KenKen® Meeting
(Number Theory and Logic)
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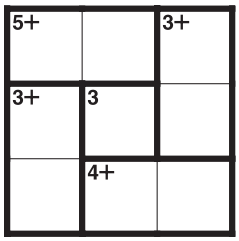
Topic
Using increasingly popular KenKen® puzzles, students will use teamwork, number sense and logic skills to solve challenges (while having a great time).

Materials Needed
- Copies of the KenKen® Puzzle Sheet (downloaded from www.mathcounts.org)

Meeting Plan
KenKen is a type of educational puzzle that continues to grow in popularity around the world. Similar to Sudoku in appearance and the desired result (one of each number in every column and every row), it requires the use of logic skills but also number sense and other math skills. You may hear terms such as *commutative property*, *permutations* and *factors* while your students are playing the game... it truly uses math!

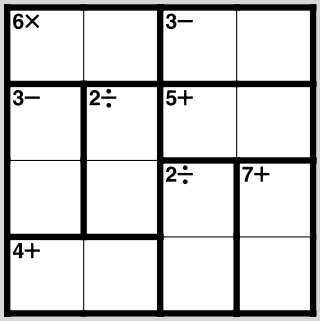


The inventor of KenKen is Tetsuya Miyamoto. As he explains in the foreword of an upcoming KenKen book for students, his students' achievement in perseverance and logical/analytical thinking skills was dramatic after using these puzzles for a year. The process Miyamoto uses in his classroom is "the art of teaching without teaching." The belief is that if educators provide students with the right material and the right environment, they will learn by themselves:

> *The purpose of the KenKen puzzle is not to "solve" the puzzle. It is not solving the puzzle that makes children smarter. Rather, it is by fully using the brain in trying to solve the puzzle through trial and error that makes children smarter. It doesn't matter if the child reaches the right answer or not—using the brain fully to try to get to the right answer has the necessary effect.*
>
> *... Children are tougher than we adults often think they are. Even if they give up on a puzzle once, please keep putting this book within their reach ... It is my experience when children re-try the same puzzle they gave up on a week ago, they often can solve it without any problem the second time. And when they solve the puzzle which they thought they could not, they build confidence in themselves. And that confidence becomes the power that fuels not just academic, but all success in life.*

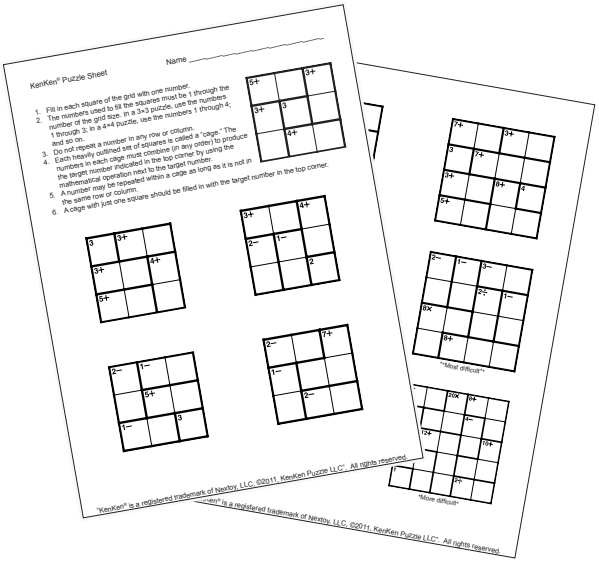
The Six KenKen Rules

1. Fill in each square of the grid with one number.
2. The numbers used to fill the squares must be 1 through the number of the grid size. In a 3×3 puzzle, use the numbers 1 through 3; in a 4×4 puzzle, use the numbers 1 through 4; and so on.
3. Do not repeat a number in any row or column.
4. Each heavily outlined set of squares is called a "cage." The numbers in each cage must combine (in any order) to produce the target number indicated in the top corner by using the mathematical operation next to the target number.
5. A number may be repeated within a cage as long as it is not in the same row or column.
6. A cage with just one square should be filled in with the target number in the top corner.



Note that Rule 4 explains the target number and operation in each cage. A cage with "2÷" tells us that the quotient of the larger number and smaller number in the cage is 2. A cage with "7+" signals that the numbers in the cage must add to 7. A cage with "6×" means that the product of the numbers in the cage is 6. A cage with "3–" indicates that the difference of the larger number and smaller number in the cage is 3. (The larger number in a "÷" cage or "–" cage does not need to be to the left or above the smaller number.)

The hope is that students will solve the puzzles on the KenKen Puzzle Sheet *without assistance from you*. Perhaps you will be too engrossed in solving your own KenKen puzzles! However, ensuring students understand the rules for KenKen is helpful. We have provided puzzles of different sizes with varying levels of difficulty for you and your students on the KenKen Puzzle Sheet (shown here and downloadable from www.mathcounts.org).


KenKen® Puzzle Sheet

Name _____

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"More difficult"

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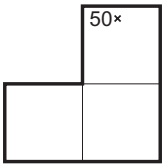
Possible Next Steps

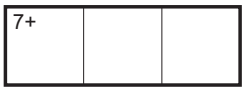
KenKen puzzles can spark great discussions about the math concepts that are present. Here are some possible questions to get your discussions started:

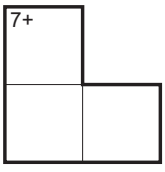
In a 4 × 4 puzzle, what is the largest sum that can be made with a two-square cage?
In an $n \times n$ puzzle, what is the largest sum that can be made with a two-square cage?

In a 4 × 4 puzzle, what is the largest difference that can be made with a two-square cage?
In an $n \times n$ puzzle, what is the largest difference that can be made with a two-square cage?

Without knowing any other information, can you complete this "50×" cage from a 5 × 5 puzzle? How do you know this?







How many possible ways are there to fill in a horizontal, three-square "7+" cage?
How many possible ways are there to fill in this L-shaped, three-square "7+" cage?

For more KenKen puzzles and information about KenKen, visit www.kenken.com.

KENKEN® Puzzles That Make You Smarter™

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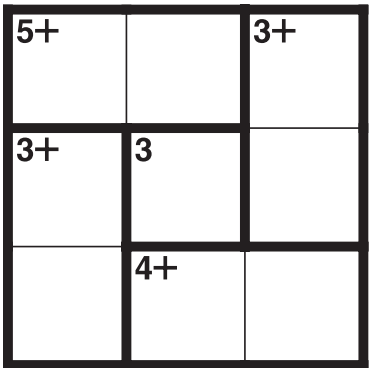

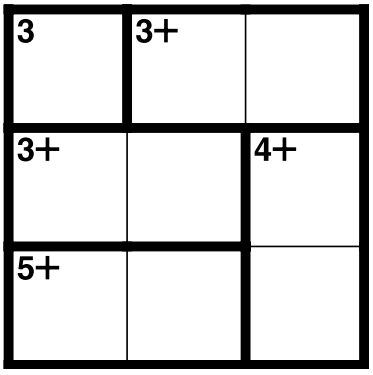

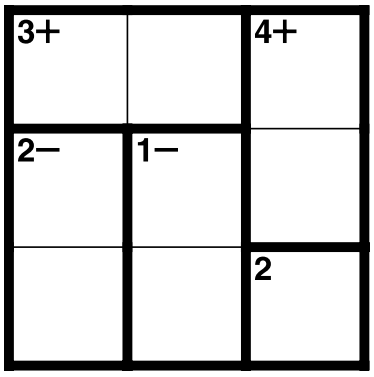

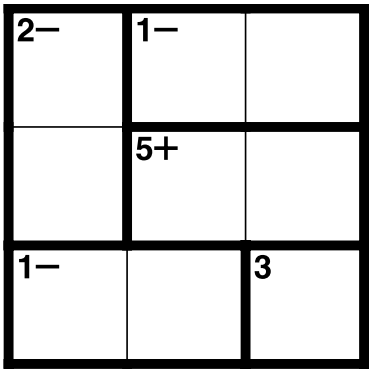

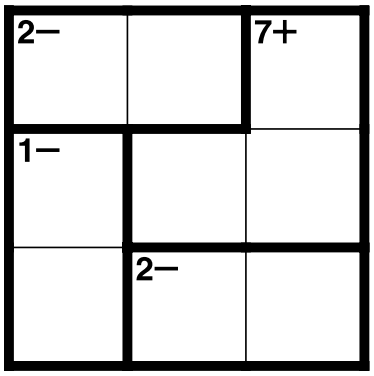

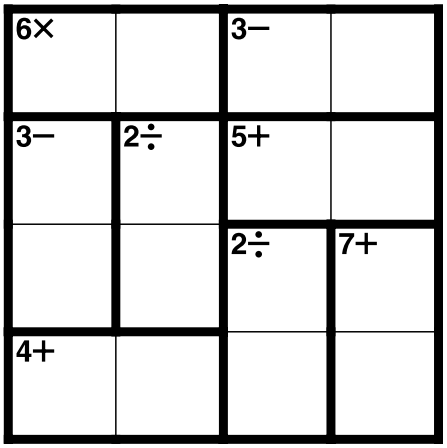

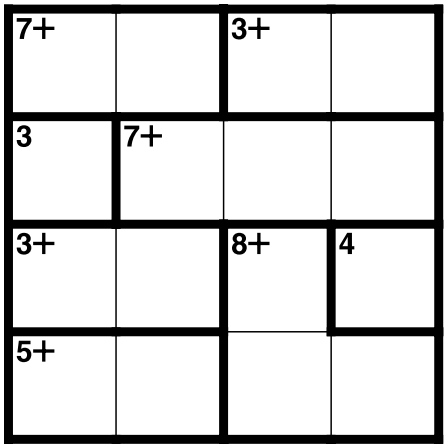

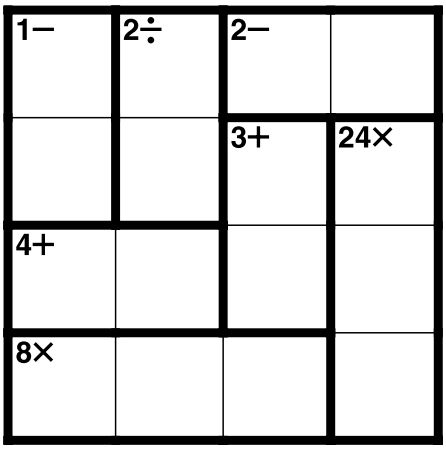

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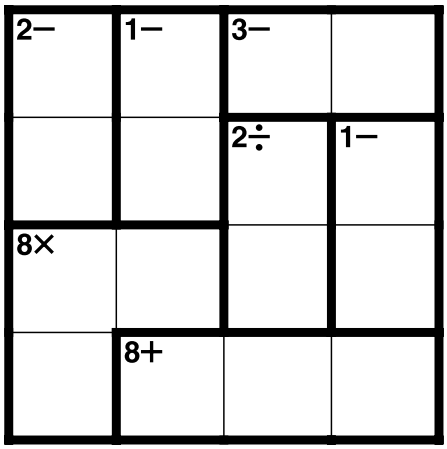

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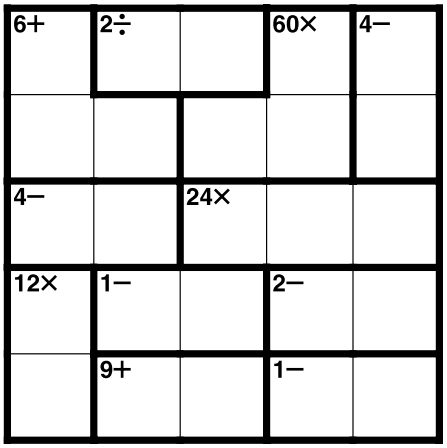

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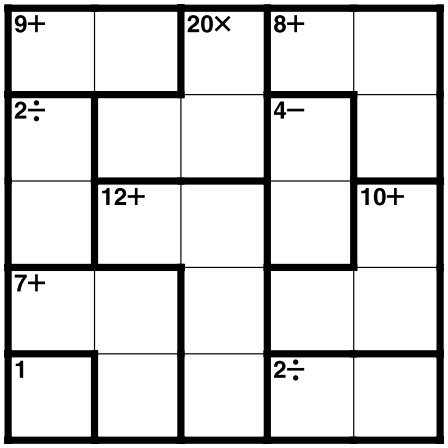

More difficult

2012-2013 KenKen® Puzzle Sheet Name _____

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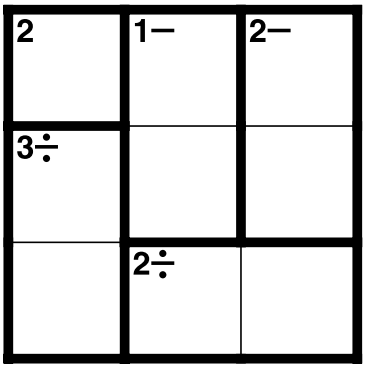

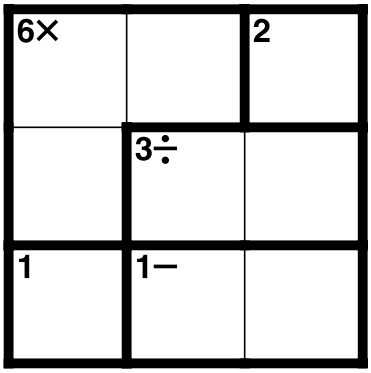

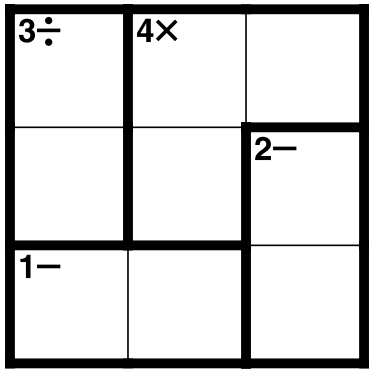

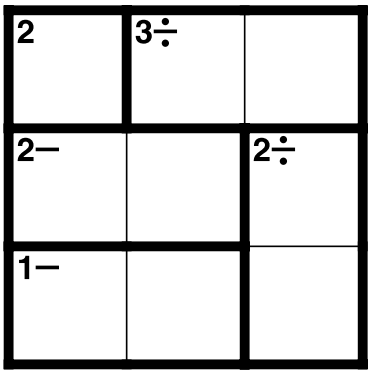

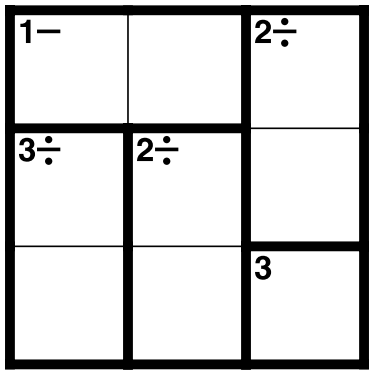

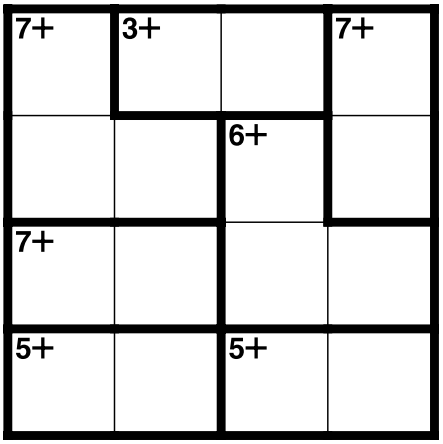

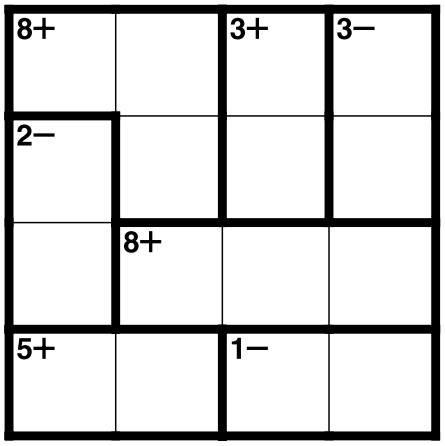

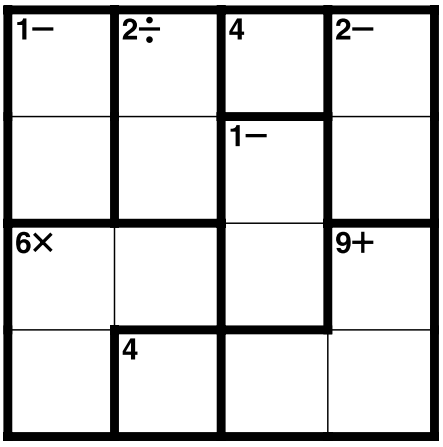

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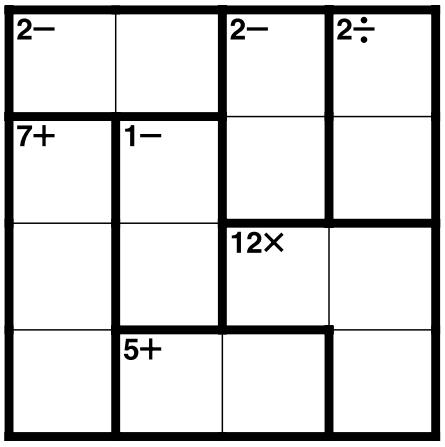

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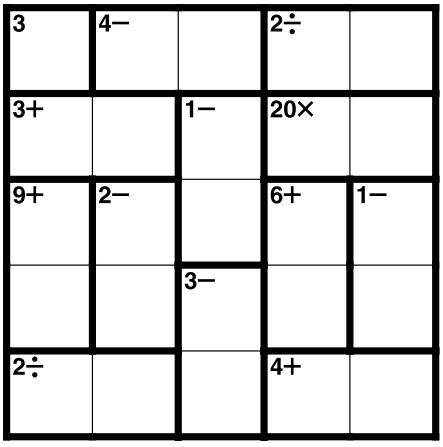

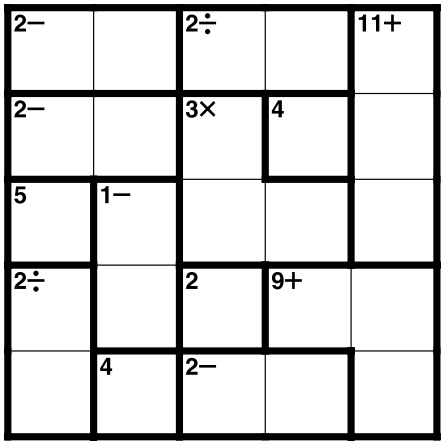

KenKen® Puzzle Sheet Name *Answer Key*

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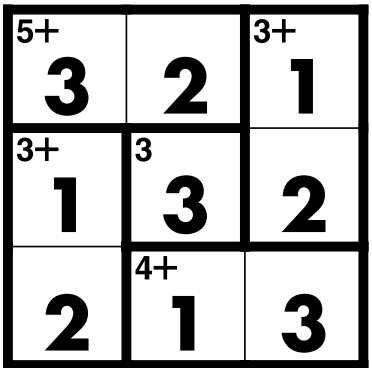

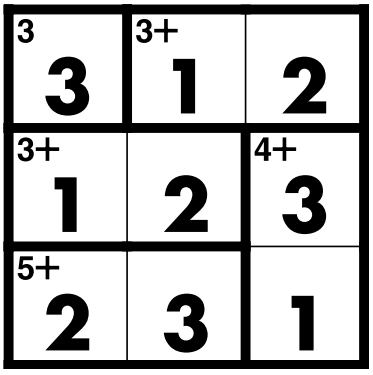

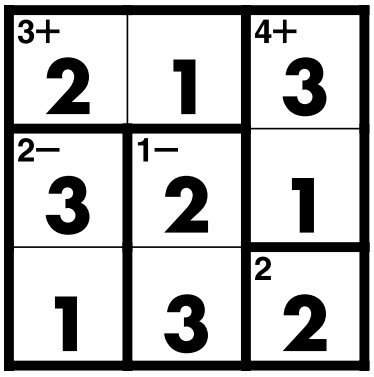

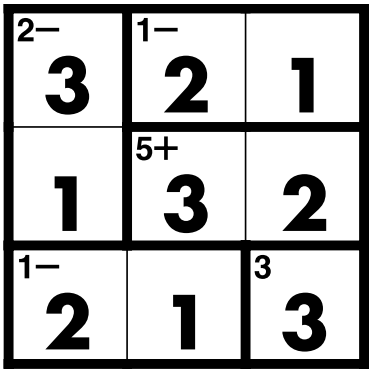

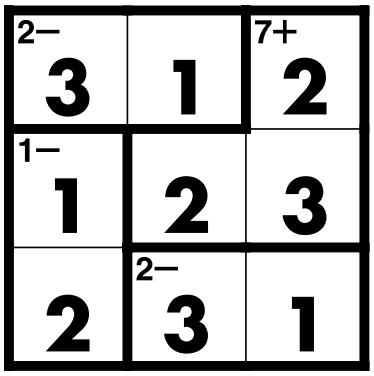

6× 2	3	3− 4	1
3− 1	2÷ 4	5+ 3	2
4	2	2÷ 1	7+ 3
4+ 3	1	2	4

7+ 4	3	3+ 1	2
3 3	7+ 2	4	1
3+ 2	1	8+ 3	4 4
5+ 1	4	2	3

1− 4	2÷ 2	2− 3	1
3	4	3+ 1	24× 2
4+ 1	3	2	4
8× 2	1	4	3

More difficult

2− 3	1− 2	3− 1	4
1	3	2÷ 4	1− 2
8× 4	1	2	3
2	8+ 4	3	1

Most difficult

6+ 1	2÷ 4	2	60× 3	4− 5
2	3	5	4	1
4− 5	1	24× 3	2	4
12× 4	1− 2	1	2− 5	3
3	9+ 5	4	1− 1	2

More difficult

9+ 5	4	20× 1	8+ 3	2
2÷ 2	5	4	4− 1	3
4	12+ 2	3	5	10+ 1
7+ 3	1	2	4	5
1 1	3	5	2÷ 2	4

More difficult

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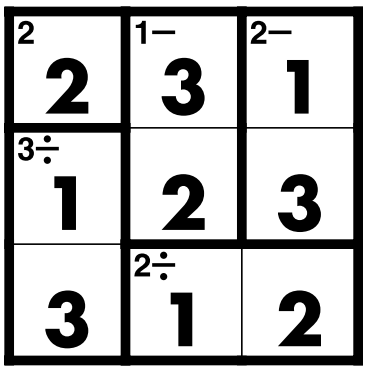

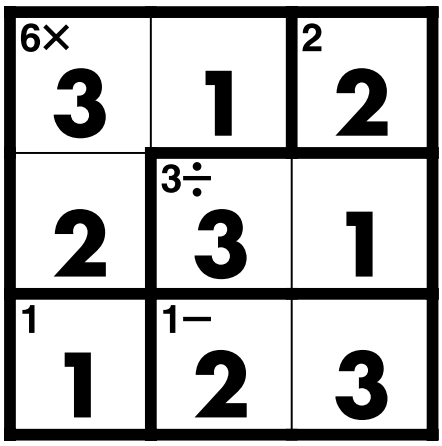

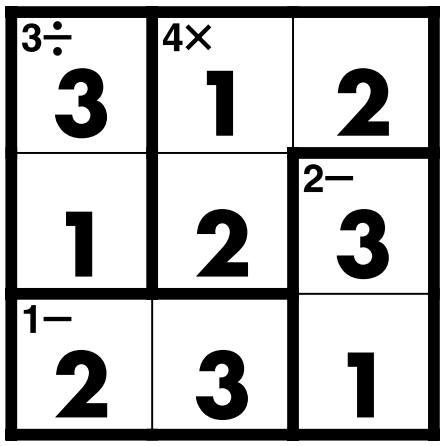

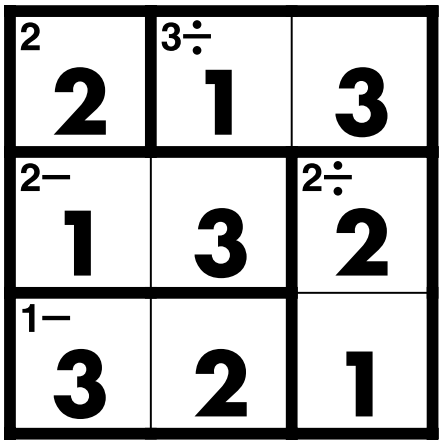

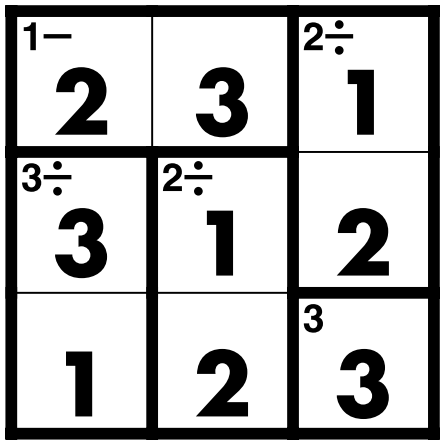

7+ 4	3+ 1	2	7+ 3
1	2	6+ 3	4
7+ 3	4	1	2
5+ 2	3	5+ 4	1

8+ 3	2	3+ 1	3− 4
2− 4	3	2	1
2	8+ 1	4	3
5+ 1	4	1− 3	2

1− 3	2÷ 2	4 4	2− 1
4	1	1− 2	3
6× 2	3	1	9+ 4
1	4 4	3	2

More difficult

2− 3	1	2− 4	2÷ 2
7+ 4	1− 3	2	1
2	4	12× 1	3
1	5+ 2	3	4

Most difficult

3 3	4− 5	1	2÷ 2	4
3+ 1	2	1− 3	20× 4	5
9+ 5	2− 3	4	6+ 1	1− 2
4	1	3− 2	5	3
2÷ 2	4	5	4+ 3	1

2− 1	3	2÷ 4	2	11+ 5
2− 3	5	3× 1	4 4	2
5 5	1− 2	3	1	4
2÷ 4	1	2 2	9+ 5	3
2	4 4	2− 5	3	1