

## NUMBER AND LETTER SERIES

fourth term by 2, i.e., the fifth term is 480. **So, each term is multiplied by a decreasing factor (or it could also be an increasing factor) to get the next term.** That is, with whatever number a particular term is multiplied to get the next term, this latest term is multiplied by a number different from the previous multiplying factor to get the next term of the series. All the multiplying factors follow a certain pattern (normally of increasing or decreasing order).

Consider the series 2, 6, 12, 20, 30, .....

|    |    |     |     |    |
|----|----|-----|-----|----|
| 2, | 6, | 12, | 20, | 30 |
| ↓  | ↓  | ↓   | ↓   | ↓  |
| +4 | +6 | +8  | +10 |    |

This can be looked at a series of increasing differences. The differences of consecutive pairs of terms are 4 (between 2 and 6), 6 (between 6 and 12), 8 (between 12 and 20), 10 (between 20 and 30) and so on. Hence, the difference between 30 and the next term should be 12 and so the next term will be 42. But this series can also be looked at as a product series.

|       |       |       |       |       |
|-------|-------|-------|-------|-------|
| 2,    | 6,    | 12,   | 20,   | 30    |
| ↓     | ↓     | ↓     | ↓     | ↓     |
| 1 x 2 | 2 x 3 | 3 x 4 | 4 x 5 | 5 x 6 |

The first term is the product of 1 and 2; the second term is the product of 2 and 3; the third term is the product of 3 and 4; the fourth term is the product of 4 and 5; the fifth term is the product of 5 and 6. Hence, the next term will be the product of 6 and 7, that is 42.

### Squares/Cubes Series:

There can be series where all the terms are related to the squares of numbers or cubes of numbers. With squares/cubes of numbers as the basis, there can be many variations in the pattern of the series. Let us look at various possibilities of series based on squares/cubes.

Each term of the series may be the square of a natural number, such as 1, 4, 9, 16, .....

|                |                |                |                |
|----------------|----------------|----------------|----------------|
| 1,             | 4,             | 9,             | 16             |
| ↓              | ↓              | ↓              | ↓              |
| 1 <sup>2</sup> | 2 <sup>2</sup> | 3 <sup>2</sup> | 4 <sup>2</sup> |

The numbers are squares of 1, 2, 3, 4 .... respectively. The number which follows 16 (which is the square of 4) will be 25 (which is the square of 5).

The terms of the series may be the squares of odd numbers (for example, 1, 9, 25, 49, .....) or even numbers (for example, 4, 16, 36, 64, .....

The terms of the series could be such that a number and its square are both given one after the other and such pairs are given in some specific pattern. For example, take the series 2, 4, 3, 9, 4, 16, .....

|    |    |    |    |    |    |
|----|----|----|----|----|----|
| 2, | 4, | 3, | 9, | 4, | 16 |
| ↓  | ↓  | ↓  | ↓  | ↓  | ↓  |
| +1 |    | +1 |    |    |    |

Here, 2 is followed by its square 4; then comes the number 3 (which is one more than 2) followed by its square 9 and so on. Hence, the next number in the series is 5 and the one after that is its square i.e., 25.

Similarly, each term could be the square root of its predecessor. For example, in the series 81, 9, 64, 8, 49, 7, 36, ....., 81 is the square of 9, 64 the square of 8, and so on. Therefore the next number which follows in the series should be the square root of 36, i.e., 6.

The terms of the series could be the squares of natural numbers increased or reduced by certain number. For example, in the series 3, 8, 15, 24, .....

|                    |                    |                    |                    |
|--------------------|--------------------|--------------------|--------------------|
| 3,                 | 8,                 | 15,                | 24                 |
| ↓                  | ↓                  | ↓                  | ↓                  |
| 2 <sup>2</sup> - 1 | 3 <sup>2</sup> - 1 | 4 <sup>2</sup> - 1 | 5 <sup>2</sup> - 1 |

We have {Squares of natural numbers - 1} as the terms. The first term is 2<sup>2</sup> - 1; the second term is 3<sup>2</sup> - 1; the third term is 4<sup>2</sup> - 1 and so on. Hence, the next term will be 6<sup>2</sup> - 1, i.e., 35 [Please note that the above series can also be looked at as a series with increasing differences. The differences between the 1<sup>st</sup> & 2<sup>nd</sup> terms, the 2<sup>nd</sup> & 3<sup>rd</sup> terms, and so on are 5, 7, 9, and so on. Hence, the next difference should be 11 giving us the next term as 35]. There could also be a series with {squares of natural numbers + some constant}.

Like we have seen series with squares of numbers, we can have similar series with cubes of numbers. For example, take the series 1, 8, 27, 64, ....

|                |                |                |                |
|----------------|----------------|----------------|----------------|
| 1,             | 8,             | 27,            | 64             |
| ↓              | ↓              | ↓              | ↓              |
| 1 <sup>3</sup> | 2 <sup>3</sup> | 3 <sup>3</sup> | 4 <sup>3</sup> |

Here, all the terms are cubes of natural numbers. So, the next term will be 5<sup>3</sup>, i.e., 125.

Consider the series 2, 9, 28, 65, .....

|                    |                    |                    |                    |
|--------------------|--------------------|--------------------|--------------------|
| 2,                 | 9,                 | 28,                | 65                 |
| ↓                  | ↓                  | ↓                  | ↓                  |
| 1 <sup>3</sup> + 1 | 2 <sup>3</sup> + 1 | 3 <sup>3</sup> + 1 | 4 <sup>3</sup> + 1 |

Here, the terms are {Cubes of natural numbers + 1}. The first term is 1<sup>3</sup> + 1; the second term is 2<sup>3</sup> + 1; the third term is 3<sup>3</sup> + 1 and so on. Hence the next term will be 5<sup>3</sup> + 1, i.e., 126.

### Miscellaneous Series:

There are series that do not come under the other patterns and are of general nature but are important and are fairly common. Even here, some times, there can be a specific pattern in some cases.

Take the series 3, 5, 7, 11, 13, ....., This is a series of consecutive PRIME NUMBERS. It is an important series and the student should look out for this as one of the patterns. The next term in this series is 17.

There can also be variations using prime numbers. Take the series 9, 25, 49, 121, ....., In this series, the terms are squares of prime numbers. Hence, the next term is 13<sup>2</sup>, i.e., 169.

Take the series 15, 35, 77, ..... The first term is  $3 \times 5$ ; the second term is  $5 \times 7$ ; the third term is  $7 \times 11$ ; here the terms are product of two consecutive prime numbers. So, the next term will be the product of 11 and 13, i.e., 143.

Take the series 8, 24, 48, 120, 168, ..... Here, the 2<sup>nd</sup> term is 3 times the first term and the 3<sup>rd</sup> term is 2 times the 2<sup>nd</sup> term, but after that it does not follow this pattern any more. If you look at the terms carefully, you will find that the terms are {one less than squares of prime numbers}. Hence, the next term will be  $17^2 - 1$ , i.e., 288.

Consider the series 1, 4, 9, 1, 6, 2, 5, 3, .....

At first sight there is nothing we can say about the series. This is actually a series formed by squares of natural numbers. However, if any of the squares is in two or more digits, each of the digits is written as a separate term of the series. Thus, the first terms are 1, 4 and 9, the squares of 1, 2 and 3 respectively. After this, we should get 16 (which is the square of 4). Since this has two digits 1 and 6, these two digits are written as two different terms 1 and 6 in the series. Similarly, the next square 25 is written as two different terms 2 and 5 in the series. So, the next square 36 should be written as two terms 3 and 6. Of these, 3 is already given. So, the next term of the series is 6.

Consider the series 1, 1, 2, 3, 5, 8, .....

|    |    |     |     |     |     |
|----|----|-----|-----|-----|-----|
| 1, | 1, | 2,  | 3,  | 5,  | 8   |
|    |    | ↓   | ↓   | ↓   | ↓   |
|    |    | 1+1 | 1+2 | 2+3 | 3+5 |

Here, each term, starting with the third number, is the sum of the two preceding terms. After taking the first two terms as given (1 and 1), then onwards, to get any term, we need to add the two terms that come immediately before that position. Hence, to get the next term of the series, we should take the two preceding terms 5 and 8 and add them up to get 13. So, the next term of the series is 13. The term after this will be 21 ( $= 8 + 13$ ).

### Combination Series:

A number series which has more than one type of (arithmetic) operation performed or more than one series combined together is a combination series. The series that are combined can be two series of the same type or could be different types of series as described above. Let us look at some examples.

First let us look at those series which are formed by more than one arithmetic operation performed on the terms to get the subsequent terms.

Consider the series: 2, 6, 10, 3, 9, 13, 4, 12, ..... Here, the first term 2 is multiplied by 3 to get the second term, and 4 is added to get the third term. The next term is 3 (one more than the first term 2) and it is multiplied by 3 to get 9 (which is the next term) and then 4 is added to get the next term 13. The next term 4 (which is one more than 3) which is multiplied with 3 to get 12. Then 4 is added to this to get the next number 16.

Consider the series: 1, 2, 6, 21, 88, ..... Here, we can observe that 88 is close to 4 times 21. It is in fact  $21 \times 4 + 4$ . So, if we now look at the previous term 21, it

is related to the previous term 6 as  $6 \times 3 + 3$ . Now we get the general pattern: to get any term, multiply the previous term with  $k$  and then add  $k$  where  $k$  is a natural number with values in increasing order from 1. So, to get the second term, the first term has to be multiplied with 1 and then 1 is added. To get the third term, the second term is multiplied with 2 and then 2 is added and so on. Hence, after 88, the next term is  $88 \times 5 + 5$ , i.e., 445.

Now, let us look at a series that is formed by combining two (or more) different series. The two (or more) series can be of the same type or of different types described above.

Consider the series: 8, 12, 9, 13, 10, 14, ..... Here the 1<sup>st</sup>, 3<sup>rd</sup>, 5<sup>th</sup>, ... terms which are 8, 9, 10, ..... form one series whereas the 2<sup>nd</sup>, 4<sup>th</sup>, 6<sup>th</sup>, etc. terms which are 12, 13, 14 form another series. Here, both series that are being combined are two simple constant difference series. Therefore the missing number will be the next term of the first series 8, 9, 10, ... which is equal to 11.

Consider the series: 0, 7, 2, 17, 6, 31, 12, 49, 20, .... Here, the series consisting of 1<sup>st</sup>, 3<sup>rd</sup>, 5<sup>th</sup>, ..... terms (i.e., the series consisting of the odd terms) which is 0, 2, 6, 12, 20, ... is combined with another series consisting of 2<sup>nd</sup>, 4<sup>th</sup>, 6<sup>th</sup>, ... terms (i.e., the series consisting of the even terms) which is 7, 17, 31, 49, ..... The first series has the differences in increasing order 2, 4, 6, 8, 10 and so on. The second series also has the difference in increasing order 10, 14, 18, ..... Since, the last term 20 belongs to the first series, a number from the second series should follow next. The next term of the second series will be obtained by adding 22 to 49, that is 71.

Consider the series: 1, 1, 4, 8, 9, 27, ..... Here, the series of squares of natural numbers is combined with the series of cubes of natural numbers. The next term in the series will be 4.

Consider the series: 2, 4, 5, 9, 9, 16, 14, ?, 20, ..... Here, we have to find out the term that should come in place of the question mark. The odd terms form one series 2, 5, 9, 14, 20, ... where the difference is increasing. The differences are 3, 4, 5, 6, ..... This series is combined with the series of even terms 4, 9, 16, ..... where the terms are squares of numbers 2, 3, 4, ..... Hence, the term that should come in place of the question mark is the next term of the second series which is  $5^2$ , i.e., 25.

### A general approach to Number Series:

The best way of approaching the number series questions is to first observe the difference between terms. If the difference is constant, it is a constant difference series. If the difference is increasing or decreasing by a constant number, then it is a series with a constant increasing or decreasing difference. If there is no constant increasing or decreasing difference, then try out the product series approach. For this, first divide the second term with the first term, third with the second, and so on. If the numbers obtained are the same, then it is a product series. Alternatively, try writing each term of the series as a product of two factors and see if there is any pattern that can be observed. If still there is no inference, but the difference is increasing or decreasing in a rapid manner, then check out the square series.

If the increase is very high, and it is not a square series, then try out the cube series.

If the difference is alternately decreasing and increasing (or increasing for some time and alternately decreasing), then it should most probably be a mixed series. Therefore test out the series with alternate numbers. If still the series is not solved, try out the general series.

The following are different models in number series questions.

- To find next/missing number.
- To find one wrong number.
- To find two wrong number.
- To find a particular term in a new series formed on the basis of a given series.
- To find a particular terms in the new series formed using the wrong number in the given series, as the first number.

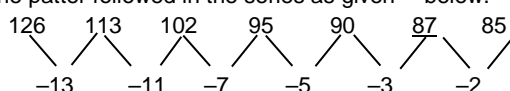
Let us study the following examples.

1. Find the missing number in the following series.

126, 113, 102, 95, 90, \_\_\_\_\_, 85

- (A) 86 (B) 87 (C) 88  
(D) 89 (E) None of these

**Sol.** The pattern followed in the series as given below.



The differences are consecutive prime numbers in decreasing order. Hence, 87 is the missing number.

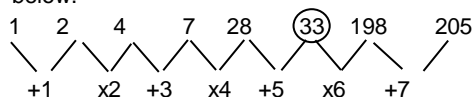
Choice (B)

2. In the following series a wrong number is given. Find the wrong number.

1, 2, 4, 7, 28, 140, 198, 205

- (A) 198 (B) 4 (C) 205  
(D) 140 (E) 28

**Sol.** The pattern followed in the given series is as given below.



In the series 140 is given instead of 33.

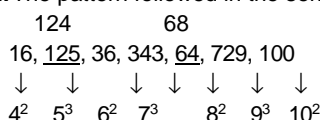
Hence, 140 is the wrong number. Choice (D)

3. In each of the following series two wrong numbers are given out of which one differs by a margin of 1 i.e. +1 or -1 and the other with a greater margin. From the choices choose the number that is differing by the greater margin. The first and the last number in the series are always correct.

16, 124, 36, 343, 68, 729, 100

- (A) 343 (B) 124 (C) 68  
(D) 100 (E) 729

**Sol.** The pattern followed in the series is as given below.



In the given series 124 and 68 are the wrong numbers. Among them 68, differs by a greater margin.

Choice (C)

4. In each of these questions a number series is given. After the series, a number is given along with (a), (b), (c), (d) and (e). You have to complete the series starting with the number given to find the values of (a), (b), (c), (d) and (e) applying the same pattern followed in the given series. Then answer the question given below each.

3, 11, 25, 77, 157, 473

5, (a), (b), (c), (d), (e)

What is the value of (d)?

- (A) 257 (B) 341 (C) 312  
(D) 411 (E) 273

**Sol.** The pattern followed in the series is:

$3 \times 3 + 2, 11 \times 2 + 3, 25 \times 3 + 2, 77 \times 2 + 3, 157 \times 3 + 2, 473$

∴ The new series is:

$5 \times 3 + 2, 17 \times 2 + 3, 37 \times 3 + 2, 113 \times 2 + 3, 341$

(a) (b) (c) (d)

∴ The value of (d) is 341.

Choice (B)

5. Each question contains a number series one of the number is a wrong number. Find out the wrong number and form a new series starting with the wrong number and using the pattern in the given series. Answer the questions based on the new series.

10, 11, 15, 24, 42, 65, 101

Find the third number in the series.

- (A) 47 (B) 36 (C) 17  
(D) 28 (E) 74

**Sol.** The pattern followed in the series is: 42

$10^{+1}, 11^{+4}, 15^{+9}, 24^{+16}, 42^{+25}, 65^{+36}, 101$

The differences are squares of consecutive natural numbers. Hence, 42 is the wrong number.

The new series is:

$42^{+1}, 43^{+4}, 47^{+9}, 56^{+16}, 72^{+25}, 97^{+36}, 133$

The third number in the series is 47.

Choice (A)

## Letter Series - Type I

The questions here are similar to the questions in Number Series Type I. Instead of numbers we have letters of the alphabet given here. We have to first identify the pattern that the series of letters follow. Then, we have to find the missing letter based on the pattern already identified. In Number Series, we saw different patterns that the numbers in the series can follow - like squares, cubes. In letter series, obviously, patterns like squares, cubes will not be possible. In Letter Series, in

general, we have a series with constant or increasing or decreasing differences. The position of the letters in the English alphabet is considered to be the value of the alphabet in questions on Letter Series. Also, when we are counting, after we count from A to Z, we again start with A, i.e., we treat the letters as being cyclic in nature. Like in Number Series, in this type of Letter Series also, we can have a "combination" of series, i.e., two series are combined and given. We need to identify the pattern in the two series to find out the missing letter. Sometimes, there will be some special types of series also. Let us look at a few examples to understand questions on Letter Series.

1. Find the next letter in the series  
D, G, J, M, P, \_\_\_\_\_  
(A) Q (B) R (C) S (D) T (E) Z
- Sol.** Three letters are added to each letter to get the next letter in the series.  
i.e.,  $D^{+3}, G^{+3}, J^{+3}, M^{+3}, P^{+3}, \underline{S}$   
 $P+3$  and  $P = 16$  and  $16 + 3 = 19$  and the 19<sup>th</sup> letter in the alphabet is S. Choice (C)
2. Find the next letter in the series  
A, B, D, H, \_\_\_\_\_  
(A) L (B) N (C) R (D) P (E) Q
- Sol.** Each letter in the given series is multiplied with 2 to get the next letter in the series.  
 $A \times 2 \Rightarrow 1 \times 2 = 2$  and the 2<sup>nd</sup> letter is B,  
 $B \times 2 \Rightarrow 2 \times 2 = 4$  and the 4<sup>th</sup> letter is D.  
Similarly,  $H \times 2 \Rightarrow 8 \times 2 = 16$  and the 16<sup>th</sup> letter is P. Choice (D)
3. What is the next letter in the series?  
B, D, G, K, P, \_\_\_\_\_  
(A) S (B) V (C) W (D) X (E) Y
- Sol.**  $B^{+2}, D^{+3}, G^{+4}, K^{+5}, P^{+6}, \underline{V}$   
 $P + 6 = 16 + 6 = 22$  and the 22<sup>nd</sup> letter is V. Choice (B)
4. I, X, J, W, K, V, L, \_\_\_\_\_  
(A) M (B) U (C) S (D) T (E) V
- Sol.** The given series is an alternate series.  
 $I^{+1}, J^{+1}, K^{+1}, L$  is one series and  
 $X^{-1}, W^{-1}, V^{-1}, \underline{U}$  is the other series.  
 $X - 1 = W, W - 1 = V$  and  $V - 1 = 22 - 1 = 21$   
and the 21<sup>st</sup> letter is U. Choice (B)

## Letter Series - Type II

The questions here are similar to those that we saw in Number Series Type II. Instead of a sequence of numbers given here we have a sequence of letters given. The letters given in the sequence need not (and in most of the cases, do not) follow any order or pattern. The student is asked to count how many times a particular letter (or group of letters) satisfying some conditions occurs and mark that number as the answer choice. Let us take some examples.

1. In the following sequence of letters how many vowels are immediately preceded by a vowel and immediately followed by a vowel?  
cpeajebcsmatammfdadhcoauidpakseadfaje  
afdc~~aa~~ae~~ka~~ae  
(A) Three (B) Four (C) Five  
(D) Six (E) Two
- Sol.** In the given letter sequence  
cpeajebcsmatammfdadhcoauidpakseadfaje  
afdc~~aa~~ae~~ka~~ae  
3 4 5 6  
There are 6 vowels which are immediately preceded by a vowel and immediately followed by a vowel. Choice (D)
2. In the following letter sequence, how many instances are there in which a vowel is immediately preceded and immediately followed by a consonant?  
spruatpghjtkpserplmijkmporkgluwrablhtupqm  
(A) Six (B) Five (C) Seven  
(D) Eight (E) Nine
- Sol.** In the given letter sequence  
spruatpghjtkpserplmijkmporkgluwrablhtupqm  
1 2 3 4 5 6  
There are six instances where a vowel is immediately preceded and is followed by a consonant. Choice (A)

### Exercise – I(a)

**Directions for questions 1 to 39:** Complete the following series.

1. 225, 224, \_\_\_\_\_, 222, 221  
(A) 220 (B) 223 (C) 219  
(D) 226 (E) 218
2. 17, 19, 23, 29, 31, 37, \_\_\_\_\_  
(A) 47 (B) 43 (C) 40 (D) 42 (E) 41
3. 225, 196, 169, \_\_\_\_\_, 121, 100, 81  
(A) 156 (B) 144 (C) 136  
(D) 125 (E) 123
4. 12, 14, 15, 16, 18, 20, \_\_\_\_\_  
(A) 22 (B) 25 (C) 21  
(D) 23 (E) 27
5. 64, 125, 216, 343, \_\_\_\_\_  
(A) 64 (B) 424 (C) 317  
(D) 512 (E) 384
6. 97, 83, 73, 67, 59, \_\_\_\_\_  
(A) 53 (B) 49 (C) 47 (D) 51 (E) 57
7. 54, 66, 82, 102, 126, \_\_\_\_\_  
(A) 146 (B) 130 (C) 154  
(D) 144 (E) 126
8. 56, 93, 124, \_\_\_\_\_, 176, 195, 212  
(A) 147 (B) 153 (C) 161  
(D) 168 (E) 173
9. 7, 11, 20, 36, 61, \_\_\_\_\_, 146  
(A) 25 (B) 91 (C) 97 (D) 92 (E) 122
10. 75, 291, 416, 480, 507, \_\_\_\_\_  
(A) 515 (B) 532 (C) 511  
(D) 521 (E) 508
11. 1027, 1031, 1037, 1045, 1054, \_\_\_\_\_  
(A) 1065 (B) 1058 (C) 1064  
(D) 1057 (E) 1053
12. 8, 16, 48, 96, 288, 576, \_\_\_\_\_  
(A) 1152 (B) 2880 (C) 1052  
(D) 1428 (E) 1728
13. 75075, 25025, 5005, 715, \_\_\_\_\_, 5  
(A) 225 (B) 365 (C) 156  
(D) 65 (E) 25
14. 12, 6, 6, 9, 18, 45, \_\_\_\_\_  
(A) 135 (B) 1475 (C) 1075  
(D) 105 (E) 180
15. 5, 5, 10, 30, 120, 600, \_\_\_\_\_  
(A) 4200 (B) 1800 (C) 2400  
(D) 3600 (E) 3000
16. 125, 375, 377, 1131, 1133, \_\_\_\_\_  
(A) 3399 (B) 1136 (C) 1135  
(D) 1234 (E) 2345
17. 12, 21, 39, 75, 147, \_\_\_\_\_  
(A) 273 (B) 291 (C) 283  
(D) 263 (E) 306
18. 12, 35, 106, 317, 952, \_\_\_\_\_  
(A) 2851 (B) 2855 (C) 1851  
(D) 1849 (E) 1843
19. 5, 13, 41, 85, 257, \_\_\_\_\_  
(A) 773 (B) 516 (C) 716  
(D) 736 (E) 517
20. 13, 39, 118, 356, 1071, 3217, \_\_\_\_\_  
(A) 9656 (B) 6459 (C) 6355  
(D) 9651 (E) 9664
21. 2, 4, 7, 35, 42, 462, \_\_\_\_\_  
(A) 5016 (B) 470 (C) 4712  
(D) 475 (E) 473
22. 440, 360, 288, 224, \_\_\_\_\_  
(A) 170 (B) 169 (C) 168  
(D) 171 (E) 156
23. 132, 182, 306, 380, 552, 870, \_\_\_\_\_  
(A) 930 (B) 1010 (C) 992  
(D) 1142 (E) 1060
24. 2, 10, 30, 68, 130, \_\_\_\_\_  
(A) 216 (B) 222 (C) 250  
(D) 210 (E) 240
25. 95, 126.5, 138, 175.5, 189, 232.5, \_\_\_\_\_  
(A) 256 (B) 272 (C) 247.5  
(D) 248 (E) 250
26. 6, 24, 60, 120, 210, \_\_\_\_\_  
(A) 432 (B) 343 (C) 368  
(D) 322 (E) 336
27. 29, 29, 27, 23, 25, 19, 23, 17, \_\_\_\_\_, \_\_\_\_\_  
(A) 19, 13 (B) 19, 15 (C) 21, 13  
(D) 19, 13 (E) 19, 17
28. 24, 625, 26, 729, 28, 841, \_\_\_\_\_  
(A) 30 (B) 29 (C) 900  
(D) 961 (E) 31
29.  $\frac{50}{500}, \frac{40}{1200}, \frac{30}{1500}, \frac{20}{1400}, \frac{\quad}{\quad}, \frac{\quad}{\quad}$   
(A)  $\frac{10}{1000}$  (B)  $\frac{100}{1900}$  (C)  $\frac{10}{900}$   
(D)  $\frac{10}{800}$  (E)  $\frac{10}{600}$
30. 5, 12, 13, 7, 14, 17, 9, 16, 19, 11, 18, 23, \_\_\_\_\_, \_\_\_\_\_  
(A) 25, 27, 25 (B) 20, 25, 27  
(C) 17, 23, 29 (D) 13, 20, 29  
(E) 12, 20, 31
31.  $6 + \sqrt{216}, 7 + \sqrt{343}, 8 + \sqrt{512}, 9 + \sqrt{729}, \frac{\quad}{\quad}, \frac{\quad}{\quad}$   
(A)  $10 + \sqrt{100}$  (B)  $10 + \sqrt{1000}$   
(C)  $100 + \sqrt{1000}$  (D)  $100 + \sqrt{10}$   
(E)  $10 + \sqrt{10}$

32. (14, 272), (17, 182), \_\_\_\_\_, (23, 56), (26, 20)  
 (A) (19, 110) (B) (20, 150) (C) (20, 110)  
 (D) (21, 462) (E) (19, 122)

33. 1, 8, 27, 16, 125, 36, 343, 64, \_\_\_\_\_, \_\_\_\_\_  
 (A) 729, 1000 (B) 81, 1000 (C) 729, 100  
 (D) 81, 100 (E) 729, 81

34. 11, 28, 327, 464, \_\_\_\_\_  
 (A) 525 (B) 5625 (C) 5125  
 (D) 5250 (E) 5225

35. 3731, 2923, 1917, 1311, \_\_\_\_\_  
 (A) 117 (B) 119 (C) 917  
 (D) 175 (E) 75

36. 2, 4, 6, 4, 6, 10, 6, 8, 14, 8, 10, 18, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_  
 (A) 10, 11, 11 (B) 9, 10, 19  
 (C) 10, 11, 21 (D) 9, 11, 19  
 (E) 10, 12, 22

37. 2, 6, 3, 5, 35, 7, 11, 143, 13, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_  
 (A) 15, 255, 17 (B) 17, 323, 19  
 (C) 13, 19, 515 (D) 17, 306, 18  
 (E) 13, 15, 255

38. 5, 12, 17, 29, 46, 75, 121, \_\_\_\_\_  
 (A) 185 (B) 196 (C) 192  
 (D) 188 (E) 216

39. 6, 8, 10, 8, 15, 17, 12, 16, \_\_\_\_\_  
 (A) 18 (B) 19 (C) 20  
 (D) 21 (E) 25

**Directions for questions 40 to 45:** In each of the following number series a wrong number is given. Find the wrong number.

40. 1, 2, 8, 48, 384, 3456  
 (A) 2 (B) 48 (C) 8  
 (D) 3456 (E) None of these
41. 6, 18, 21, 60, 66, 198, 201  
 (A) 18 (B) 21 (C) 60  
 (D) 6 (E) 198
42. 5, 8, 15, 26, 50, 98, 194  
 (A) 15 (B) 26 (C) 50  
 (D) 98 (E) None of these
43. 10, 8, 13, 35, 135, 670, 4007  
 (A) 8 (B) 670 (C) 135  
 (D) 35 (E) 13
44. 7, 8, 20, 43, 107, 232, 448  
 (A) 43 (B) 232 (C) 107  
 (D) 7 (E) 20
45. 6, 12, 36, 80, 150, 252, 392  
 (A) 80 (B) 6 (C) 36  
 (D) 252 (E) None of these

**Directions for questions 46 to 51:** In each of the following series two wrong numbers are given out of which one differs by a margin of 1 i.e. +1 or -1 and the other with a greater margin. From the choices choose the number that is differing by the greater margin. The first and the last number in the series are always correct.

46. 1, 4, 15, 64, 260, 1024, 4096, 16384  
 (A) 1024 (B) 64 (C) 15  
 (D) 260 (E) None of these

47. 1, 2, 7, 21, 88, 445, 2673, 18739  
 (A) 7 (B) 21 (C) 445  
 (D) 88 (E) 2673

48. 2, 10, 30, 65, 130, 222, 349, 520  
 (A) 10 (B) 30 (C) 349  
 (D) 65 (E) None of these

49. 15120, 7560, 2525, 630, 126, 20, 3  
 (A) 7560 (B) 2525  
 (C) 630 (D) 126  
 (E) None of these

50. 1, 5, 15, 30, 55, 95, 140, 204  
 (A) 30 (B) 140  
 (C) 15 (D) 55  
 (E) 95

51. 2, 6, 24, 107, 560, 3386, 23772  
 (A) 6 (B) 24  
 (C) 107 (D) 560  
 (E) 3386

**Directions for questions 52 to 56:** In each of these questions a number series is given. After the series, a number is given along with (a), (b), (c), (d) and (e). You have to complete the series starting with the number given to find the values of (a), (b), (c), (d) and (e) applying the same pattern followed in the given series. Then answer the question given below each.

52. 2, 3, 5, 7, 11, 13  
 13, (a), (b), (c), (d), (e)  
 What is the value of (d) in the series?  
 (A) 27 (B) 23 (C) 29  
 (D) 27 (E) None of these
53. 7, 9, 18, 21, 63, 67, 268  
 (a), (b), (c), (d), 39, (e)  
 What is the value of (b) in the series?  
 (A) 3 (B) 10 (C) 5  
 (D) 12 (E) 15
54. 0, 6, 24, 60, 120, 210  
 210, (a), (b), (c), (d), (e)  
 What is the value of (b) in the series?  
 (A) 720 (B) 623 (C) 512  
 (D) 504 (E) None of these
55. 1, 3, 11, 47, 239, 1439  
 (a), (b), (c), (d), (e), 2159  
 What is the value of (a) in the series?  
 (A) 1-5 (B) 2 (C) 3  
 (D) 4 (E) None of these
56. 2, 5, 28, 17, 126, 37  
 37, (a), (b), (c), (d), (e)  
 What is the value of (d) in the series?  
 (A) 730 (B) 999 (C) 101  
 (D) 99 (E) 513

**Directions for questions 57 to 61:** Each questions contains a number series one of the number is a wrong number. Find out the wrong number and form a new series starting with the wrong number and using the pattern in the given series. Answer the questions based on the new series.

57. 7, 10, 15, 22, 33, 48  
What is the fifth term in the new series?  
(A) 70 (B) 60 (C) 75  
(D) 55 (E) None of these
58. 7, 21, 66, 138, 420, 846  
What is the fifth term of the new series?  
(A) 1098 (B) 3652 (C) 924  
(D) 512 (E) None of these
59. 5, 7, 12, 15, 60, 65  
What is the fourth term in the new series?  
(A) 19 (B) 125 (C) 20  
(D) 382 (E) None of these
60. 15, 30, 39, 96, 99, 198, 200, 600  
What is the third term in the new series?  
(A) 400 (B) 796 (C) 76  
(D) 556 (E) 80
61. 7, 9, 13, 21, 40, 69, 133  
What is the fifth term in the new series?  
(A) 49 (B) 86 (C) 70  
(D) 142 (E) 124

**Directions for questions 62 to 65:** In each of the following questions, two rows of numbers are given. The resultant number of each row is to be worked out separately based on the following rules and the question below the row of numbers is to be answered. The operations of numbers progress from left to right.

Rules:

- If an odd number is followed by a composite odd number, they are to be multiplied.
- If an even number is followed by an odd number, they are to be added.
- If an even number is followed by a number, which is a perfect square, the even number is to be subtracted from the perfect square.
- If an odd number is followed by a prime number, the first number is to be divided by the second number.
- If an odd number is followed by an even number, the second one is to be subtracted from the first one.

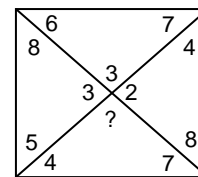
62. 14 196 23  
10 x 152  
If x is the resultant of the first row, what is the resultant of the second row?  
(A) 367 (B) 91  
(C) 63 (D) 105  
(E) None of these
63. 65 5 9  
109 24 5  
What is the difference between the resultants of the two rows?  
(A) 5 (B) 90  
(C) 17 (D) 100  
(E) None of these

64. 79 64 21  
m 7 28  
If m is the resultant of the first row, what is the resultant of the second row?  
(A) 9 (B) 19 (C) 15  
(D) 24 (E) None of these

65. 143 11 8  
12 36 3  
What is the sum of the resultants of the two rows?  
(A) 64  
(B) 42  
(C) 32  
(D) 80  
(E) None of these

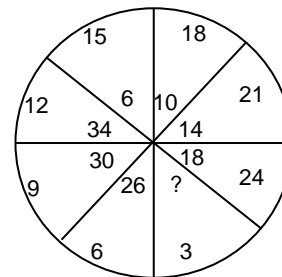
**Directions for questions 66 to 71:** Find the missing term(s) in the given figure(s).

66.



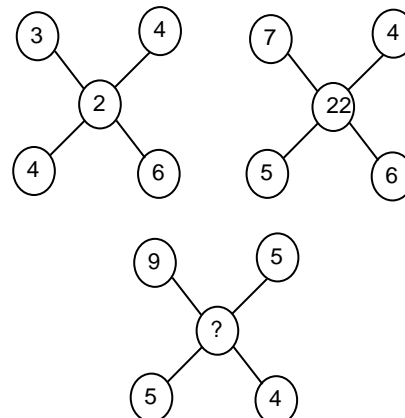
- (A) 1 (B) 2  
(C) 4 (D) 3  
(E) 5

67.



- (A) 22 (B) 20 (C) 12 (D) 15 (E) 24

68.



- (A) 222 (B) 12 (C) 22 (D) 14 (E) 11



69.

|  |   |    |    |    |
|--|---|----|----|----|
|  |   | 15 |    |    |
|  |   | AZ | CX | 31 |
|  | ? | EV | ?  |    |
|  |   |    |    | 63 |

- (A) GT, 125 (B) FS, 127 (C) HS, 125  
(D) GT, 127 (E) EV, 127

70.

|     |   |   |   |    |
|-----|---|---|---|----|
|     |   | 6 |   |    |
|     | C | E | H |    |
| ?   | L | N | Q | 7  |
|     | U | W | Z |    |
| 208 | ? | F | I | 16 |
|     |   |   |   | 51 |

- (A) 545, A (B) 1040, D (C) 1045, D  
(D) 1045, A (E) 1040, F

71.

|    |    |    |
|----|----|----|
| DG | IF | ?B |
| 28 | 54 | ?  |

- (A) R62 (B) S38 (C) R38  
(D) E8 (E) P32

**Directions for questions 72 to 75:** Select the correct alternative from the given choices.

72. Based on the code given below, find the missing term.

|          |         |          |
|----------|---------|----------|
| ren      | 1224    | qdm      |
| dfh      | 48      | ceg      |
| cbn      | 24      | bam      |
| fst      | ?       | ers      |
| (A) 72   | (B) 120 | (C) 1890 |
| (D) 1368 | (E) 210 |          |

73. Based on the code given below, find the missing term.

|         |         |         |
|---------|---------|---------|
| ldi     | 432     | hac     |
| nspv    | 384     | imot    |
| wtr     | 216     | qnq     |
| woe     | ?       | skb     |
| (A) 252 | (B) 401 | (C) 480 |
| (D) 216 | (E) 288 |         |

74. Based on the code given below, find the missing term.

|          |          |         |
|----------|----------|---------|
| fab      | 793      | cad     |
| lot      | 105267   | dum     |
| can      | 6921     | don     |
| man      | 22313    | ?       |
| (A) and  | (B) link | (C) fun |
| (D) pink | (E) dog  |         |

75. Based on the code given below, find the missing term.

|          |         |         |
|----------|---------|---------|
| pet      | 968256  | cat     |
| bat      | 171396  | can     |
| sad      | 331776  | act     |
| and      | 393129  | ?       |
| (A) sand | (B) one | (C) the |
| (D) none | (E) tap |         |

### Exercise – 1(b)

**Directions for questions 1 to 38:** Complete the following series.

- A, B, D, H, \_\_\_\_, F  
(A) P (B) T (C) X (D) H
- E, A \_\_\_\_, O, I  
(A) E (B) U (C) X (D) V (E) Z
- D, F, G, H, J, K, L, M N, \_\_\_\_  
(A) O (B) Q (C) P (D) R (E) T
- E, J, O T, Y, \_\_\_\_  
(A) D (B) Z (C) C (D) E (E) G
- G, J, N, Q, U, \_\_\_\_  
(A) W (B) X (C) Y (D) Z (E) B
- R, K, F, C, \_\_\_\_  
(A) Z (B) Y (C) W (D) A (E) D
- BY, CX, EV, GT, KP, \_\_\_\_  
(A) JQ (B) MN (C) PK  
(D) LO (E) RV

- AI, EO, IU, \_\_\_\_, UE  
(A) OU (B) OI (C) UA  
(D) OA (E) OE
- AP, BQ, CR, DS, \_\_\_\_  
(A) ET (B) EU (C) TE  
(D) EV (E) IV
- QN, RP, TS, WW, \_\_\_\_, FH  
(A) AC (B) XB (C) AB  
(D) YC (E) CE
- EA, IE, OK, SO, YU, \_\_\_\_  
(A) WX (B) WB (C) YD  
(D) ZX (E) CY
- KPD, LOE, MNF, NMG, \_\_\_\_  
(A) ONF (B) OLH (C) MLH  
(D) MNH (E) NLH
- BEP, CIQ, DOR, FUS, GAT, \_\_\_\_  
(A) HEV (B) HIT (C) IET  
(D) IEU (E) HIV

14. GKF, IPC, LTY, PWT, UYN, \_\_\_\_  
 (A) ABZ (B) XBX (C) XAH  
 (D) AZG (E) YBG
15. QLR, JPD, RNU, GNC, SPX, DLB, \_\_\_\_  
 (A) ARE (B) AJA (C) BTU  
 (D) KJE (E) TRA
16. PKC, SPF, XSK, AXN, \_\_\_\_, IFV  
 (A) CAQ (B) FCS (C) FAS  
 (D) CFS (E) EGR
17. GTB, CYV, YDP, \_\_\_\_, QND  
 (A) DIV (B) UIJ (C) DDV  
 (D) UVV (E) VJK
18. JTU, \_\_\_\_, UCF, BFM, JHU  
 (A) OYZ (B) JCZ (C) OCF  
 (D) JCZ (E) MZY
19. ABDH, BDHP, CFLX, DHPF, \_\_\_\_  
 (A) EKNT (B) TNEK (C) EJTN  
 (D) JNTE (E) GLFR
20. KJAM, GGWJ, \_\_\_\_, YAOD, UXKA  
 (A) CDUI (B) DFTC (C) DCTF  
 (D) CDSG (E) DEVG
21. TCFK, RADJ, OXAF, JSVA, \_\_\_\_  
 (A) DMPU (B) DMOT (C) CMOT  
 (D) CLOT (E) BNKR
22. FTJMP, GRMIU, EUINO, \_\_\_\_, DVHON, IPOGW  
 (A) BYDTL (B) HQNHV (C) YNHAV  
 (D) HQDTL (E) GNSPR
23. ATNHG, DKCMB, CVPJI, GNFPE, EXRLK, JQISH, GZTNM, \_\_\_\_  
 (A) MTLVK (B) HSKUJ (C) RIJTU  
 (D) PQMTH (E) QHMRT
24. ACEGI, BDFHJ, KMOQS, \_\_\_\_, UWYAC, VXZBD  
 (A) TUVWX (B) LPRTV (C) LNPRT  
 (D) PQRTV (E) LMPSV
25. KLNQ, UVXA, EFHK, OPRU, \_\_\_\_  
 (A) ZAFK (B) XYAD (C) YZBE  
 (D) YABD (E) XZBD
26. 1AB2, 3CD4, 5EF6, 7GH8, \_\_\_\_  
 (A) 9IJ10 (B) 8HI9 (C) 9JI10  
 (D) 8IH9 (E) 8IJ9
27. A1, B4, C9, \_\_\_\_, E25  
 (A) D12 (B) D18 (C) D16  
 (D) D15 (E) D19
28. 1B1, 2D2, 3F3, 4H4, \_\_\_\_  
 (A) 3I6 (B) 6I3 (C) 4J6  
 (D) 5J5 (E) 7N6
29. 2W3, 1S9, 1Q7, \_\_\_\_, 1K1  
 (A) 1P6 (B) 1M3 (C) 1R8  
 (D) 1S9 (E) 2W3
30. A3B, C1B, D9E, E1D, \_\_\_\_  
 (A) G1F (B) H18J (C) G10F  
 (D) G15F (E) F13G
31.  $\frac{B}{8}, \frac{D}{64}, \frac{F}{216}, \frac{J}{1000}$   
 (A)  $\frac{G}{343}$  (B)  $\frac{G}{49}$  (C)  $\frac{H}{512}$   
 (D)  $\frac{H}{64}$  (E)  $\frac{I}{81}$
32. Q6W, T13G, K7D, P9G, \_\_\_\_  
 (A) R21C (B) J16Q  
 (C) N13A (D) F18C  
 (E) H6B
33. N15A, P18B, R21C, \_\_\_\_, V27E  
 (A) S23D (B) S25F (C) T24D  
 (D) T25E (E) T26F
34. BC25, CE64, EG144, GK324, \_\_\_\_  
 (A) HO529 (B) KM729 (C) HI289  
 (D) KM576 (E) GK361
35. 1I8, 4H6, 9G4, 6F3, \_\_\_\_  
 (A) 5E2 (B) 2E5 (C) 1D6  
 (D) 6D1 (E) 2C7
36. 2F3, 3O5, 5I7, 7Y11, \_\_\_\_  
 (A) 11L13 (B) 11J15 (C) 13M17  
 (D) 13K15 (E) 11M13
37. 1E4, 9Y16, 25I36, 49I64, \_\_\_\_  
 (A) 67O81 (B) 81Y100  
 (C) 81X100 (D) 64M81  
 (E) 81R100
38. A16C, B36D, C64E, D100F, \_\_\_\_  
 (A) E35G (B) E169H  
 (C) F169G (D) F196H  
 (E) E144G
- Directions for questions 39 to 43:** Select the correct alternative from the given choices.
39. In the following sequence of digits, how many odd digits are immediately preceded by and immediately followed by even digits?  
 2 9 6 8 1 3 4 8 7 6 5 2 1 3 4 3 6 8  
 (A) 4 (B) 3 (C) 5 (D) 6 (E) 2
40. In the following sequence of digits, how many digits are either immediately preceded by a multiple of 3 or immediately followed by a multiple of 3?  
 5 3 1 9 3 3 2 3 5 7 3 6 9 3 2 4  
 (A) 7 (B) 13 (C) 10 (D) 11 (E) 9
41. In the following sequence of alphanumeric characters, how many characters are neither immediately followed by a digit nor immediately preceded by a letter?  
 x k 3 t m p 5 2 a 3 6 4 q j h  
 (A) 2 (B) 5 (C) 4 (D) 6 (E) 3
42. In the following sequence of digits, how many digits are immediately preceded by a digit which is a multiple of 3 and immediately followed by a digit which is a multiple of 4?  
 7 3 2 4 6 8 9 3 5 7 8 4 3 2 1 5 6 3 8  
 (A) 5 (B) 2 (C) 4 (D) 6 (E) 3

43. In the following sequence of digits, how many digits, which are multiples of three, are either immediately followed by an odd digit or immediately preceded by an even digit?  
6 5 7 9 1 1 3 2 3 5 7 8 7 6 2 8  
(A) 2 (B) 4 (C) 5 (D) 1 (E) 3

**Directions for questions 44 to 47:** The following questions are to be answered based on the position of letters in the English alphabet, when they are written in normal order i.e. A to Z.

44. The letter which is fifth to the left of the letter, which is third to the right of K is \_\_\_\_\_.  
(A) J (B) K (C) N (D) L (E) I
45. Find the letter which is second to the right of the letter, which is fifth to the right of N.  
(A) U (B) T (C) R (D) S (E) Q
46. Which letter is second to the left of the letter, which is fourth to the right of Q?  
(A) P (B) T (C) Q (D) U (E) S

47. Which letter is third to the left of the fourth letter to the left of J?  
(A) D (B) E (C) B (D) C (E) F

**Directions for questions 48 to 50:** The following questions are to be answered based on the position of letters in the English alphabet, when they are written in reverse order i.e. Z to A.

48. What is the fifth letter to the right of the third letter to the left of J?  
(A) J (B) K (C) I (D) H (E) M
49. Which letter is second to the left of the letter, which is fourth to the left of E?  
(A) T (B) N (C) K (D) L (E) R
50. Find the letter which is third to the right of the letter which is seventh to the left of L.  
(A) R (B) P (C) T (D) O (E) Q

### Key

#### Exercise – 1(a)

|       |       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|
| 1. B  | 12. E | 23. C | 34. C | 45. B | 56. C | 67. A |
| 2. E  | 13. D | 24. B | 35. E | 46. D | 57. E | 68. E |
| 3. B  | 14. A | 25. D | 36. E | 47. E | 58. C | 69. C |
| 4. C  | 15. D | 26. E | 37. B | 48. D | 59. A | 70. C |
| 5. D  | 16. A | 27. C | 38. B | 49. B | 60. E | 71. B |
| 6. C  | 17. B | 28. A | 39. C | 50. E | 61. C | 72. B |
| 7. C  | 18. B | 29. C | 40. D | 51. E | 62. C | 73. E |
| 8. B  | 19. E | 30. D | 41. C | 52. C | 63. D | 74. A |
| 9. C  | 20. A | 31. B | 42. A | 53. C | 64. E | 75. C |
| 10. A | 21. D | 32. C | 43. B | 54. D | 65. C |       |
| 11. C | 22. C | 33. D | 44. E | 55. B | 66. A |       |

#### Exercise – 1(b)

|      |       |       |       |       |       |       |       |       |       |
|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1. A | 6. D  | 11. E | 16. C | 21. D | 26. A | 31. C | 36. E | 41. B | 46. E |
| 2. B | 7. B  | 12. B | 17. B | 22. B | 27. C | 32. C | 37. B | 42. B | 47. D |
| 3. C | 8. D  | 13. A | 18. A | 23. A | 28. D | 33. C | 38. E | 43. E | 48. D |
| 4. A | 9. A  | 14. D | 19. C | 24. C | 29. B | 34. D | 39. A | 44. E | 49. C |
| 5. B | 10. C | 15. E | 20. D | 25. C | 30. E | 35. A | 40. B | 45. A | 50. B |