Analysis of Classic Questions for Silver 20 - Silver 24

1. Finding Graphic Area

Calculate the area of the shaded shape based on the given conditions. Students need to carefully observe the characteristics of irregular shapes, analyze their differences from regular shapes, and find appropriate calculation methods. By using practical operations such as division, piecing together, and measurement, students can more intuitively understand the concept of the area of irregular shapes. During the problem-solving process, it is necessary to flexibly apply the learned knowledge and try different methods to solve the area calculation problems of irregular shapes. This type of question can effectively exercise students' observation and analysis abilities, hands-on practical abilities, and problem-solving abilities.

Common methods for calculating the area of irregular shapes:

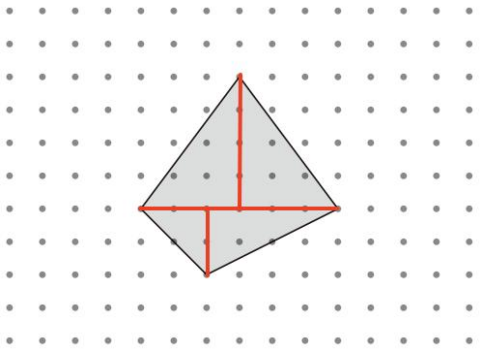
(1) Division Method: Divide the irregular shape into several basic shapes with known area formulas (such as rectangles, triangles, circles, etc.), calculate the area of these small shapes separately, and finally sum them up to get the area of the entire irregular shape.

(2) Completion Method: Convert the irregular shape into one or more regular shapes by adding or subtracting some areas. Calculate the area of these regular shapes, then adjust according to the added or subtracted area to get the area of the original irregular shape.

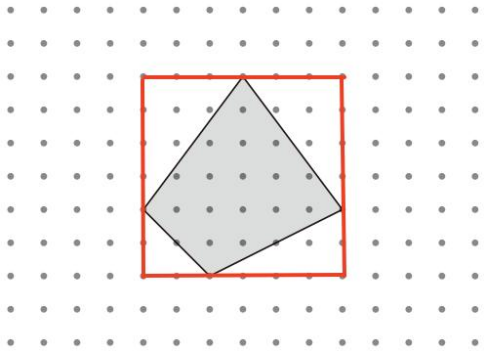
(3) Grid Counting Method: For some relatively simple irregular shapes with clear boundaries, the area can be estimated by counting grids. Place the shape on a grid composed of small squares, count the number of squares occupied by the shape, where each square represents a certain area, thereby estimating the area of the entire shape.

(4) Using Geometric Transformations: For some shapes that can be transformed into regular shapes through rotation, translation, or reflection, perform these transformations first, then calculate the area.

Take the following figures as examples: Both the division method and the completion method can be used to solve the problem.



(Division Method)

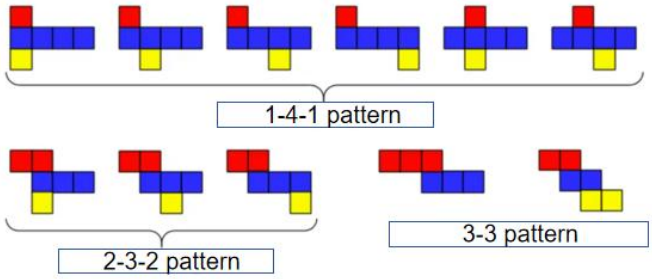


(Completion Method)

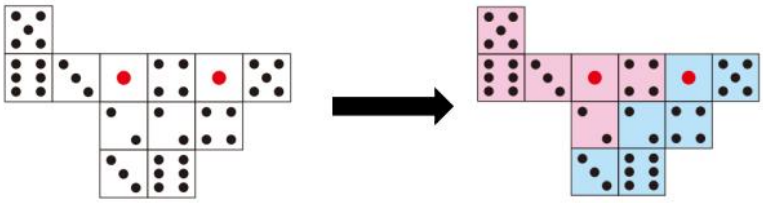
2. Dice Unfolding Diagrams

This type of question is related to the net of a cube. What is the net of a three-dimensional figure? A figure that can be spliced into a cube is a net. There are 11 types of nets for a cube in total. When solving this type of question, it is not only necessary to know the nets, but also to know the rule that the sum of the dots on the opposite faces of a dice is 7.

First of all, let's understand the 11 types of nets, which are usually divided into 4 categories: "141 pattern", "231 pattern", "222 pattern" and "33 pattern". Among them, there are 6 types of "141 pattern" nets, 3 types of "231 pattern" nets, only 1 type of "222 pattern" net, and only 1 type of "33 pattern" net.



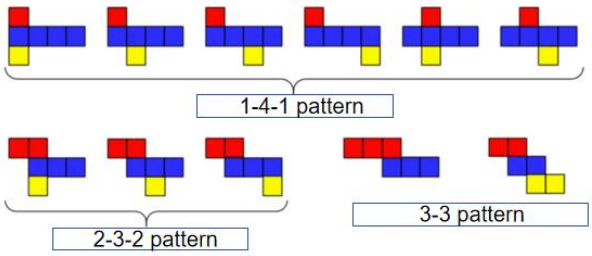
After understanding these 11 types of nets and thinking about the distribution rule of dice dots (the sum of dots on opposite faces is 7), let's try to decompose the dice net.

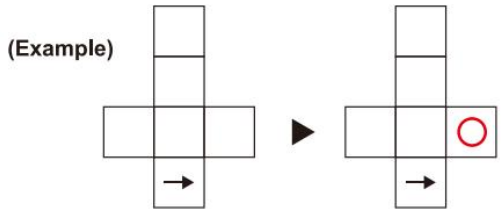


In the problem-solving process, students must try repeatedly and not give up easily.

3. Spliced and Unfolded Graphic

The solution method for this type of question is quite similar to that of dice net diagrams, both requiring the understanding and memorization of the 11 types of cube net diagrams. It is necessary to imagine the face pointed to by the arrow after folding the net diagram into a cube.





(Example Demonstration)

If you encounter difficulties in solving the problem, you can make a net diagram and actually fold it to find the face pointed to by the arrow after assembly.

4. Completing + - × Calculations

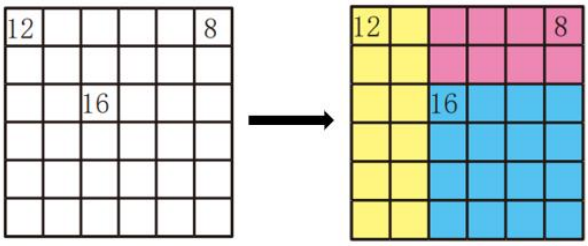
This type of question requires deducing the calculation symbols in reverse through the answers, exercising students' reverse thinking. When solving the problem, pay attention to the calculation rules regarding the multiplication sign, that is: multiplication first, then addition and subtraction.

(1) 6 □ 5 □ 4 □ 3 □ 2 □ 1 = 7

※ Must use "×".
6 +5 -4 +3 -2 -1 =7 is incorrect.

5. Multiplication Grid Integration

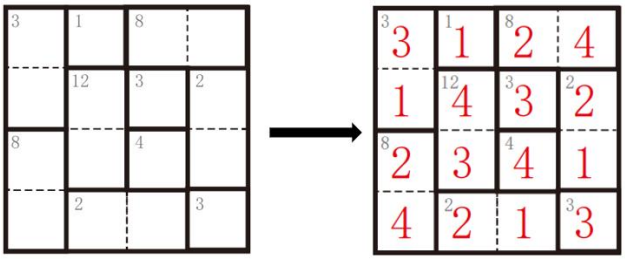
In the exercises, the multiplication table will be comprehensively and flexibly applied. When dividing grids, the multiplication tables of 2, 3, 6, and so on may be used. Therefore, please consider comprehensively and apply the learned multiplication tables flexibly to solve problems.



For example, in the exercise shown in the figure above, the multiplication tables "2×6=12", "2×4=8", and "4×4=16" are simultaneously used to decompose the grid.

6. Multiplication Maze

This type of question is similar to the number puzzle "Kakuro". First, let's understand the problem-solving rules: the small number in the upper left corner of the grid is the product of the numbers in the grid framed by thick lines. Fill in non-repeating numbers 1～4 in the grids of each row and column respectively, so that the product of the numbers in the grid framed by thick lines is consistent with the number in the upper left corner of the frame.



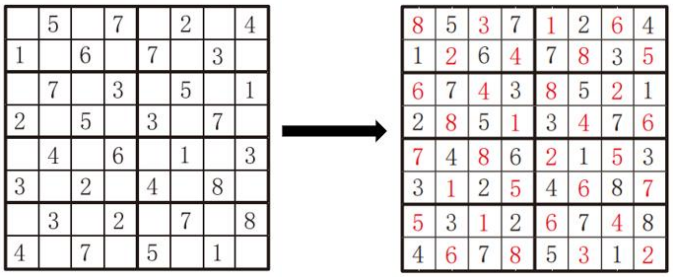
7. Sudoku

Sudoku is a well-known mathematical logic game that is solved with paper and pen. "Su" refers to numbers, and "Doku" means uniqueness. Students need to infer the numbers of all remaining blank cells based on the known numbers on the board, and ensure that each row, each column and each palace framed by thick lines contains numbers from 1 to N without repetition. Students are required to get the answers through observation and reasoning according to the known numbers and problem-solving conditions, so as to cultivate their observation ability, logical reasoning ability and problem-solving ability.

The Silver20-Silver24 include 6×6 Sudoku and 8×8 Sudoku exercises.

6×6 Sudoku: Fill in numbers 1-6 in the blank cells respectively, so that the rectangles framed by thick lines, each horizontal row and each vertical column all contain unique numbers from 1 to 6 without repetition.

8×8 Sudoku: Fill in numbers 1-8 in the blank cells respectively, so that the rectangles framed by thick lines, each horizontal row and each vertical column all contain unique numbers from 1 to 8 without repetition.



(8×8 Sudoku)

During the problem-solving process, students can start with the rows, columns or thick-framed rectangles with more numbers to narrow down the answer range.

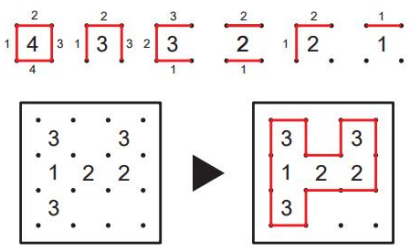
8. Pathfinding B

Slitherlink, is a classic mathematical puzzle game.

Slitherlink not only has the fun of drawing mazes, but also can train students to use logical thinking to infer calmly and systematically trace the clues, so as to comprehensively improve their mental ability. Different from Sudoku, Slitherlink requires connecting the dots according to the given hint numbers, and it is also one of the representative works in connection-type puzzles.

Problem-solving rules for Pathfinding B: Each number indicates the number of lines passing around it. Connect the dots to form a closed loop with the head and tail connected. Note: The direction of the connection can only be horizontal and vertical, not diagonal, and the connections cannot intersect; no lines can be drawn around the number 0; lines can be drawn in places without numbers.

(Example)



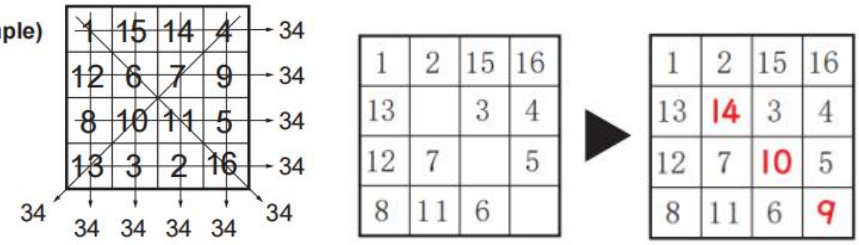
During the exercise, students need to clarify the number of lines that should appear around the numbers. In the problem-solving process, do not be anxious, infer calmly until the lines are connected into a loop.

9. Magic Square

Magic Square, also known as the vertical and horizontal diagram or magic chart in ancient times, is a mathematical game with a long history. What is a Magic Square? An n-order square matrix composed of n×n numbers, which has the property that the sum of numbers on each diagonal, each horizontal row and each vertical column is equal, is called a Magic Square.

The Magic Square practice involved in Silver20 is the 4-order Magic Square. It is necessary to fill in numbers from 1 to 16 in the blank spaces of the 16-grid square, so that the sum of numbers in each horizontal row, each vertical column and two diagonals in the Magic Square is the same (the sum is 34). Note that each number from 1 to 16 can only be used once. Students need to read the known information from the Magic Square, flexibly use the mastered knowledge to deduce the answer by continuous trial and error, so as to cultivate observation ability, calculation ability, logical thinking ability and reasoning ability.

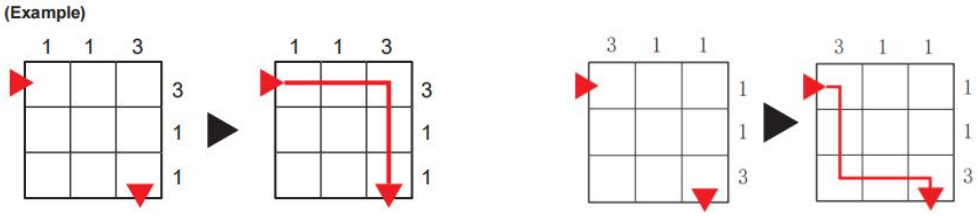
(Example)



Students can find the answer through repeated trial and error, that is, repeated reasoning and verification. For example, in the second column on the left, 2+ ? +7+11=34. Calculate the number in the blank space through this way of thinking, and check after getting the answer. Find the answer in this way!

10. Pathfinding C

Pathfinding C is a logic puzzle. The numbers represent the number of blank cells that the path passes through in each row and each column. Open a path from the starting point to the end point. Note that the same blank cell can only be passed once. The path can only go horizontally and vertically, not diagonally.

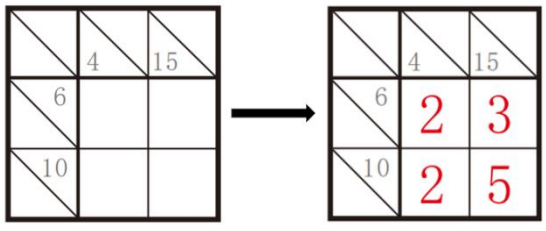


In the problem-solving process, students need to observe the numbers on both the horizontal and vertical sides at the same time, consider how to proceed to the next step while considering whether such progress meets the number requirements on both the horizontal and vertical sides. In accordance with the rules and problem-solving basis, solve the problem through continuous trial and error and reasoning verification!

11. Prime Number Maze

Prime Number: Also known as a prime, it refers to a natural number greater than 1 that has no other factors except 1 and itself. In other words, a natural number greater than 1 is a prime number if it can only be divisible by 1 and itself. For example, 2, 3, 5, 7 and 11 are all prime numbers because they can only be divisible by 1 and themselves.

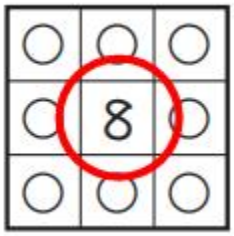
Prime Number Maze requires filling in prime numbers in the grid to make the multiplication of each row and each column hold true. The existing numbers represent the product of all numbers in the corresponding rows and columns. The filled numbers can appear repeatedly.



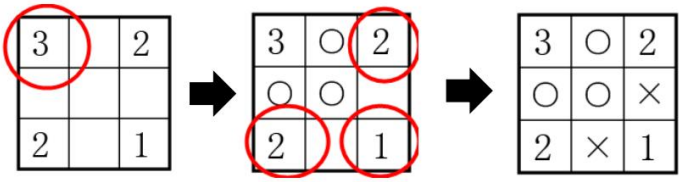
12. Mine sweeping

Find out which grid has a bomb through the numbers, draw ○ in the grid with a bomb, and draw × in the grid without a bomb. The number in the grid indicates the number of bombs around the number. How to determine it? Let's observe the example below.

The number 8 means there are 8 bombs around the number 8. We can draw a circle with 8 as the center, and the grids involved in this circle are the places where bombs are buried.

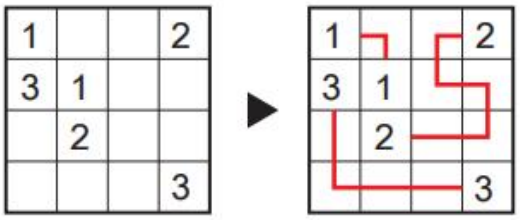


The number 3 means there are 3 bombs around the number 3. Draw a circle with 3 as the center, and you can determine the position of the bombs around 3. Use this method to judge the position of the bombs around several other numbers respectively. There are already 2 bombs around the two numbers 2, and 1 bomb around the number 1. After determining the positions of all bombs, you can draw × in the grids without bombs.



13. Number Pairing

Number Pairing is an interesting number puzzle, a bit similar to the well-known game 'Connect the Same'. Students need to connect the same numbers with lines. However, it should be noted that only horizontal or vertical lines can be used for connection. Each blank cell can only be passed once, cells with numbers cannot be passed, diagonal movement is not allowed, and the connecting lines cannot intersect with each other.



In the problem-solving process, students should carefully observe the numbers in the grid and all numbers at the same time. While considering connecting the same numbers, they should also consider whether it affects the connection of other numbers and whether it conforms to the problem-solving rules. Solve the problem through reasoning and verification.

14. Dividing Figure Area Equally

Dividing Figure Area Equally requires drawing a line passing through the blue dot to divide the area of the shape equally. When solving this type of question, it is necessary to memorize the area formulas of common plane figures.

Rectangle: Area = length × width, $S=ab$

Square: Area = side length × side length, $S=a^2$

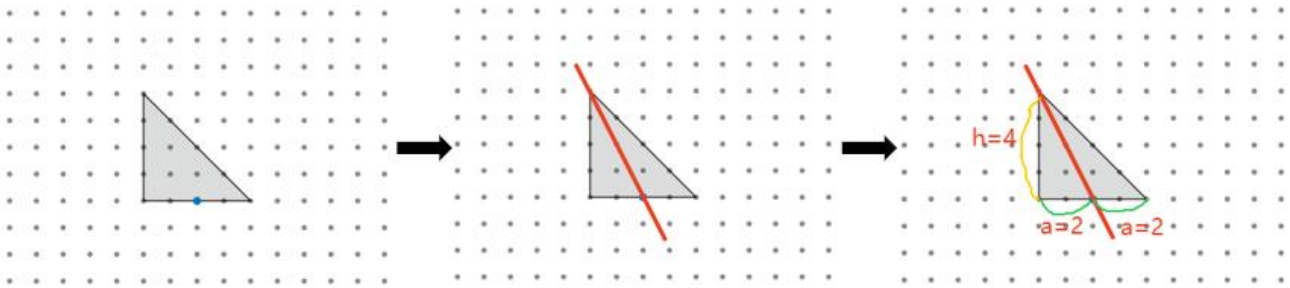
Triangle: Area = base × height ÷ 2, $S=ah/2$

Parallelogram: Area = base × height, $S=ah$

Trapezoid: Area = (upper base + lower base) × height ÷ 2, $S=(a+b)h/2$

Circle: Area = radius × radius × π

At the same time, it is also necessary to learn the use of auxiliary lines, for example, the following question:



Through thinking, it can be concluded that this red line can divide the area of the triangle equally, because the two triangles after division both have a base of 2 and a common height. Therefore, connecting the upper vertex with the blue point can divide the shape equally.

15. Six-piece Puzzle

The Six-piece Puzzle belongs to the challenging problem part and is an optional content (can be done or not). It is a training to cultivate students' hypothetical thinking ability, observation ability, graphic ability and other abilities by using the teaching aid 'Six-piece Puzzle'. The 'Six-piece Puzzlee' is the most suitable teaching aid for learning graphic basics. Another advantage of the 'Six-piece Puzzle' is that it can solve problems while having fun, which can help students 'fall in love with thinking'! How to place the figures as shown in the picture? Ask students to fully feel the characteristics of the Six-piece Puzzle, and it doesn't matter even if it is used upside down. Some parts may not be used when placing the figures. There is more than one answer and many methods. When using it, please remind students to pay attention to safety. There is no time limit for this part of the exercise, please keep challenging the difficult problem.

(Example)

If you cannot restore the Six-piece Puzzle to the box after operation, please ask students to observe the box cover and the cover of the exercise book, and the answer is here.