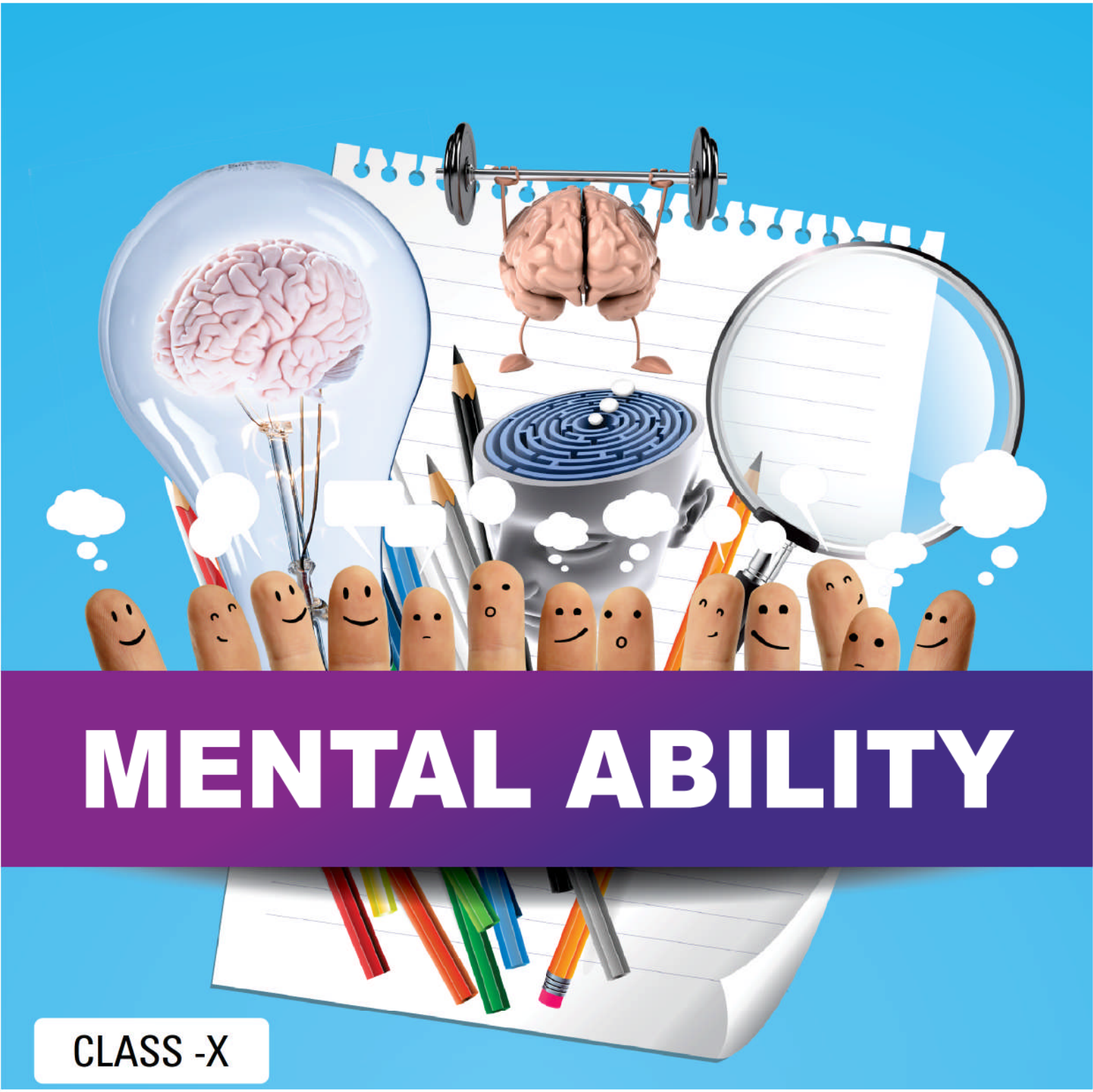

MENTAL ABILITY

CLASS -X

VERBAL AND NON-VERBAL REASONING

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CONTENT

MENTAL ABILITY

1
NUMBER SERIES

A number series is a collection of numbers which follow a particular pattern or rule. The pattern followed by the number in the series remains the same throughout. Each number in a number series is called a term.

CASE-I : COMPLETING THE GIVEN SERIES BY FINDING THE MISSING TERM(S) :

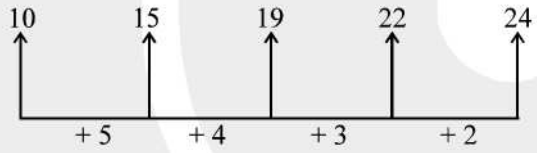
In problems, a number series is given with one or two terms missing therein. The missing term can be either at the end or in the middle or even at the beginning of the series. The missing term is normally indicated by a blank or a question mark. Students are required to identify the pattern followed by the terms in the series and find the missing number. Since the pattern followed by each series is different, it is not possible to give a general formula or technique to solve the problems. Students should observe the terms in the series carefully and find out the pattern followed.

For better understading, we classify this into the following categories.

Difference series : The differece series can be further, classified as follows:

(a) Number series with a constant difference ; Here the difference between two consecutive numbers is always constant. For example, the numbers of the series 1, 4, 7, 10, 13 ..... are such that the difference between two consecutive terms is constant. Here this difference is 3.

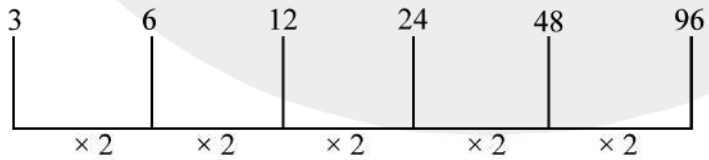
(b) Number series with increasing /decreasing difference : Here the difference between consecutive terms is not constant. It either decreases or increases, e.g. the series 10, 15, 19, 22, 24 ....



Here the difference between 1st & 2nd terms, 2nd & 3rd terms, 3rd & 4th terms and so on are 5, 4, 3, 2 respectively.

Since the difference between 22 & 24 is 2, the next difference should be 1. So, the number that comes after 24 should be 25.

Product series : Consider the series 3, 6, 12, 24, 48, 96.

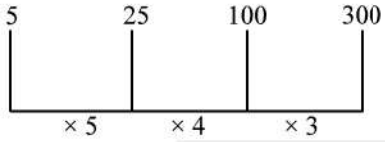


Here, each number in the series is multiplied by 2 to get the next term. So, the term that comes after 96 is 192.

Similarly we can have a series where numbers are obtained by dividing the previous term with a constant number, e.g. consider the series 81, 27, 9, 3..... Here, each term is obtained by dividing the previous term by 3 (or in other words by multiplying the previous term by 1/3).

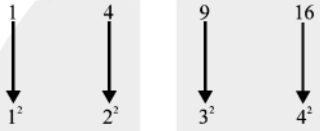
Therefore next term will be $3 \times \frac{1}{3} = 1$

Consider the series 5, 25, 100, 300.....



Here, the first term is multiplied by 5 to get the second term. The second term is multiplied by 4 to get the third term. The third term is multiplied by 3 to get the fourth term. Therefore to get the fifth term, we have to multiply fourth term by 2, i.e.the fifth term is 600. Here each term is multiplied by decreasing factor (or it could also be an increasing factor) to get the next term.

Squares/Cubes series : There can be a series where all the terms are related to the square of numbers or cube of numbers. There can be many variations in such series. For example, each term of the series may be the square of a natural number such as 1, 4, 9, 16 ....



Here the term that follows 16 will be square of 5, i.e. 25.
The terms of the series may be the square of odd number, e.g. 1, 9, 25, 49 ..... or even numbers e.g. 4, 16, 36, 64.....

Combination series : This is a type of series where more than one arithmetic operation is performed. Let us take an example. 1, 3, 7, 2, 6, 10, 3, 9, 13 .....
Here the first term is multiplied by 3 to get the second term. To get the third term we add 4 to the second term. To get the 4th term, we add 1 to the first term. After this the cycle will be repeated.
Thus 5th term = $2 \times 3 = 6$
6th term = $6 + 4 = 10$
7th term = $2 + 1 = 3$ and so on.
Consider another series, 1, 2, 6, 21, 88 ....
Here, we can observe that 88 is close to the 4 times of 21 or it is $21 \times 4 + 4$. Similarly 21 is $6 \times 3 + 3$, 6 is $2 \times 2 + 2$ and 2 is $1 \times 1 + 1$. So the next term to 88 should be $88 \times 5 + 5 = 445$

Triangular Pattern Series : Sometimes, the differences between the consecutive terms of a series, again form a series. The differences between the consecutive terms of the new series so formed, again form a series. This pattern continues till we attain a uniform difference between the consecutive terms of the series.

Miscellaneous series : Take the series 1, 3, 5, 7, 9, 11, 13 ..... It is a series of odd numbers. So the next term will be 15. There can be many variations in miscellaneous series e.g. 2, 12, 30, 56, 90, 132 .....
This is series of product of two series, as $1 \times 2, 3 \times 4, 5 \times 6, 7 \times 8, 9 \times 10, 11 \times 12$. We can explain this series as product of odd number and even number series.

CASE-II : FINDING THE WRONG TERMS IN THE GIVEN SERIES. (NUMBER ODDMAN OUT) :

The concept is very much similar to the one learnt in 'number series'. In number series we are required to find the missing term, whereas in 'number oddman' we are required to find the wrong term which does not follow the pattern. In both the cases, our main work is to observe the terms of the given number series carefully and to identify the pattern followed therein.

Let us consider some examples to understand the concept of oddman.

(a) 1 4 9 16 25 36 63 81

On observing the terms of the above number series carefully, we notice that all the terms except 63 are perfect squares of natural numbers. 63 is not a square of a natural number. Hence, 63 is the oddman.

(b) 235 354 424 541 613

This problem is somewhat tricky. The sum of digits of each term except 354 si 10. The sum of digits of 354 is 3 + 5 + 4 = 12. Hence 354 is the oddman.

CASE-III : CORELATION OF THE SERIES [TWO SERIES ARE GIVEN IN WHICH SECOND SERIES FOLLOWS THE PATTERN OF FIRST SERIES :

CASE-IV : ELEMENTARY IDEA OF PROGRESSIONS :

(i) **Arithmetic Progression (A.P.) :** The sequence of the form a, a + d, a + 2d, a + 3d, ... is known as an Arithmetic Progression (A.P.), where a is called first term and d is called common difference.

For example : 3, 6, 9, 12, ... is an A.P. with a = 3 and d = 6 - 3 = 3.

Note : In an A.P., we have nth term = a + (n – 1) d

(ii) **Geometric Progression (G.P.) :** The sequence of the form a, ar, ar^2, ar^3, ... is known as a geometric progression (G.P.) where a is first term and r is common ratio.

For example : 1, 5, 25, 125, ... is a G.P. with a = 1 and $r = \frac{5}{1} = \frac{25}{5} = 5$.

Note : In a G.P. we have nth term = ar^{n-1}.

EXERCISE - 1

Find the missing term(s) in the following questions :

Q.1 0, 4, 6, 3, 7, 9, 6, ?, 12
(1) 14 (2) 8 (3) 10 (4) 11

Q.2 0, 3, 12, 30, ?, 105, 168
(1) 63 (2) 62 (3) 61 (4) 60

Q.3 4, 18, 48, 100, ? ,
(1) 150 (2) 163 (3) 180 (4) 210

Q.4 11, 10, ?, 100, 1001, 1000, 10001
(1) 101 (2) 110 (3) 111 (4) None of these

Q.5 5, 2, 11, 23, ?
(1) 196 (2) 367 (3) 254 (4) 235

Q.6 3, 7, 23, 95, ?
(1) 62 (2) 128 (3) 479 (4) 575

Q.7 2, 7, 27, 107, 427, ?
(1) 1262 (2) 1707 (3) 4027 (4) 4207

Q.8 3, 10, 101, ?
(1) 10101 (2) 10201 (3) 10202 (4) 11012

Q.9 2, 15, 4, 12, 6, 7, ?, ?
(1) 8, 8 (2) 8, 0 (3) 3, 8 (4) None of these

Q.10 8, 9, 8, 7, 10, 9, 6, 11, 10, ?, 12
(1) 5 (2) 7 (3) 8 (4) 11

Q.11 $11\frac{1}{9}, 12\frac{1}{2}, 14\frac{2}{7}, 16\frac{2}{3}, ?$

(1) $8\frac{1}{3}$ (2) $19\frac{1}{2}$ (3) 20 (4) $22\frac{1}{3}$

Q.12 2, 9, 28, ?, 126, 217, 344
(1) 50 (2) 65 (3) 70 (4) 82

Q.13 210, 120, ?, 24, 6, 0
(1) 64 (2) 48 (3) 35 (4) 60

Q.14 2, 12, 36, 80, 150, ?
(1) 194 (2) 210 (3) 252 (4) 258

Q.15 8, 15, 28, 53, ?
(1) 120 (2) 106 (3) 104 (4) 102

Q.16 12, 15, 18, 21, ?
(1) 24 (2) 23 (3) 22 (4) 25

Q.17 2, 10, 19, 29, 40, 52, 65, 79, 94, ?
(1) 110 (2) 109 (3) 108 (4) None of these

Q.18 4, 7, 10, 11, 22, 17, 46, 25, ?
(1) 58 (2) 69 (3) 86 (4) 94

Q.19 2, 2, 4, 4, 6, 8, 8, ?
(1) 10 (2) 12 (3) 14 (4) 16