

THE NUMERICAL IQ MANUAL – SAMPLE SECTIONS

Prepare for the Unexpected

So far, a number in the series has been determined from an arithmetic operation on *one* previous number in the series. Sometimes a number in the series is constructed from an arithmetic operation on *two or more* previous numbers, as in the following example:

What is the missing number in this series?

1 2 3 5 8 13 ?

The difference between successive numbers in this series is

1 1 2 3 5

In this case, the series of differences is the same as the original series, except for the initial "1". This means that a number in the original series is obtained when you **add the two previous numbers** in the series: $1+2=3$, $2+3=5$, $3+5=8$, and $5+8=13$. So the missing number in the series is $8+13=21$.

The other operations of subtraction, multiplication, or division may also be involved in series of this type. The "difference" and "ratio" techniques described in the previous sections will help unveil what operation is utilized in a particular problem.

Here is an example where division is used:

What is the missing number in this series?

256 32 8 4 2 ?

The difference method is not fruitful in this case, so you should try taking successive ratios instead. The ratios are $256/32=8$, $32/8=4$, $8/4=2$, and $4/2=2$. This series of ratios is identical to the original series except for the final "2". This shows that a number in the original series is obtained when you **take the ratio between the two previous numbers** in the series: $256/32=8$, $32/8=4$, $8/4=2$. So the missing number in the series is $4/2=2$.

Sometimes a number in a series is determined from an arithmetic operation on more than one previous number.

Double Trouble

Another class of shaped analogy problems presents you with a *double* number row instead of a single number row, as in the example below:

In each figure below, the same arithmetic rule is applied to the three numbers in the squares to produce the number in the circle. Find the missing number in the circle of the third figure:

The diagrams show three examples of a double row analogy problem. Each example consists of a horizontal line with three squares above it and one square below it, followed by a circle. The first example has squares with 2, 6, and 3, and a circle with 15. The second example has squares with 5, 3, and 2, and a circle with 17. The third example has squares with 20, 10, and 50, and a circle with a question mark.

Here, a shaped number set consists of three numbers placed inside a succession of squares drawn either above or below a horizontal line, and a fourth number placed inside a circle drawn at the end of the horizontal line.

In each set, the same arithmetic rule is applied to the three numbers in the squares to produce the number in the circle. The third set has a missing number in the circle, and you are asked to determine this number. The solution approach is the same as in the previous sections: *identify the arithmetic rule from the example sets, then apply this rule to the set with the missing number.*

If the pattern of squares is *the same* in each of the three sets, as in the example above, *two* operations are usually involved in the arithmetic rule for double row analogy problems. One operation applies to the numbers in the *upper row* (numbers above the horizontal line), and the other operation applies to the numbers in the *lower row* (numbers below the horizontal line).

In the example problem above, *multiplication* is used for the upper row, and *addition* is used for the lower row. The rule is to **multiply the numbers in the upper squares, and add the number in the lower square to the result.** This rule works for the first two sets, since $(2 \times 6) + 3 = 12 + 3 = 15$ and $(5 \times 3) + 2 = 15 + 2 = 17$. Applying the same rule to the third set, we get $(20 \times 10) + 50 = 200 + 50 = 250$. So the missing number is 250.

Sometimes the pattern of squares in a double row analogy problem is *not* the same in each of the three sets. This usually indicates that a *single* operation should be performed on all three numbers in the squares, *where a square's position above or below the horizontal line indicates whether the number inside is positive or negative*.

Here is an example of this type of double row analogy problem:

In each figure below, the same arithmetic rule is applied to the three numbers in the squares to produce the number in the circle. Find the missing number in the circle of the third figure:

The first diagram shows a circle with the number 4. It is formed by three squares: two in the top row (2 and 3) and one in the bottom row (1). The second diagram shows a circle with the number 5. It is formed by three squares: two in the top row (6 and 2) and one in the bottom row (3). The third diagram shows a circle with a question mark. It is formed by three squares: two in the top row (1 and 5) and one in the bottom row (2).

This problem contains patterns of squares that are different in each of the three sets. Therefore, you should assume that the numbers are signed (positive or negative) according to whether they are in the upper or lower row.

You then need to look for a single operation to apply to all three signed numbers in a set to arrive at the number in the end circle. It turns out that the rule is to **add all the numbers in the squares, assuming the numbers in the squares in the upper row are positive and the numbers in lower row are negative**. This rule works for the first two sets, since $2+3+(-1)=4$ and $6+(-3)+2=5$. Applying this rule to the third set, we get $(-2)+1+5=4$. So the missing number is 4.

In double number row problems, a number's placement above or below the horizontal usually represents

- **A specific operation on the number, or**
- **The sign of the number**