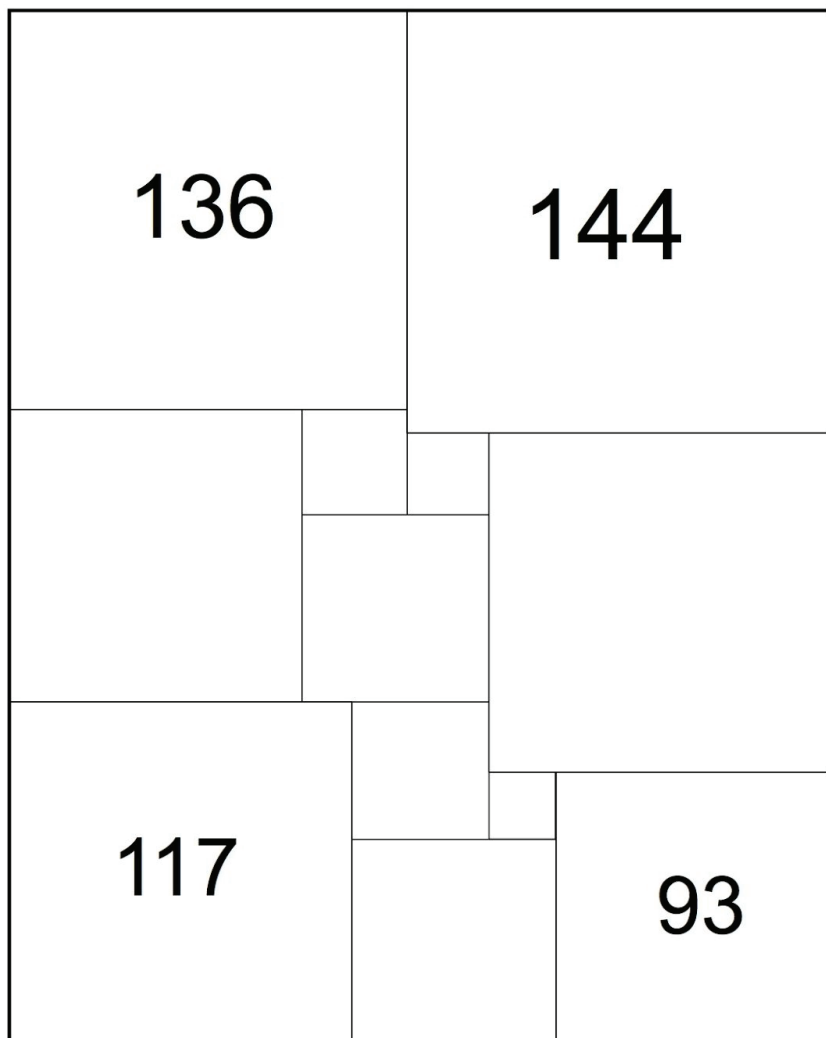
Using the known lengths of the sides of some squares, use addition and subtraction to determine the lengths of the sides of the other squares.

Hint: Start by determining the size of the square near the center of the rectangle.

17

11

Working with triple-digit side lengths now, find the length of each square and the lengths of the sides of the rectangle in which they are enclosed.
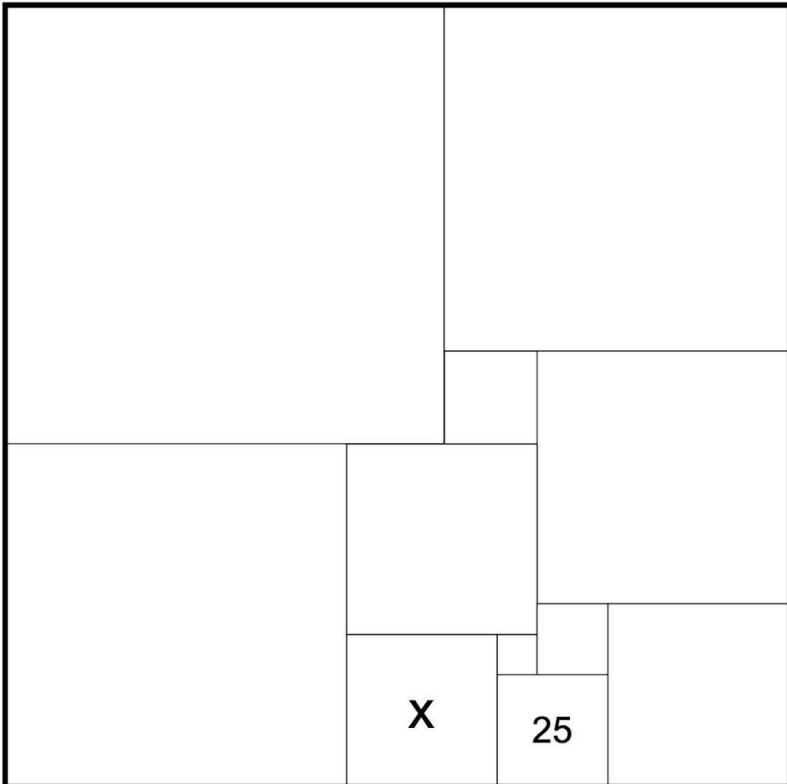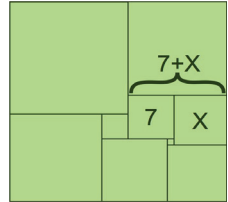
Algebra on Rectangles – by Gord Hamilton, Math Pickle

This is another rectangular tiling, but this time you are given fewer clues. Use the 25 by 25 square to figure out the dimensions of all the other squares – and the value of x.

As in the previous puzzle, the number or variable (letter) in each square represents the length of the sides of that square.

7+X

7   X

X   25

What is the largest ratio possible (biggest square : smallest square) in a rectangle tiled with all different sized squares?

Find more algebra on square puzzles on the MathPickle website at:
**mathpickle.com/project/algebra-on-rectangles**

Skyscrapers – Skyscraper Puzzles provided by Peter Liljedahl

Please help the city planner figure out where to build skyscrapers according to the following rules:

- Place a skyscraper in each square.
- Each row and each column must have skyscrapers of different heights, i.e., no two skyscrapers in a row or column have the same number of floors.
- The number outside the grid (the clues) specifies how many skyscrapers you can see if you stand on that number.
- Taller skyscrapers block the view of shorter skyscrapers located behind them.
- The number inside the grid indicates the number of stories in a skyscraper.
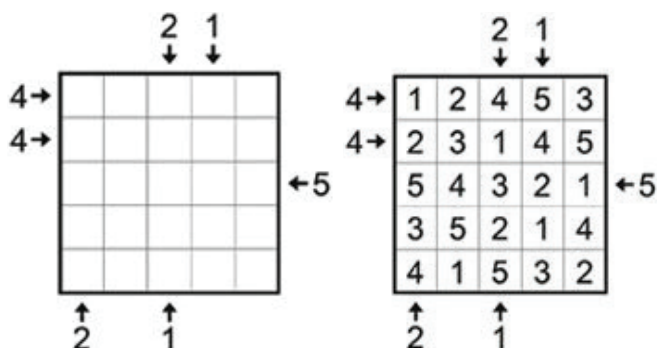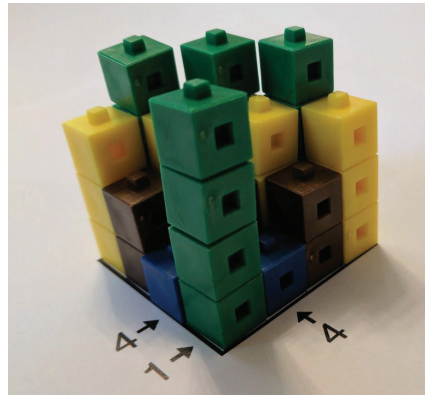

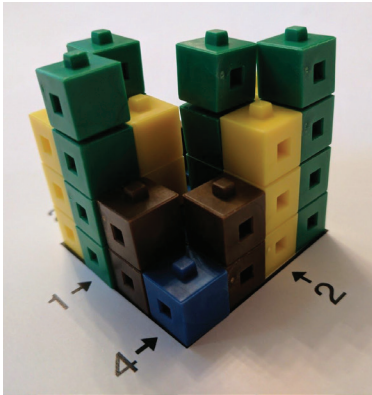Below is a 3D diagram of what a puzzle would look like when viewed from an airplane. The blocks are city skyscrapers and the clues indicate how many of them are visible when viewed from that direction. With this diagram, it is clear how lower skyscrapers are hidden by the higher ones.
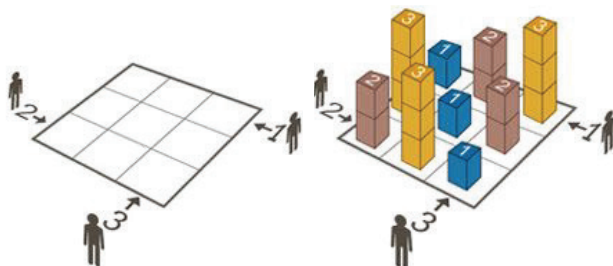
Reprinted with permission from Conceptis Ltd.
conceptispuzzles.com/index.aspx?uri=puzzle/skyscrapers/rules

Solve the puzzles by building skyscrapers or by writing the height of each building in the grid.

Skyscrapers #1

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

Skyscrapers #2

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

Skyscrapers #3
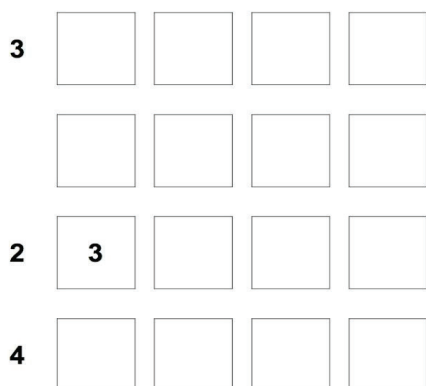
Skyscrapers #4
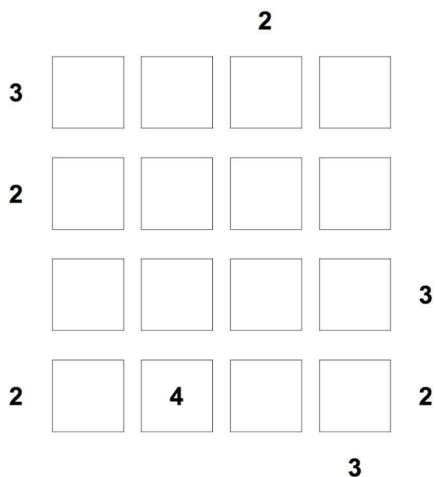
Skyscrapers #5
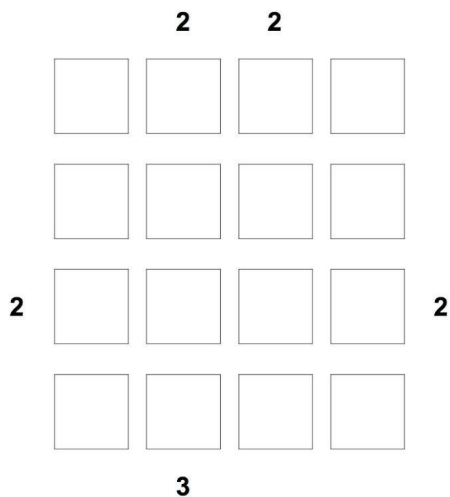
Skyscrapers #6
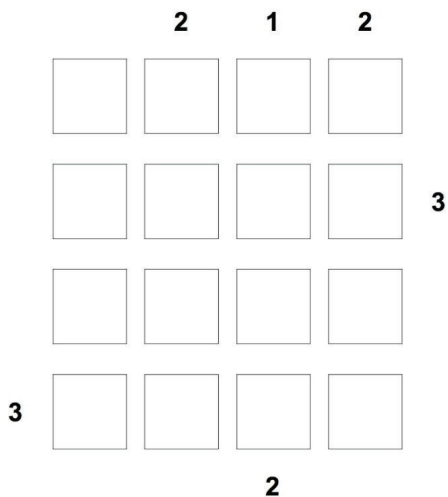
Find more Julia Robinson Mathematics Festival problem sets at:
jrmf.org/problems.php

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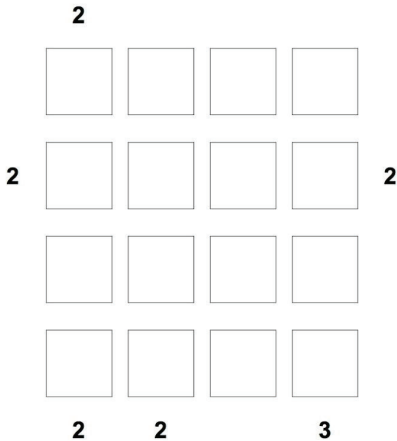
Skyscrapers #7

Skyscrapers #8
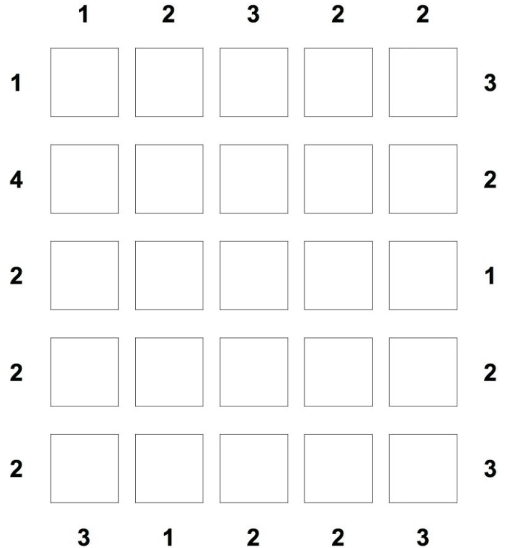
Skyscrapers #9
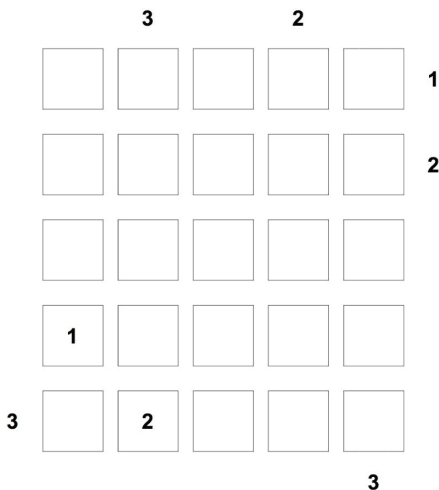
Craft Your Own Skyscraper Puzzle

- Work backwards from an answer.
- Put in all 4N clues outside the grid.
- Remove some of the clues to make a harder puzzle.
- Does your puzzle have just one solution?
- *Work forward with interesting clues.*
- Specify some "interesting" situations by specifying crafting relevant clues as you set up the puzzle.

Find more Skyscraper puzzles online at **brainbashers.com/skyscrapers.asp**
and **conceptispuzzles.com/index.aspx?uri=puzzle/skyscrapers**

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Festival Organizers' Information

What You Need to Know to Get Started Running Your Own Festival

A **Julia Robinson Mathematics Festival** offers students advanced and thought-provoking mathematics in a social and cooperative atmosphere. Students choose among several tables offering problem sets, games, or puzzles with mathematical themes. They work as long as they wish, while a facilitator provides support and encouragement. Motivation comes from the social interaction, rather than from any prize, grade, medal, or ranking. Festivals are run locally and supported by a national network. They can address any level of student, from those struggling with mathematics to those soaring in achievement.

What is a Julia Robinson Mathematics Festival?
A Festival is an event at which students play with mathematics. Typically, there are a dozen or more tables, each with a facilitator and a problem set, game, puzzle, or activity. Students play and explore individually or in groups, share insights, and make discoveries. Facilitators elicit logical processes for approaching, exploring, or solving problems. The facilitator strives to ask questions rather than provide suggestions or answers. Success is not measured by the number of problems solved nor students' speed, but rather by how long students stick with activities and by the breadth and depth of their explorations and insights.

Festival activities are designed to open doors to higher mathematics for K–12 students, doors that are not at the top of the staircase, but right at street level.

Who is the Audience?
Festivals are customized for the audience at hand. Local organizers specify their intended audience, and the JRMF organization helps select problems. We support Festivals for students in grades K–3 (usually with their parents), for students in grades 4–6, for middle school students, and for high school students. Some Festival activities are accessible to students with almost no mathematical background, while others engage students with deep mathematical experience. And there are activities for students in between. The social interaction attracts and motivates all kinds of students.

The local organizers decide whether to target certain grades or a wide band of grades. We support festivals for elementary students only, middle school students only, and middle school/high school students. The greater the grade span, the more challenging the festival can be to host.

Why Host a Math Festival?

First and foremost, a Julia Robinson Mathematics Festival brings engaging and deep mathematical content to students in grades K through 12 (ages 4 - 18). Teachers who have experience as a JRMF facilitator use its 'hands off' pedagogical style in their classrooms. Our Festivals engage many types of students, including those who don't enjoy competition or working under time pressure. A Festival is also a community event, bringing together institutions and organizations as their constituents celebrate mathematics.

What Support is Offered to Local Organizers?

The JRMF organization offers:
- A registration system.
- Advice on seeking local funding and recruiting facilitators.
- Help selecting problem sets from our databank of over 100 activities.
- Copy and logos for advertising, banners, and printed materials.
- Training support for facilitators.

How Much Does a Festival Cost?

We never want finances to be an obstacle to hosting a Festival. The JRMF is a non-profit institution whose mission is to inspire interest in mathematics, creativity, and collaboration among K-12 students. We encourage those who can't afford the costs to apply for a Festival funding grant.

What Happens After a Festival?

We ask that you provide us feedback. We welcome suggestions for how to improve our Festivals and support the hosting organizations. If you are interested in organizing or hosting a Festival, email us at **info@jrmf.org**.

We would love for you to join our team!

Contact us for more information:

Founder: Nancy Blachman
Executive Director: Mark Saul
EMAIL : info@jrmf.org
PHONE : 917-796-8697
WEBSITE : www.JRMF.org

What is a Julia Robinson Mathematics Festival?

A Festival is an event at which students play with mathematics.
Typically, there are a dozen or more tables, each with a facilitator and a problem set, game, puzzle, or activity. Students are encouraged to look for patterns, pursue more than one approach, and share their explorations and discoveries. A facilitator at each table listens, supports, and guides the participants.

The aims of our Festivals are:

- **To evoke mathematical interest and enthusiasm in problem solving and discovery.**
- **To help students make connections among widely different areas of mathematics.**
- **To broaden the kinds of teaching and learning experiences in the students' education.**

Festivals reach many types of students, including those who don't enjoy competitions or working under time pressure. A Festival is also a community event, bringing together institutions and organizations as their constituents celebrate mathematics together.

Interested in volunteering, organizing or hosting a Festival?
Contact us for more information: