Brain Teasers 2

Teacher Resources
Classroom Activities

Math Puzzles

Teacher's Notes: Like the puzzles "Four Equations" and "Disorder" in *Brain Teasers 2,* these puzzles help students develop the ability to recognize mathematical patterns and relationships between sets of numbers.

Age level: 3rd grade and up

Science and math skills: Observing, problem solving, recognizing patterns and relationships, computation

Time: 15 minutes to work on puzzles

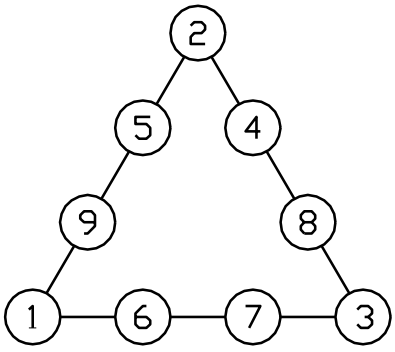
Materials:
• Copies of the Student Handout

Procedure:
1. Give students copies of the handout.
2. Let students work on the puzzles for a specified period of time.
3. Let students share their solutions and their problem-solving strategies with the rest of the class.

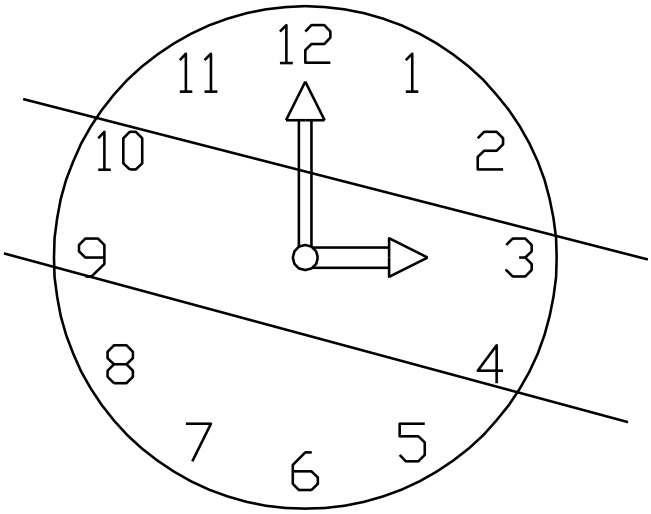
Puzzles and Solutions:

Puzzle 1

Place the numbers 1 through 9 in the circles around the triangle so that the numbers along any side add up to 17. The first three numbers have been done for you.



Puzzle 2
Draw two straight lines across the clock face so that the numbers in each part add up to the same amount.



Stick Puzzles

Teacher's Notes: Stick puzzles, like those in the exhibit, help develop pattern recognition and creative-thinking strategies. You can set up the puzzles below using coffee stirrers or straws cut in 2-inch lengths.

Age level: 2nd grade and up

Science and math skills: Observing, problem solving, recognizing patterns, transforming geometric figures

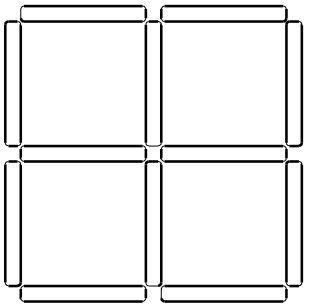
Time: 15 minutes to set up puzzles, 20 minutes for students to work on puzzles

Materials:
• about 60 sticks if puzzles are set up at stations in an activity area; about 20 sticks per student (or per pair) if each student (or pair) will set up each puzzle
• copies of Student Handout

Procedure:
1. Set up the puzzles as shown on the Student Handout at stations in an activity area and let students try to solve them. Or give each student (or pair) a set of 20 sticks and the Student Handout and have them set up and try to solve each puzzle in turn.
2. Once all students have had a chance to try the puzzles, have students share their solutions and their strategies for solving the puzzles.

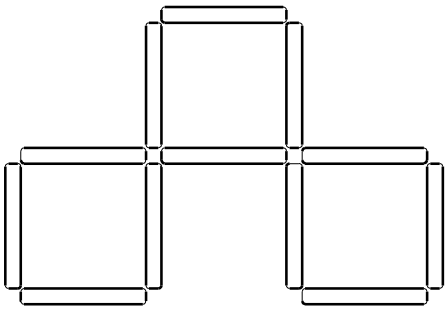
Puzzles and Solutions:

Puzzle 1
Start with the sticks like this:

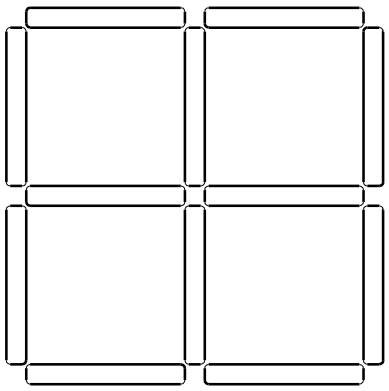


Move three sticks to make three squares, all the same size.

Solution:

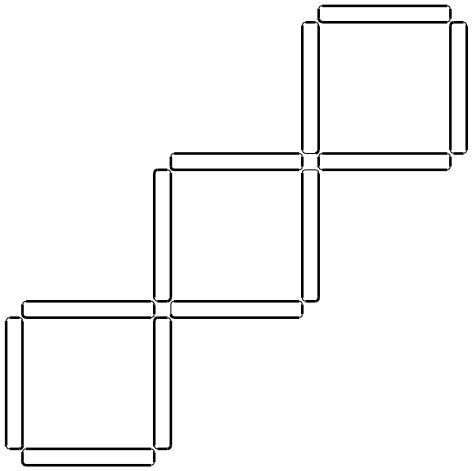


Puzzle 2
Start with the sticks like this:

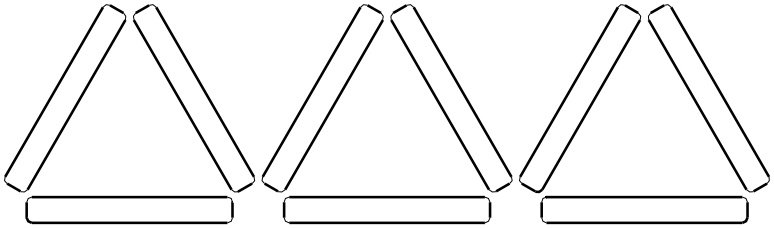


Move four sticks to make three squares, all the same size.

Solution:

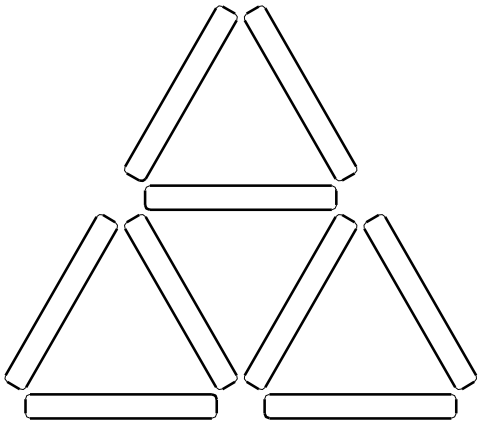


Puzzle 3
Start with the sticks like this:

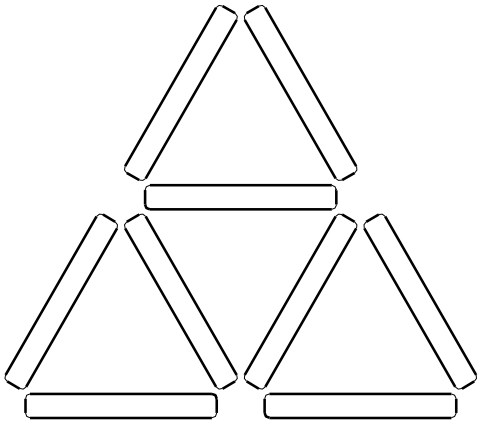


Move three sticks to make five triangles.

Solution:

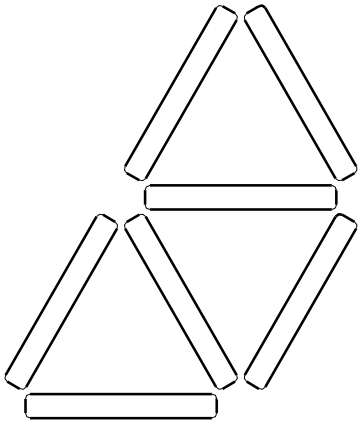


Puzzle 4
Start with the sticks like this:



Move two sticks to make three triangles, all the same size.

Solution



Put-Together Puzzles

Teacher's Notes: Puzzles that involve putting together pieces to create a design or figure help develop spatial sense and an ability to recognize relationships.

Letter puzzles
Letter puzzles, like the "Make a T" puzzle in the exhibit, may seem simple yet be quite difficult to solve. The best of these puzzles challenge our preconceived notions of how the pieces should fit together.

You can make letter puzzles for students to try or have students make the puzzles themselves. Puzzles can be made of heavy paper, cardboard, or wood.

Two patterns for letter puzzles are included here, but you can easily make others. First draw the letter on graph paper. Then divide it into a few pieces. To make the puzzle more difficult, try dividing the letter into pieces along diagonal lines.

Age level: 2nd grade and up

Science and math skills: Observing, problem solving, recognizing relationships, developing spatial sense, cooperative learning

Time: 15 minutes to trace and cut out pieces, more time if students design their own puzzles; 10-15 minutes for students to work on puzzles

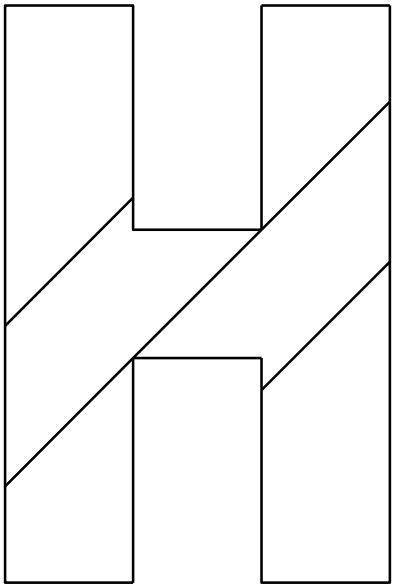
Materials:
- copies of puzzle patterns
- heavy paper, cardboard, or wood
- scissors or other cutting tools (depending on material used for puzzles)

Procedure:
1. Cut out the pieces from the puzzle patterns. Trace the pieces onto cardboard or wood and cut them out. (If you're using wood, be sure to sand the edges.)
2. Let students try to put the pieces together to form the letters.
3. If you have time, let students design and make their own letter puzzles.

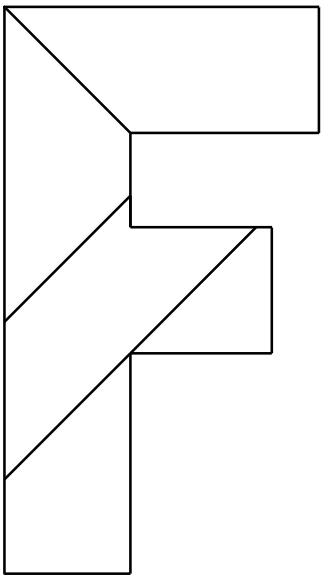
Puzzles and Solutions:
The puzzle patterns show the solutions.

Puzzle Patterns
Cut along lines indicated.

H Puzzle



F Puzzle



Logic Puzzles

Teacher's Notes: Like the puzzle "Crossing the River" in *Brain Teasers 2,* logic puzzles challenge the puzzle solver to plan ahead and think in sequence.

Age level: 4th grade and up

Science and math skills: Observing, analyzing, logical reasoning, problem solving, cooperative learning

Materials:
• copies of Student Handout

Time: 10 to 20 minutes for students to work on puzzles

Procedure:
1. Have students work in pairs to solve these logic puzzles.
2. Let pairs share their solutions with the rest of the class.

Puzzles and Solutions:

Five-Minute Timer
If you have a three-minute sand timer and a four-minute sand timer, how can you measure five minutes?

Solution: Turn both timers over at the same time. When the three-minute timer ends, turn it over. When the four-minute timer ends, one minute of sand will have run into the bottom of the three-minute timer. Turn the three-minute timer over again to add this minute to the previous four minutes to get five minutes.

Counterfeit Coin
You have been given a bag of 24 coins. One of the coins in the bag is counterfeit. The rest of the coins are made of gold. The counterfeit coin is made of a metal that looks like gold, but is not as heavy as gold. Using a balance scale only, what is the least number of weighings you would need to tell which is the fake coin?

Solution: Three. First divide the coins into three groups of eight. Weigh two of the groups against each other to determine which of the three groups weighs the least. Divide the lightest eight coins into three groups: three, three, and two. Weigh the two groups of three against each other. If they balance, the lightest coin must be one of the remaining two. Weigh these against each other to determine the fake coin. If the two groups of three don't balance, choose the lightest group and weigh two of the coins against each other. If the coins balance, you know the fake coin is the one that's left. If they don't balance, you know the lightest one is the fake. Either way, it takes just three weighings.

Logic Puzzles

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Teacher's Notes
Tracing Figures
Like the puzzle "String Houses" in *Brain Teasers 2,* these puzzles challenge the learner to use strategic thinking and to recognize patterns and relationships.

Age level: 4th grade and up

Science and math skills: problem solving, strategic thinking, recognizing and analyzing patterns and relationships

Time: 15 minutes for students to work on the puzzles, 10 minutes for discussion

Materials:
• copies of Student Handout

Procedure:
1. Give students copies of the handout.
2. Have students try tracing the figures without lifting their pencils and without retracing any lines.
3. Discuss students' results. Which figures are traceable? Which are not? What patterns do students notice? Is there a way to determine whether or not a figure is traceable without actually trying it?
4. Encourage students to create their own possible and impossible figures.

Puzzles and Solutions:
Figure 1

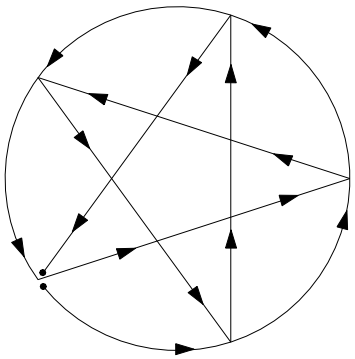


Figure 2

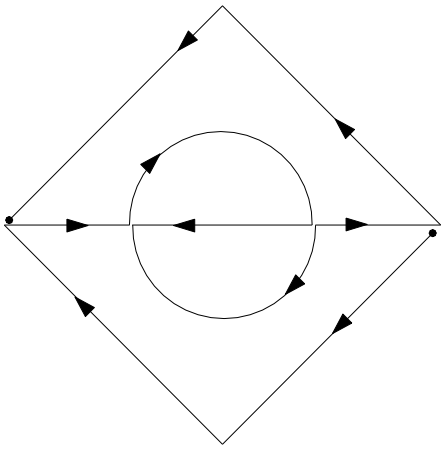
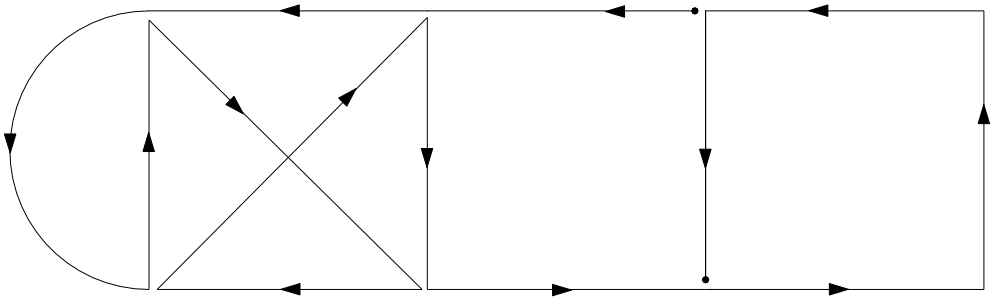


Figure 3
impossible

Figure 4
impossible

Figure 5

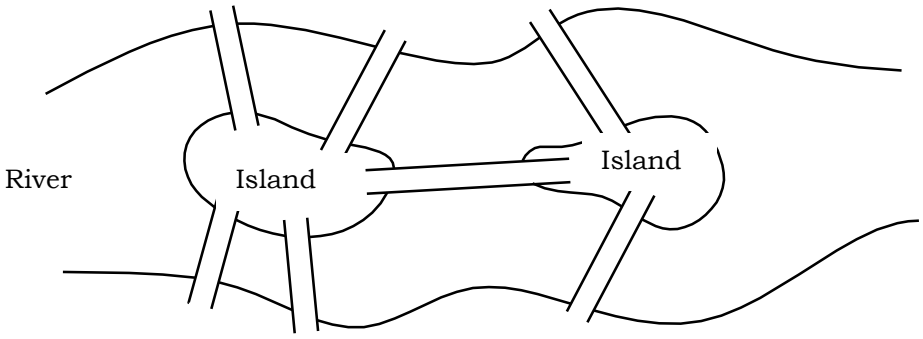


Explanation:
Encourage students to look at the corners and intersections of lines in each figure. How many lines come together at each point? If an odd number of lines comes together, that point is called an *odd vertex*. If an even number of lines comes together at a point, it is called an *even vertex*. Have students list the number of odd and even vertices for each figure and determine whether or not that figure can be traced. Have them look for a pattern in the data. Students should discover that if a figure contains more than two odd vertices, it cannot be traced without retracing some lines.

Figure 4 is based on a famous puzzle known as the "Seven Bridges of Konigsberg," which is presented as follows:

A river runs through the city of Konigsberg, and in the middle of the river are two islands. Seven bridges link the riverbanks and the islands. Is it possible to find a route that crosses all the bridges but does not cross any bridge more than once?

City of Konigsberg:



The Swiss mathematician Leonard Euler studied the problem and found it impossible. He analyzed similar mathematical problems and came up with a rule: If a figure has more than two odd vertices, it can't be traced without retracing some lines. Through his work, Euler established a new and important area of mathematical study known as *network theory.*