Welcome to Albion School of Physics and Mathematics:

Intellectual Club

WELCOME BACK!

The goal of this session is to have fun playing games to introduce basic mathematical concepts. Mathematical jokes and games often rely on patterns, numbers, and logic, and through them, we can develop better problem-solving skills while enjoying the process.

Puzzles in Real Life: Where Do We Use Logic Every Day?

- Can you think of situations where logical reasoning helps in daily life?
- How do detectives use logic to solve mysteries?
- What about doctors, engineers, or video game designers—how do they use logical thinking?

Homework

Perpetual Calendar

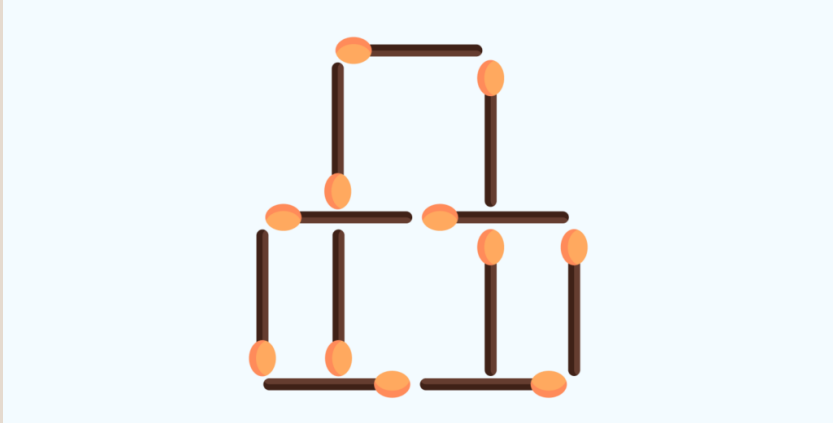
In 1957 John Singleton patented a desk calendar that could represent any date from 01 to 31 using two cubes, but he let the patent lapse in 1965. Each cube bears six digits, one on each face.

A two-cube calendar, and two of the days it can represent.

The picture shows how such a calendar represents the 5th and the 25th day of the month. I have intentionally omitted any other numbers from the faces. You are allowed to place the cubes with any of the six faces showing, and you can also put the grey one on the left and the white one on the right.

What are the numbers on the two cubes?

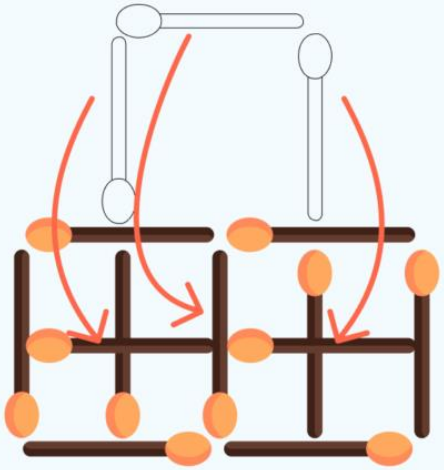
Move 3 matches to get 11 squares



Homework answers

Perpetual Calendar

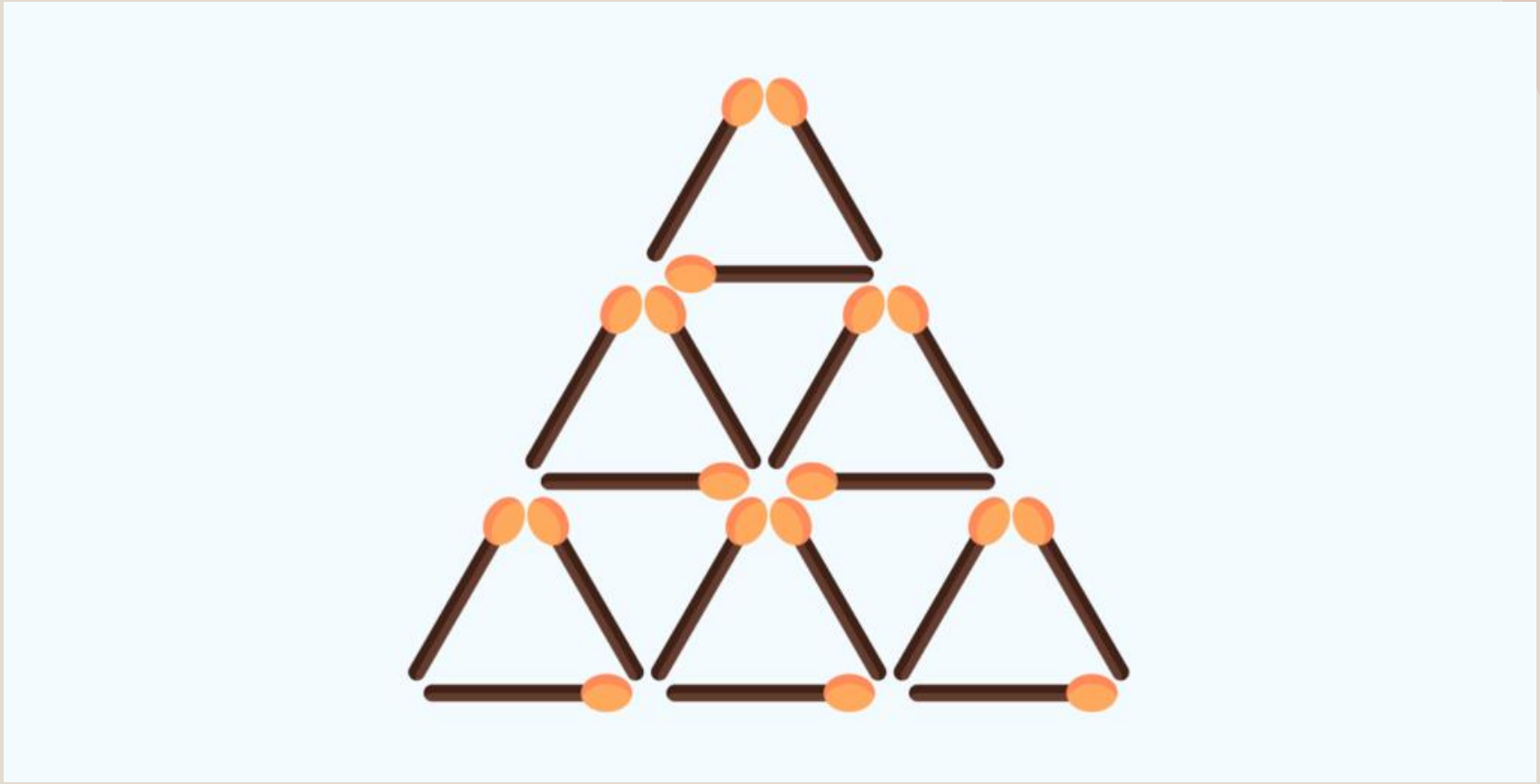
Each cube must include 1 and 2 so that 11 and 22 can be represented. If only one cube bears a 0, then at most six of the nine numbers 01–09 can be represented, so both must bear a 0 as well. That leaves six spare faces for the seven digits 3–9, so the puzzle looks impossible ... until you realise that the cube bearing the number 6 can be turned upside down to represent 9. So the white cube bears the numbers 0, 1, 2, 6 (also 9), 7 and 8, and the grey cube bears the numbers 0, 1, 2, 3, 4 and 5. (Note that I've shown a 5 on my grey cube, and that tells us which cube is which.)



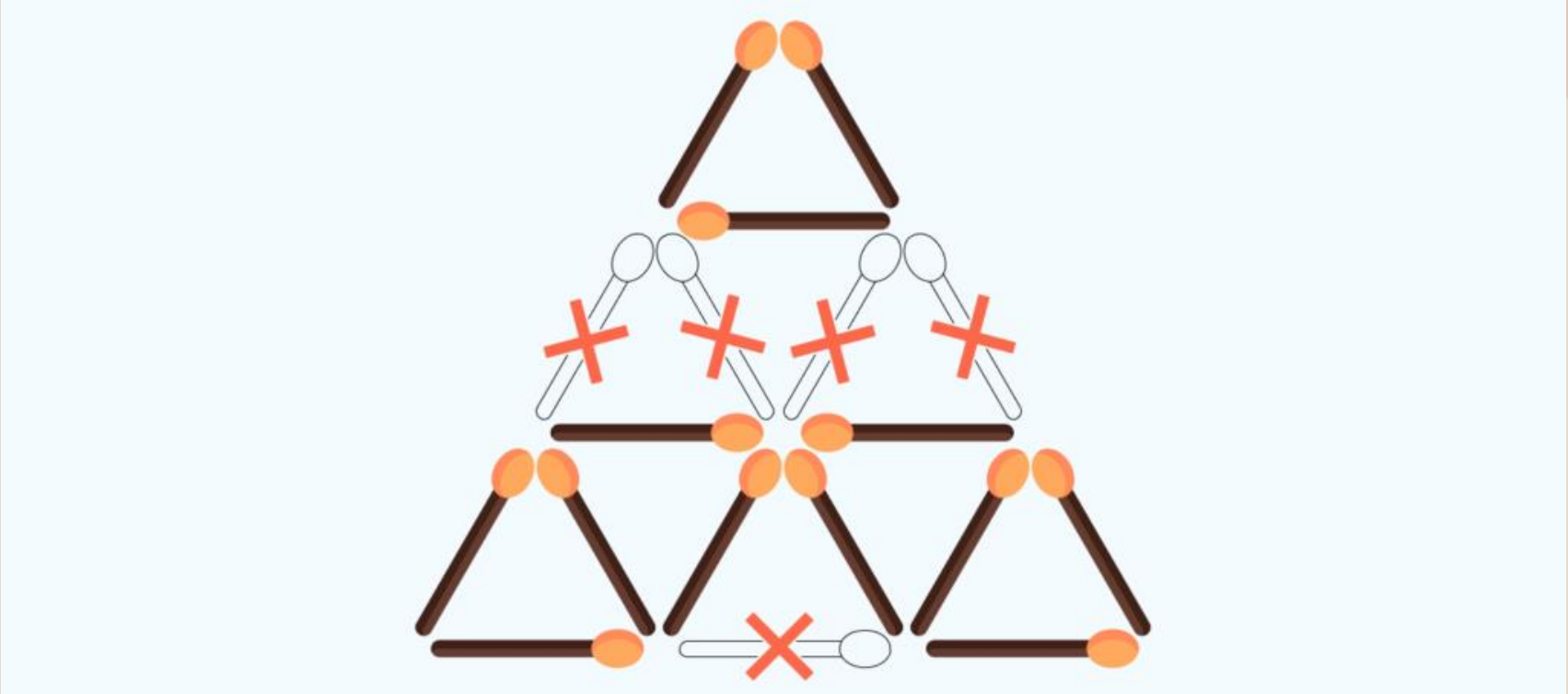
What’s the best way to check if your puzzle solution is correct?

- Do you always go back and verify your solution, or do you trust your first answer?

Remove 5 matches to get 5 equal triangles



Remove 5 matches to get 5 equal triangles



The 24 game

- We’ll start by picking 4 random numbers together
- The goal is to use addition, subtraction, multiplication, and division to make the total 24
- We’ll start together and then get into teams and compete!

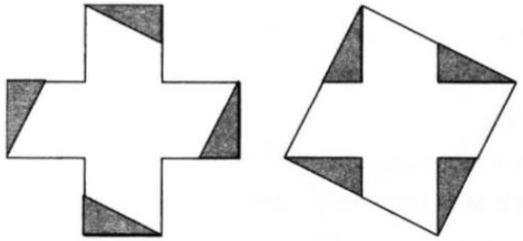
How Do We Approach a Difficult Puzzle?

- When faced with a tricky problem, what do you do first?
- Do you break it down into smaller parts?
- Do you look for a pattern, or do you try different possibilities randomly?
- What are the benefits of stepping away from a puzzle and coming back to it later?

Greek cross puzzle

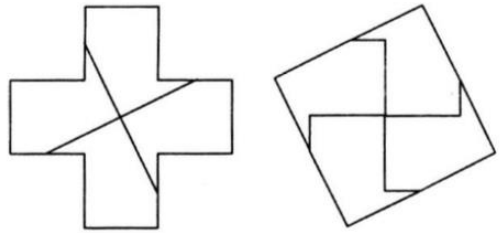
How to Unmake a Greek Cross

To paraphrase the old music-hall joke, almost any insult will make a Greek cross. But what I want you to do is *unmake* a Greek cross. In this region of Puzzledom, a Greek cross is five equal squares joined to make a + shape. I want you to convert it to a square, by cutting it into pieces and reassembling them. Here's one solution, using five pieces. But can you find an alternative, using four pieces, *all the same shape*?



Greek cross to square in five pieces. Now do it with four.

How to Unmake a Greek Cross



Converting a Greek cross to a square.

Adding probabilities

- What’s the probability of selecting an ace or a red king from a deck of 52 cards?
- What’s the probability of rolling a 5 or 6 when a die is once rolled?

Adding probabilities

- **If A and B are mutually exclusive events then P(A or B) = P(A) + P(B)**

thank you

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