Maths Challenge

Creative and Critical Thinking Skills

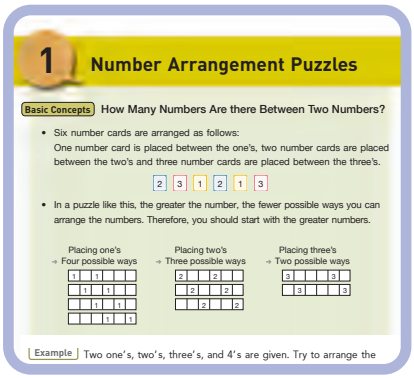
Ages 11-12
Intermediate



5A

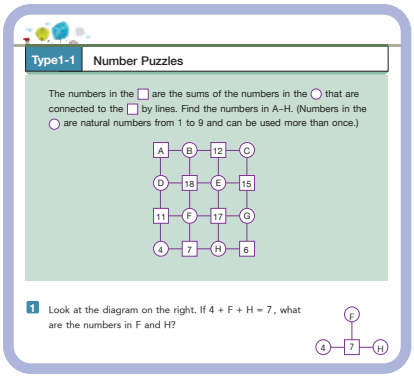
SAMPLE

How to Use This Book



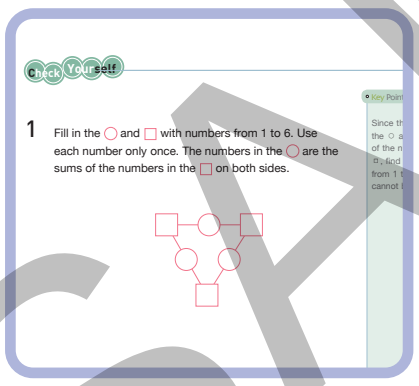
Basic Concepts

Creative Mathematics begins right here! At the beginning of each lesson, **Basic Concepts** presents the main idea, along with various examples and diagrams that illustrate the main idea. The problems here are based on the basic concepts. The Class Notes guide you through the procedure step by step.



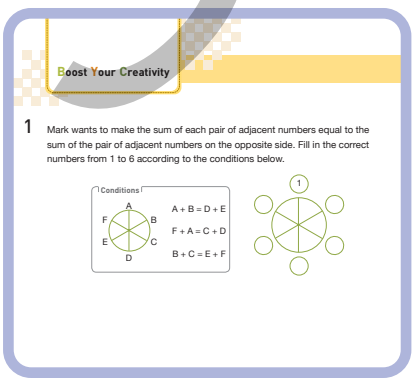
Types

The main types of questions for each topic are introduced here. Follow the steps to find the solution to each problem.



Check Yourself

Now that you have a good grasp of the basic concepts and types of problems, you can start on the different problems on your own. Key Points are provided to help you work towards the solution.



Boost Your Creativity

This is where you practise applying your creativity to problems. Think creatively in order to reach a logical solution for each problem.

SAMPLE



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SAMPLE

1 Number Arrangement Puzzles

Basic Concepts How Many Numbers Are there Between Two Numbers?

- Six number cards are arranged as follows:
  One number card is placed between the one's, two number cards are placed between the two's and three number cards are placed between the three's.

2	3	1	2	1	3

- In a puzzle like this, the greater the number, the fewer possible ways you can arrange the numbers. Therefore, you should start with the greater numbers.

Placing one's
→ Four possible ways

1		1			
	1		1		
		1		1	
			1		1

Placing two's
→ Three possible ways

2			2		
	2			2	
		2			2

Placing three's
→ Two possible ways

3				3	
	3				3

Example Two one's, two's, three's, and 4's are given. Try to arrange the eight numbers with the rules given above.

or

Class Notes

① When there are two one's, two's, three's and 4's you can place four numbers between two four's in ___ way(s). For each way, there is/are ___ way(s) to place three numbers between two three's.

4					4		
4		3			4	3	
4			3		4		3

	4					4	
	4					4	
	4					4	

		4					4
		4					4
		4					4

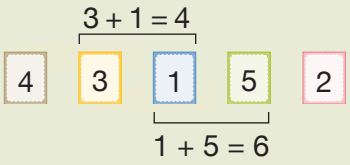
② If you try to place the numbers in each arrangement starting with four's, you will find that there are two different ways to place two numbers between two two's and one number between two one's. The two ways are as follows:

4		3			4	3	

SAMPLE

Basic Concepts What Is the Sum Between Two Numbers?

- Number cards from 1 to 5 are arranged such that the sum of the numbers between 4 and 5 is 4, and the sum of the numbers between 2 and 3 is 6.



- What Is the Sum Between Two Numbers? In this case, you should begin with numbers that have the greater sum in between them.

Example Arrange the numbers from 1 to 7 according to the conditions below.

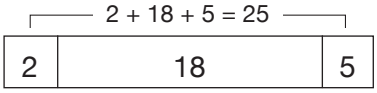
Conditions

1. The sum of the numbers between 1 and 6 is 11.
2. The sum of the numbers between 2 and 5 is 18.
3. The sum of the numbers between 3 and 4 is 3.

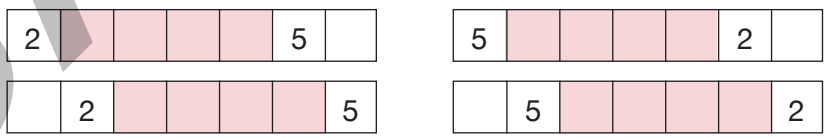


Class Notes

① The sum of all the numbers from 1 to 7 is 28.
According to condition 2, the sum of the numbers between 2 and 5 is ____. If you add 2 and 5 to that sum, you will get an answer of 25.



So, the possible number outside 2 and 5 is 28 – ____ = ____.



② According to condition 3, the sum of the numbers between 3 and 4 is 3.
So, the possible numbers between 3 and 4 are ____ and ____.



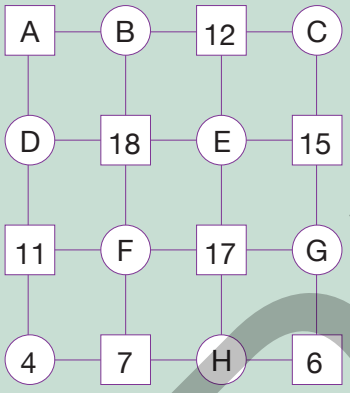
③ Fill in the rest of the numbers according to condition 1.



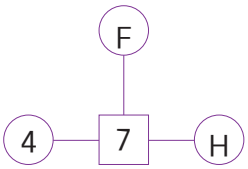
SAMPLE

Type1-1 Number Puzzles

The numbers in the □ are the sums of the numbers in the ○ that are connected to the □ by lines. Find the numbers in A~H. (Numbers in the ○ are natural numbers from 1 to 9 and can be used more than once.)



1 Look at the diagram on the right. If 4 + F + H = 7 , what are the numbers in F and H?



2 With your results from **1**, find the values of E, F, G and H to satisfy G + H = 6, and E + F + G + H = 17.

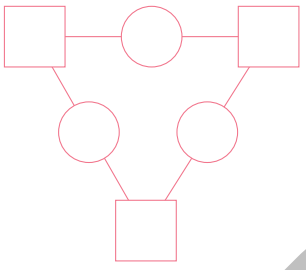
3 Using the values of E, F , G and H, find the values of the remaining letters.

SAMPLE

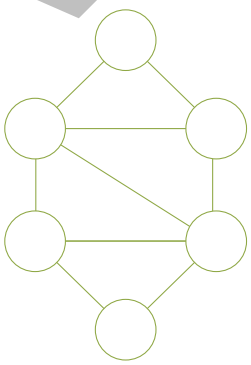


Check Yourself

1 Fill in the ○ and □ with numbers from 1 to 6. Use each number only once. The numbers in the ○ are the sums of the numbers in the □ on both sides.



2 Fill in the ○ with numbers from 1 to 6 such that two consecutive numbers ① — ② and ⑤ — ⑥, are not connected by lines.



Key Points

Since the numbers in the ○ are the sums of the numbers in the □, find all numbers from 1 to 6 that cannot be in the ○.

Write 1 and 6, which have the least consecutive numbers, in the ○s that are connected by the most number of lines.



SAMPLE

Type 1-2 Happy Number

Find the greatest 7-digit happy number that meets the conditions below. (The happy number is made up of seven natural digits.)

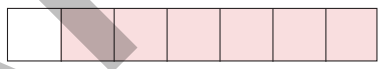
Conditions

ⓐ The sum of all seven digits is 30.
ⓑ A digit cannot be used more than once.
ⓒ The digit in the centre is the lucky digit 7.
ⓓ The greatest digit among the seven digits comes first.
ⓔ The sixth digit from the left is 3 times greater than the last digit.
ⓕ The fifth digit is equal to the difference between the third and fourth digits.

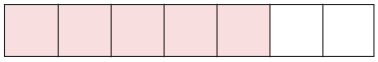


1 Based on conditions ⓐ, ⓑ and ⓒ find the seven digits.

2 Based on condition ⓓ, find the digit that comes first.



3 Based on condition ⓔ, find the last digit and the sixth digit. The sixth digit is three times greater than the last digit.



4 If the difference between the third and the fourth digits is equal to the fifth digit, find the greatest 7-digit number.



SAMPLE



Check Yourself

Key Points

Start with digits with the given position.

1 Find the smallest 7-digit number that meets the conditions below.

Conditions

ⓐ Use all digits from 1 to 7 only once.
ⓑ The last digit is the greatest number.
ⓒ The digit in the centre is the difference between the digits on both sides of the number.
ⓓ The digit that comes first is 5.
ⓔ The sum of the sixth digit and the digit in the centre is equal to the first digit.
ⓕ The difference between the second and third digits is equal to the sixth digit.

Start with the digits that have the greatest sum in between.

2 Based on the table below, fill in the digits from 1 to 9. Use each digit only once.

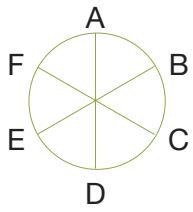
	Between 1 and 3	Between 3 and 6	Between 6 and 7	Between 7 and 9
Sum of the digits	5	8	21	29



SAMPLE

1 Mark wants to make the sum of each pair of adjacent numbers equal to the sum of the pair of adjacent numbers on the opposite side. Fill in the correct numbers from 1 to 6 according to the conditions below.

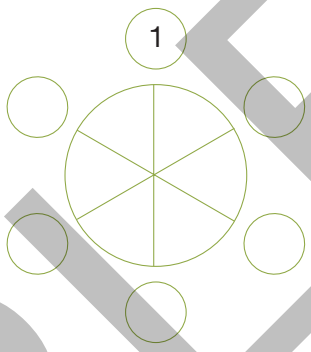
Conditions



$A + B = D + E$

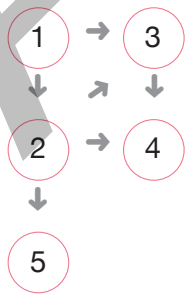
$F + A = C + D$

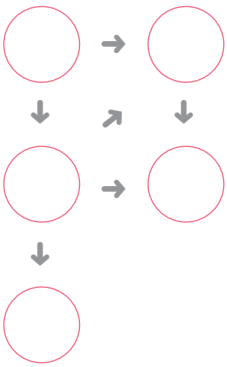
$B + C = E + F$

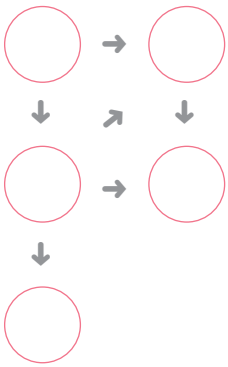


2 Using numbers from 1 to 5, write the appropriate numbers in the ○ to make the arrows start at a smaller number and end at a greater number. (Exclude the solution shown in the example.)

Example







SAMPLE



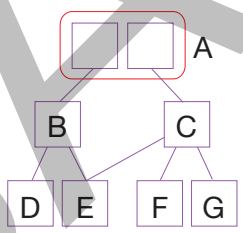
3 Using digits from 1 to 9 only once, find the smallest 9-digit number according to the conditions below.

Conditions

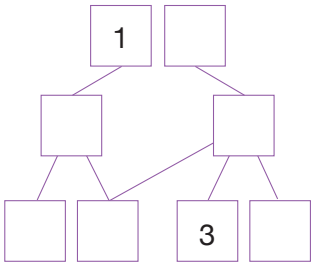
ⓐ The sum of the digits between 1 and 3 is 11.
ⓑ The sum of the digits between 4 and 6 is 8.
ⓒ The sum of the digits between 7 and 8 is 19.
ⓓ The sum of the digits between 8 and 9 is 26.

4 Arrange number cards: 2, 4, 5, 6, 7 and 9 according to the conditions below.

Conditions



A = B + C
B = D + E
C = E + F + G
F = 3



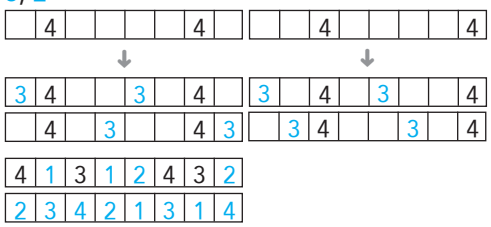
SAMPLE

Answer Key

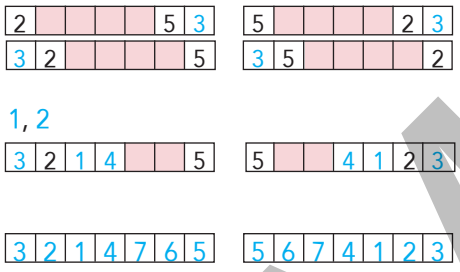
I Number Puzzles

1 Number Arrangement Puzzles p. 8 –p. 9

Example ① 3, 2



Example ① 18, 25, 3



② 1, 2

③

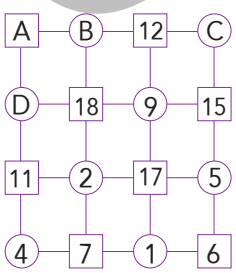
Type 1-1 Number Puzzles p. 10 –p. 11

1 The numbers in F and H are 1 and 2 to satisfy F + H = 3.

2 If F = 1 and H = 2, G + H = 6 implies that G = 4, and E + F + G + H = 17 implies that E = 10. But each value can only be a number from 1 to 9, which means that our assumption (F = 1, H = 2) is wrong. Therefore F = 2 and H = 1. G + H = 6 implies that G = 5, and E + F + G + H = 17 implies that E = 9.

→ E = 9, F = 2, G = 5, H = 1

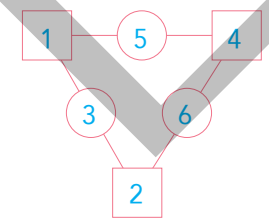
3



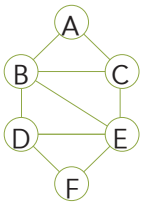
C + 9 + 5 = 15 implies that C = 1.
C + 9 + B = 12 implies that B = 2.
B + D + 9 + 2 = 18 implies that D = 5.
B + D = A implies that A = 7.
→ A = 7, B = 2, C = 1, D = 5

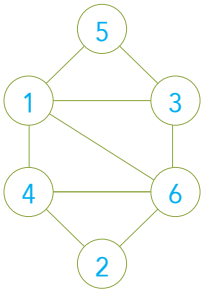
Check Yourself

1 The numbers 1 and 2 cannot be put in ○. Write 1 and 2 in □. Then fill in the rest of the ○ and □ according to the rule.



2 Write 1 and 6, which have the least consecutive numbers in the ○ that are connected by the most number of lines, B and E, respectively. Write 2 in F, the only ○ that is not connected to 1. Write 5 in A, the only ○ that is not connected to 6. Then write 3 in C, the remaining ○ that is not connected to 1 or 2. Finally, place the last number 4 in D.





SAMPLE