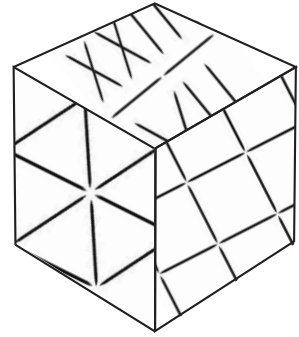


# PUZZLES AND GAMES

## THE TOOTHPICK WAY



Many thinking skills go into solving math problems. The more advanced the mathematics, the more skills you need. You rely less on straight memorization and more on your ability to think clearly and logically. Many great mathematicians, scientists, and writers enjoyed puzzles and tricks. Lewis Carroll loved word games. Benjamin Franklin enjoyed making magic squares. Still others enjoyed puzzles such as toothpick and coin puzzles.

Successful puzzle-solving sometimes requires you to think in a logical way. Many puzzles distract the person puzzling them out with unnecessary information. To solve the puzzle, you must think in a straight line and avoid taking the wrong road because of assumptions you make. Sometimes puzzle-solving requires that you stop looking at the puzzle in the usual way and try to see it from a different perspective.

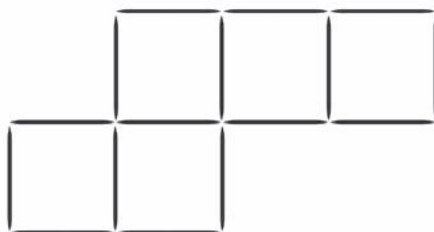
Toothpick puzzles allow you to exercise these skills and focus your thinking. Many of them are geometric in nature because the toothpick acts like a kind of line segment. Doing these puzzles exercises your skill in seeing the relationship between geometric designs and shapes. But, remember, not all toothpick puzzles involve geometric shapes.

Here are a couple of classics to get you started on good puzzle-solving thinking.

- ① *A Subtraction Puzzle:* Look at the fifteen toothpicks shown. Can you remove six to leave ten?



- ② *Lose That Square:* Look at the five squares formed by the toothpicks below. Can you move two toothpicks to turn five squares into four squares?

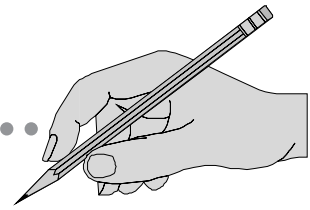


- ③ *A Triangular Puzzle:* Seven toothpicks make a triangle with a base of three toothpicks and two equal sides of two toothpicks each. Can you move three toothpicks to turn one triangle into three triangles? Hint: The three small triangles will be inside a quadrilateral with only two parallel sides.



- ④ *Triangles and Squares:* Can you make two squares and four triangles from eight toothpicks?

# YOUR TURN



Have some fun solving these toothpick puzzles. You may need to think logically about how to move the toothpicks or you may need to try looking at the shapes in a new or different way in order to solve the puzzles.

- 5 Can you move only one toothpick to make the following equations correct?

$$||| - \vee = ||$$

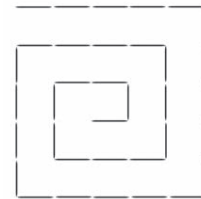
$$\frac{XXIII}{VII} = ||$$

Some puzzles require you to think creatively about shapes and their relationships. Can you change one shape or group of shapes into another configuration of shapes?

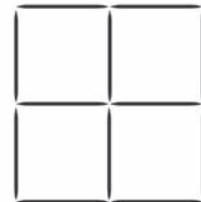
- 6 Find the relationship between geometric shapes. Arrange twelve toothpicks in a hexagon with six spokes. Move four toothpicks to create three triangles from the original design.



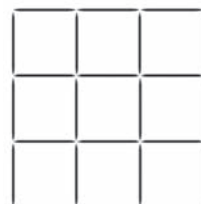
- 7 Make a spiral from thirty-five toothpicks. Move four toothpicks of the spiral to make three squares.



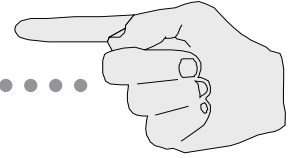
- 8 Arrange twelve toothpicks in four connected squares. Move three toothpicks to create three squares.



- 9 Arrange twenty-four toothpicks in nine squares arranged in a 3-by-3 block. With twelve more toothpicks, create four more squares. Then, remove four toothpicks from your design to leave nine squares.

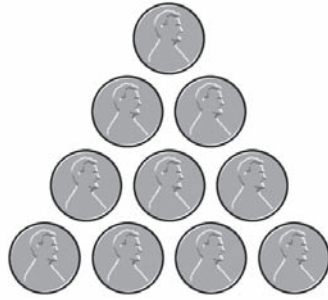


# AND ANOTHER THING .....



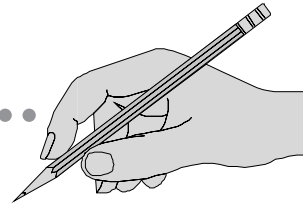
**N**ow let's try a little coin fun.

- ⑩ Can you turn this triangle upside-down by moving only three coins?



- ⑪ Arrange six coins in a cross shape. Move one coin to form two rows, each of which has four coins.
- ⑫ Arrange twelve coins in a square. Rearrange them to form another square with five coins on each side.

# ANSWER KEY



## PUZZLES AND GAMES—THE TOOTHPICK WAY

1. A subtraction puzzle



2. Lose that square



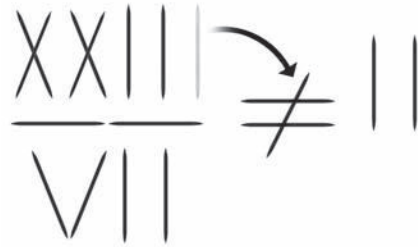
3. A triangular puzzle



4. Triangles and squares



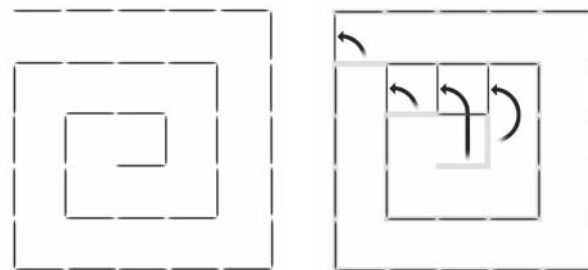
5. Move one toothpick to solve the equations.



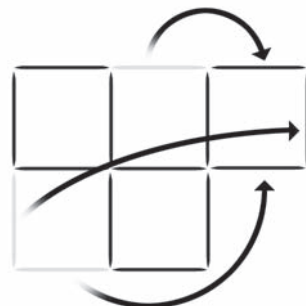
6. Move four toothpicks to create three triangles.



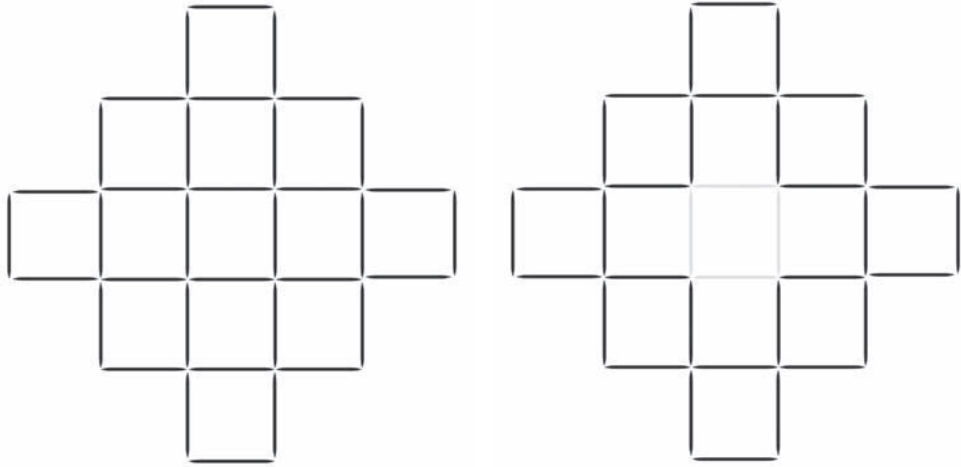
7. Move four toothpicks of the spiral to make three squares.



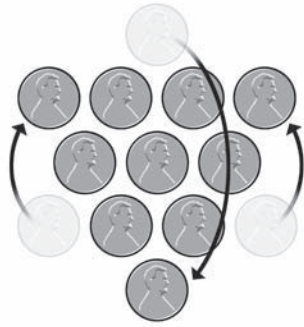
8. Move three toothpicks to create three squares.



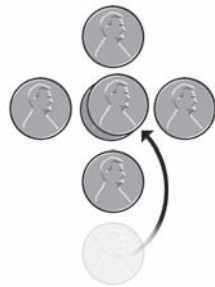
9. Create four more squares with twelve toothpicks. Remove four toothpicks to leave nine squares.



10. Turn the triangle upside down by moving three coins.



11. Move one coin to form two rows of four coins.



12. Rearrange the coins to form a square with five coins on each side.

