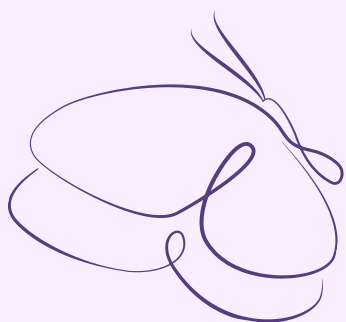


Project Noether

2026 Puzzle Contest

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ROMAN MATCHSTICK DILEMMAS

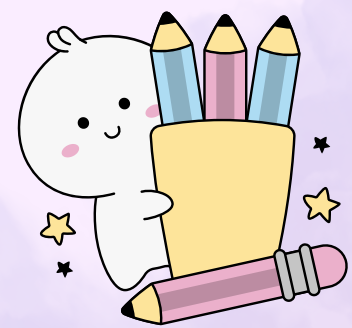
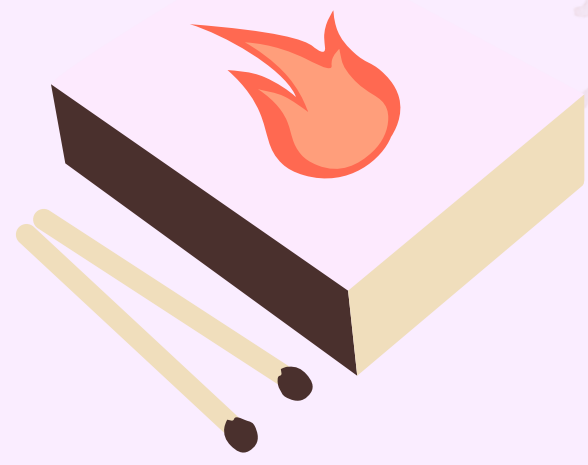
Roman children are trying to learn arithmetic visually using matchsticks, but a cheeky student has scrambled them and left puzzles for you to solve. You may only move one matchstick, and may form anything with it (not just changing numbers). Slanted lines count as well. Known approximations work. Numbers may be interpreted as symbols and the sort.

Example Equation:

$$V - I = VI$$

Solution:

$$VI - I = V$$



I - 1

V - 5

X - 10

L - 50

Roman Matchstick Dilemmas:

Easy:

1. $V - IV = IX$

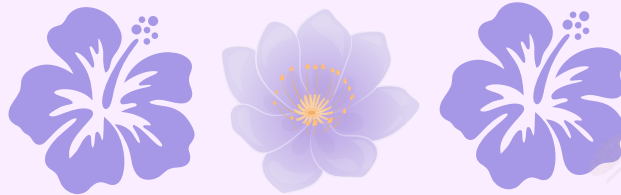
2. $VII - III = IX$



Medium:

3. $LXXI - IX = LX$

4. $XI + I = VI$



Hard:

5. $VI = II$

6. $XXII \div VIII = II$



Cross-Sequence

In a cross sequences puzzle, the goal is to fill every empty square with a positive integer so that the numbers in each row and each column can be arranged in some order to form an arithmetic sequence.

Example Problem Solution:

The center column contains a 6 and a 13. To create an arithmetic sequence that includes 6 and 13, we have $(-1, 6, 13)$ or $(6, 13, 20)$. Since each square must contain a positive integer, the bottom-center square must contain **20**. We only consider entries that are positive integers for the remaining squares.

The bottom row is $(16, 18, 20)$ or $(18, 19, 20)$ or $(18, 20, 22)$. Only placing **19** in the bottom right square also creates an arithmetic sequence in the right column: 16, 19, 22.

Next, the middle row is $(10, 13, 16)$ or $(13, 16, 19)$. If we fill the middle-left square with a 19, then the top-left square must be filled with a 17 or 20 to create an arithmetic sequence in the left column. Neither of these creates an arithmetic sequence in the top row. So, the middle-left square is **10**.

Finally, only a **14** in the top-left square creates an arithmetic sequence in both the left column and the top row.

Final Answer:

14	6	22
10	13	16
18	20	19

17 or 20

17 or 20	6	22
19	13	16
18	20	19

Example:

Fill the empty squares to complete the Cross-Sequence puzzle below

	6	22
	13	16
18		

	6	22
	13	16
18	20	

	6	22
	13	16
18	20	19

	6	22
10	13	16
18	20	19

1.

17		22
	36	
34		23

2.

6		15
11	33	
		8

Note: Do not write numbers in the dark purple squares

3.

	19	
55		11
	5	
35		9

4.

	4	5	
			13
30			
	57		18

5.

1	16			6
		17		45
22			13	
15				
	30	33		

6.

	29	
		38
33		8
43		44
53		14
63		
	90	

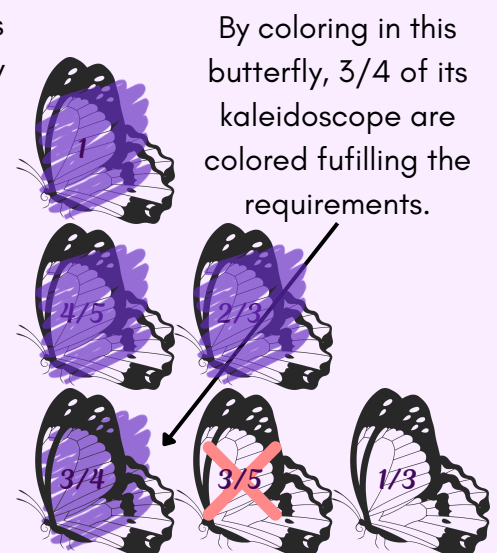
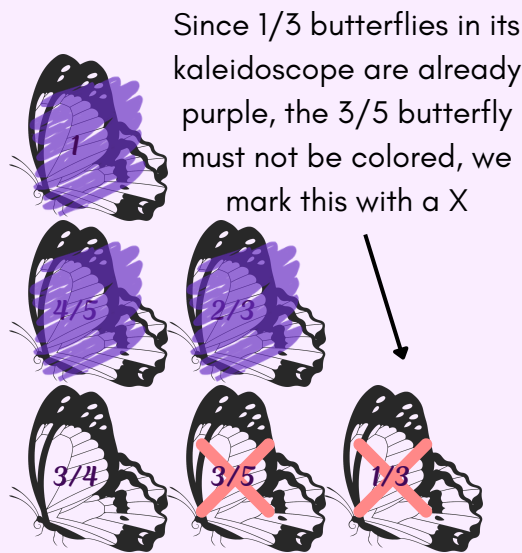
Color the Butterflies Purple

In a Color the Butterflies Purple puzzle, the goal is to color some of the butterflies in a grid.

A clue on each butterfly's wings gives the fraction of butterflies in its kaleidoscope that must be colored.

A kaleidoscope is a group of butterflies, which includes the butterfly and all butterflies adjacent to it, including diagonals.

Example:



Final Answer:



Note: You may circle, shade, or make any marking to represent a colored butterfly. However, any uncolored butterflies must be blank or clearly labeled.

1.



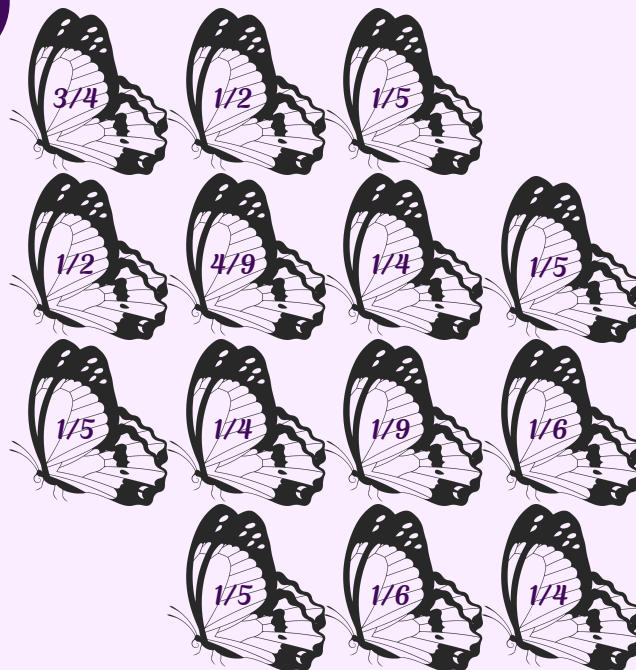
2.



3.



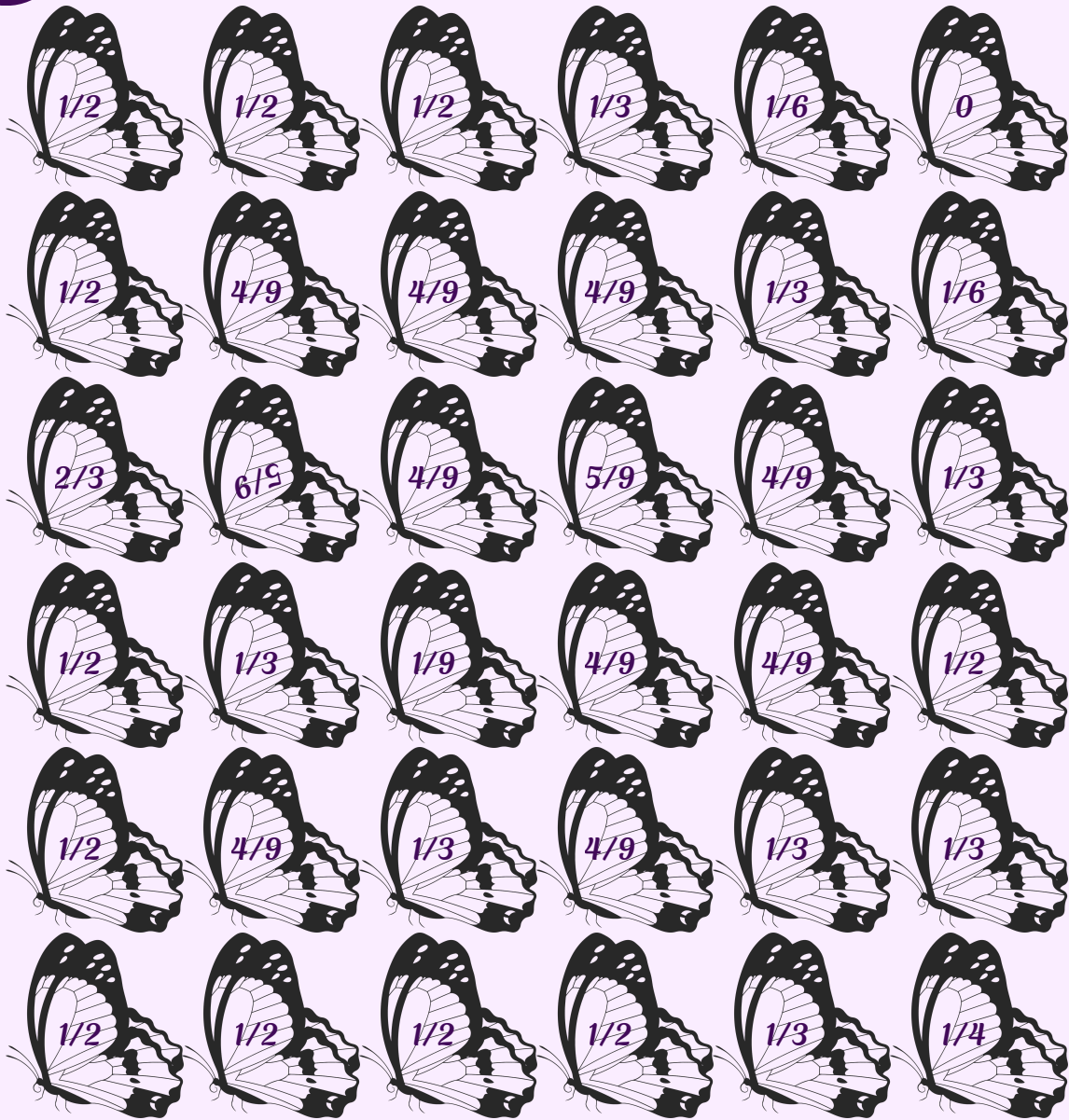
4.



5.



6.



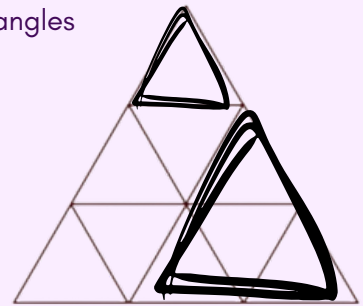
Triangle Counter

In a Triangle Counter puzzle, the goal is to find out how many triangles can be found in a figure. All of the shapes must be convex triangles with three (3) sides. An example is shown to the left.

in this figure, there are two types of triangles: those made up of one small triangle, and those made up of 3 small triangles. we can call these medium triangles. finally, the entire figure is one large triangle comprised of 9 small triangles. we can call this a large triangle.

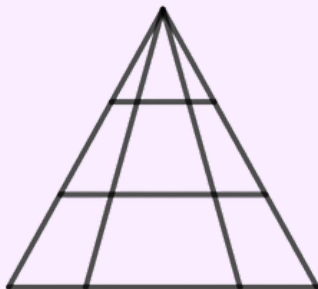
you can see the small and medium triangles here!!

small triangles: 9
medium triangles: 3
large triangles: 1
TOTAL: 13!



1.

count the number of triangles in this figure!



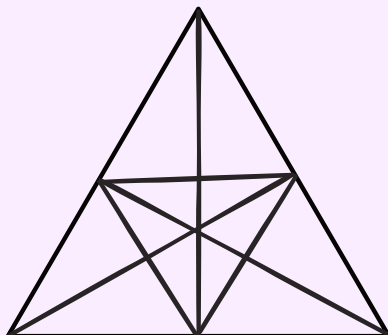
2.

count the number of triangles in this figure!



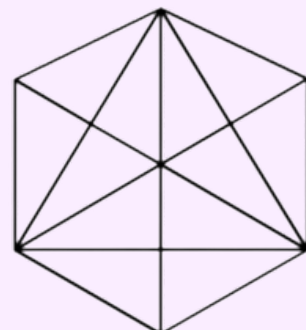
3.

count the number of triangles in this figure!



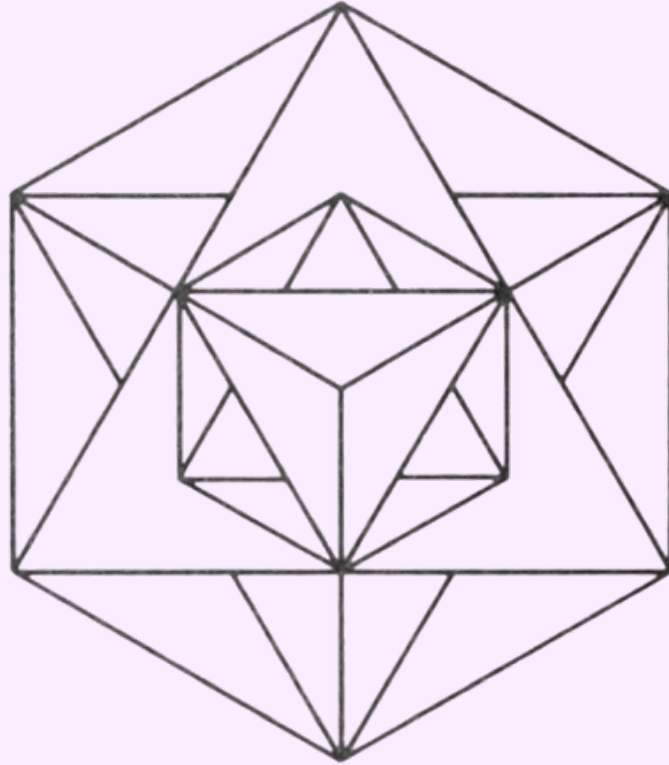
4.

count the number of triangles in this figure!



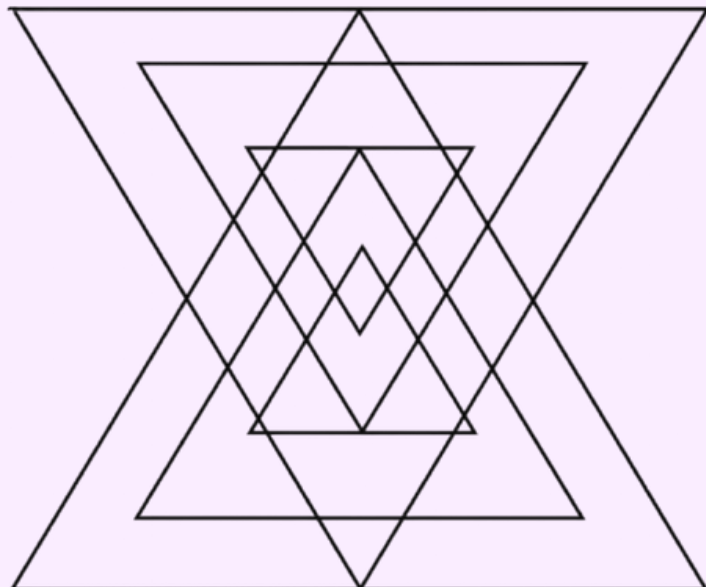
5.

count the number of triangles in this figure!



6.

count the number of triangles in this figure!



Fraction Sumsudoku

Given a plot, you need to solve the Sudoku. In Sudoku, one number may appear only once in a column or row. Squares with a slash (/) must have two digits to form a fraction. Each section (a group of squares sharing the same color and adjacent to each other) may have a sum equal to the number written in top left corner of the section. The sections are outlined. If there is no number in the section, it has no sum it needs to equal. You are also provided a range of number to use. The sum of each section must be a whole number.

The bottom corner must have a 4, as that is the only number in the section and that is the sum value of that section. Also, the bottom left section (medium dark purple) has one fraction. For that section to be a whole number, the denominator must be a 1, so any fraction in that section would make a whole number.

If we look at the top right section (dark purple) that has a sum value of 3, we know that the fractions must have a large denominator in order to have a small sum. Since the bottom right corner has a 4, the fraction's denominator must be a three. Since the numerator cannot be 4 in that section either, we know that the numerator and the empty square must be a 1 or 2, making the numerator of the top middle square 4. To make a whole number for the fraction sums, then the numerator of the middle right square is 2. Then the top right corner has a 1.

Then, the top left square must have a 2 so that the three squares in the row have different values. In the left column, then only 4 and 3 can be placed. Since a 4 cannot be placed in the left column bottom row as a 4 is in the right column bottom row, then 4 is placed in the left column middle row.

This leaves a 1 in the middle column middle row square. Below that, then a 2 must be placed in the middle column bottom row square, resulting in the final answer.

Example:

Use numbers 1-4

7	3	
		4

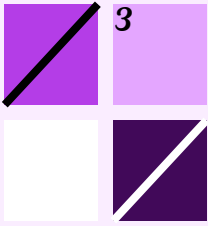
7	3	
		4

7	3 4	1
		2
		3
		4
		4

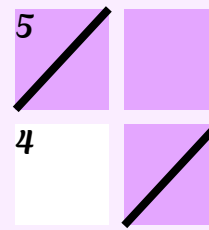
Final Answer:

7	3 4	1
2		3
		2
		3
		4
		4

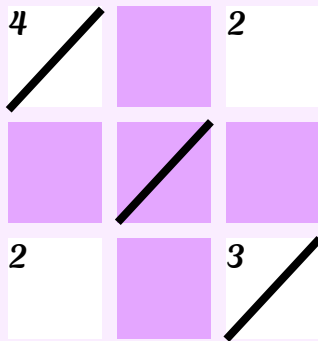
1. Use numbers 1-3



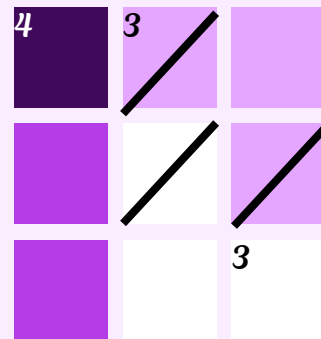
2. Use numbers 1-4



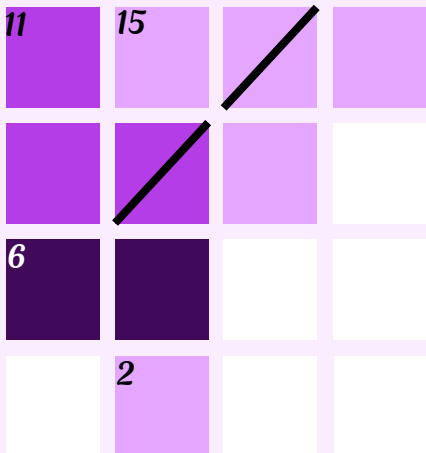
3. Use numbers 1-3
 Note: The white boxes in the corners are not touching, meaning all four of them are different sections.



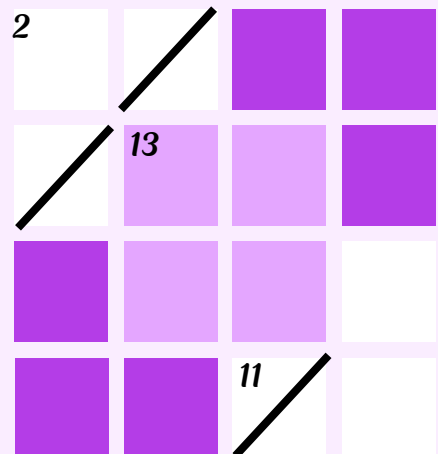
4. Use numbers 1-4



5. Use numbers 1-5



6. Use numbers 1-5



Bonus Puzzle Set 1

All of the following puzzles are reasoning-based puzzles with minimal calculations required. Think carefully and thoroughly!

A teacher had her purse stolen. The thief had to be Annie, Caroline, Diane, Emily, or Grace.

When questioned, each child made three statements:

Annie: (1) I didn't take the purse. (2) I have never in my life stolen anything. (3) Emily did it.

Caroline: (4) I didn't take the purse. (5) My dad is rich enough, and I have a purse of my own. (6) Grace knows who did it.

Diane: (7) I didn't take the purse. (8) I didn't know Grace before I enrolled in this school. (9) Emily did it.

Emily: (10) I am not guilty. (11) Grace did it. (12) Annie is lying when she says I stole the purse.

Grace: (13) I didn't take the teacher's purse. (14) Caroline is guilty. (15) Diane can vouch for me because she has known me since I was born.

Later, each child admitted that two of his statements were true and one was false. Assuming this is true, **who stole the purse?**

Ask a friend to pick a number between 1 and 1000. After asking him 10 yes-or-no questions, you tell him the answers. **What were the questions?** (Any questions that illustrate the correct concept will be accepted)

Three puzzle competitors are blindfolded. A white piece of paper is glued to each one's forehead, and they are told that not all the pieces of paper are black. The blindfolds are removed, and the prize goes to the first man to deduce whether the paper on his forehead is white or black. All three announce white at the same time. **Why?**

Bonus Puzzle Set 2

Make your own puzzle!

Design your own unique type of problem! (tiebreak only)

Include:

- Name of your type of problem (The problem should be original)
- Instructions
- Up to three practice exercises (with solutions) (We highly recommend doing 3 exercises to get full points)
- Make it fun!