WORKBOOK OF QUANTITATIVE APTITUDE AND REASONING - I

PREFACE

Companies that hire students through campus placements have various rounds to shortlist suitable candidates; these rounds include aptitude tests, group discussions and then personal interview. Most, if not all the companies follow this recruitment pattern.

Almost 90% of the applied candidates don't clear the aptitude test. The aptitude test is used to test the candidate on Quantitative Aptitude, Verbal Ability, and Analytical Ability/Logical Reasoning.

Quantitative Aptitude and Reasoning is very important subject to test your problem solving skills. So, in every competitive written exam they asked questions from this subject, not only in written they may ask some brain storming puzzles in interview also. It is the one of the key concept to qualify written exam almost every students who know basic mathematics can solve most of the questions in the exam but the main problem is that the time management, the recruiters does not give enough time to solve the problems so one who has more practice the model questions before exam can easily solve in the exams.

This book is essential for aptitude exams as all the important topics are discussed in this book. This book explains all the concepts clearly and also covers all the types of the questions.

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VEDIC MATHS

Multiplication of Two 2-Digit Numbers

1. Write Your Problem Down. Write down your numbers sitting on top of each other, like you would do when multiplying normally

```
    2   1
*   2   3
-----------
```

2. Multiply. Multiply the numbers in the ones place and put the product directly under the ones

```
    2   1
*   2   3
-----------
        3
```

3. Cross Multiply. Cross multiply like you would for fractions by taking the top number's tens digit multiplied by the bottom numbers ones place. Then take the top number's ones place multiplied by the bottom number's tens place. Add the two products and place the answer to the left of the ones place's answer.

```
    2   1        2*3=6
*   2   3        1*2=2
-----------      (6+2=8)
    8   3
```

4. Multiply Again. Multiply the numbers in the tens place and place the answer to the left of the previous step's answer.

```
    2   1
*   2   3
-----------
4   8   3
```

The working in our above example can therefore be depicted as

```
   21
  ×23
-----
```

2 × 2 / 1 × 2 + 2 × 3 / 1 × 3 = 483

which can be summarized as

```
   21
  ×23
-----
```

4/ 2 + 6 / 3 = 483

When the units figure is "one" in both the numbers being multiplied, the process of multiplication is simplified further. Consider the following multiplication:

```
   41
  ×81
-----
```

$4 \times 8 / 8 \times 1 + 1 \times 4 / 1 \times 1$

You will notice that the middle digit of the answer is $8 \times 1 + 1 \times 4$ i.e. $(8 + 4) \times 1$. So, instead of multiplying "across" for the middle term, you could simply add the tens digit of the two numbers.

Therefore, $41 \times 81 = 32 / (4 + 8) / 1 = 3321$.

Similarly, in 71×91, you could obtain the middle term as 16 by merely adding 7 and 9.

Multiplication of Two 3-Digit Numbers

Let us consider the multiplicand to be ABC and the multiplier to be DEF, as shown below:

$$\begin{array}{r} A\ B\ C \\ \times\ D\ E\ F \\ \hline \end{array}$$

Step 1 $C \times F$

Step 2 $B \times F + C \times E$ + Carry of Step 1

Step 3 $A \times F + C \times D + B \times E$ + Carry of Step 2

Step 4 $A \times E + B \times D$ + Carry of Step 3

Step 5 $A \times D$ + Carry of Step 4

For Example; 2 3 4

6 5 1

$2 \times 6 / 6 \times 3 + 2 \times 5 / 3 \times 5 + 6 \times 4 + 2 \times 1 / 4 \times 5 + 3 \times 1 / 4 \times 1$

$= 12/28/ 41/ 23 / 4 = 152334$

Squares of Numbers

Numbers	Method
1 – 25	Memorization
Numbers ending in a five 15, 25, 35, 45, …	Remove the last digit (five), multiply the resulting number (n) by the next number (n + 1), and tag on a 25 at the end of the product. Example: 65 × 65 6× 7 = 42 Tag on a 25 to make 4225. Calculate 35 × 35 = 1225
25 – 50	Calculate the difference (d) from 50. First two digits are: 25-d Last two digits are: d^2(if more than two digits then carry hundred's digit number) Example: To calculate 46 × 46: d = 4 Calculate 46 × 46 = (25-4)16 = 2116
50 – 75	Calculate the difference (d) from 50. First two digits are: 25+d Last two digits are: d^2(if more than two digits then carry hundred's digit number) Example: To calculate 54 × 54: d = 4 Calculate 54 × 54 = (25+4)16=2916

75 – 100	Calculate the difference (d) from 100. First two digits are: 100-2d Last two digits are: d^2(if more than two digits then carry hundred's digit number) Example: To calculate 94 × 94 d = 6 Calculate 94 × 94 = (100-12)36= 8836
100 – 125	Calculate the difference (d) from 100. First two digits are: 100+2d Last two digits are: d^2(if more than two digits then carry hundred's digit number) Example: To calculate 113 × 113 d = 13 Calculate 113 × 113 = (100+26)169=12769

Square Root of a Number

Step 1: First of all group the number in pairs of 2 starting from the right.
Step 2: To get the ten's place digit, Find the nearest square (equivalent or greater than or less than) to the first grouped pair from left and put the square root of the square.

Step 3: To get the unit's place digit of the square root.
Remember the following
Squares of numbers from 1 to 9 are 1, 4, 9, 16, 25, 36, 49, 64, 81, and 100.

If number ends in	Unit's place digit of the square root
1	1 or 9(10-1)
4	2 or 8(10-2)
9	3 or 7(10-3)
6	4or 6(10-4)
5	5
0	0

Step 4: Multiply the ten's place digit (found in step 2) with its consecutive next number and compare the result obtained with the first pair of the original number from left.
Remember,
If first pair of the original number > Result obtained on multiplication then
Select the greater number out of the two numbers as the unit's place digit of the square root.

If first pair of the original number < the result obtained on multiplication, then
Select the lesser number out of the two numbers as the unit's place digit of the square root.

Example: √784=?
Step 1: We start by grouping the numbers in pairs of two from right as follows
7 <u>84</u>
Step 2: To get the ten's place digit,
We find that nearest square to first group (7) is 4 and √4=2
Therefore ten's place digit=2
Step 3: To get the unit's place digit,
We notice that the number ends with 4, so the unit's place digit of the square root should be either 2 or 8(Refer table).

Step 4: Multiplying the ten's place digit of the square root that we arrived at in step 1(2) and its consecutive number(3) we get, 2×3=6

ten's place digit of original number > Multiplication result

7>6

So we need to select the greater number (8) as the unit's place digit of the square root.

Unit's place digit =8

Ans: √784=28

Cube Root of a Number

Step 1: First of all group the number in pairs of 3 starting from the right.

Step 2: To get the ten's place digit, Find the nearest cube (equivalent or greater than or less than) to the first grouped pair from left and put the cube root of the cube.

Step 3: To get the unit's place digit of the cube root.

Remember the following

Number	Cube	Cubes ends with
1	1	1
2	8	8 (Compliment of 2)
3	27	7 (Compliment of 3)
4	64	4
5	125	5
6	216	6
7	343	3 (Compliment of 7)
8	512	2 (Compliment of 8)
9	729	9
10	1000	0

Thus as seen cubes have distinct ending, there is no overlapping. Thus, if the given number is perfect cube, then the last digit will help to find the cube root.

Example: Find the cube root of 54872?

Step 1: We start by grouping the numbers in pairs of three from right as follows

54 872

Step 2: To get the ten's place digit,

We find that nearest cube to first group (54) is 27 and (27) ^1/3=3

Therefore ten's place digit=3

Step 3: To get the unit's place digit,

We notice that the number ends with 2, so the unit's place digit of the cube root is 8(Refer table).

Ans: cube root of 54872=38

Practice Questions

1. Find the product of following numbers:

1] 53*28	2] 62*39	3] 27*83
4] 37*91	5] 76*48	6] 542*142
7] 234*471	8] 865*713	9] 364*901

2. Find the squares of numbers:

1] 15^2	2] 75^2	3] 45^2
4] 85^2	5] 55^2	6] 35^2
7] 12^2	8] 18^2	9] 23^2
11] 29^2	11] 37^2	12] 44^2
15] 59^2	14] 67^2	15] 73^2
16] 121^2	17] 125^2	18] 117^2
19] 78^2	20] 83^2	21] 88^2
22] 92^2	23] 98^2	24] 94^2
25] 105^2	26] 109^2	27] 113^2
28] 65^2-37^2	29] 99^2-78^2	30] 111^2-95^2

3. Find the square root of numbers:

1] 4624	2] 676	3] 961
4] 1521	5] 2304	6] 6724
7] 6241	8] 9409	9] 13456
10] 11664	11] 15129	12] 24964

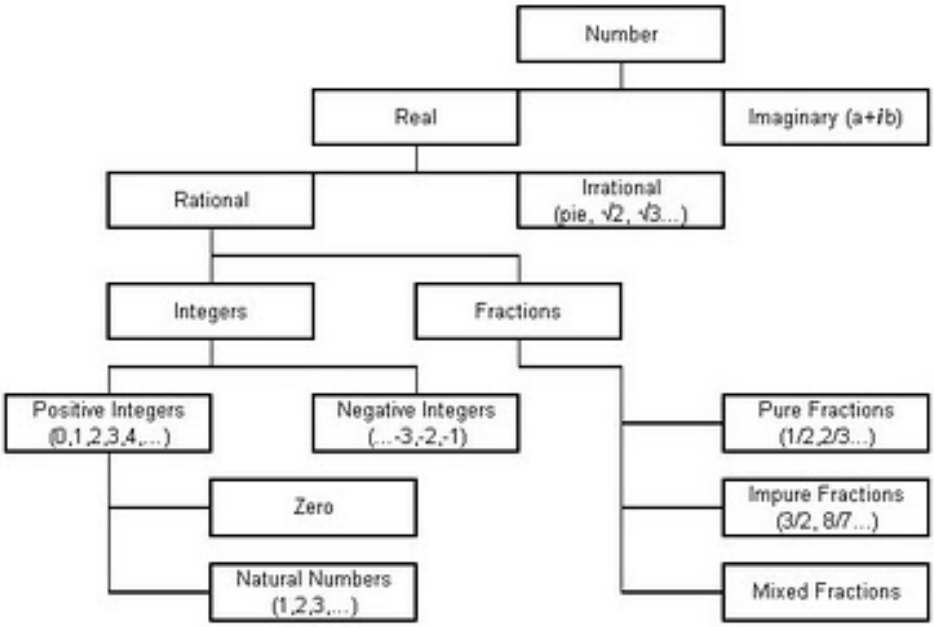
4. Find the cube root of numbers:

1] 1331	2] 4096	3] 6859
4] 10648	5] 21952	6] 50653
7] 79507	8] 205379	9] 262144
10] 636056	11] 830584	12] 1092727

NUMBER SYSTEM

Classification of the numbers

The concept of numbers is made clear from the number tree.



1. **Natural Numbers:** The numbers 1, 2, 3, 4, 5….are called natural numbers or positive numbers.

   Example: 1, 2, 3, 4, 5……∞

2. **Whole Numbers: –**The numbers including "0" and all natural numbers are called the while numbers.

   Example: 0, 1, 2, 3, 4, 5……∞

3. **Integers –** The numbers including 0 and all the positive and negative of the natural numbers are called integers.

   Example: -∞……-3, -2, -1, 0, 1, 2, 3……∞

4. **Rational Numbers: –** A number which can be expressed in the form p/q where p and q are integers and $q \neq 0$ is called a rational number.

   For example, 4 is a rational number since 4 can be written as 4/1 where 4 and 1 are integers and the denominator $1 \neq 0$. Similarly, the numbers 3/4, -2/5, etc. are also rational numbers.

   Between any two numbers, there can be infinite number of other rational numbers.

Any terminating or recurring decimal is a rational number.

5. **Irrational Numbers: –** Numbers which are not rational but which can be represented by points on the number line are called irrational numbers. Examples for irrational numbers are

   Example: $\sqrt{2}, \sqrt{3}, \sqrt{5}, \sqrt{8}$, etc.

   Numbers like π, e are also irrational numbers.

   Between any two numbers, there are infinite numbers of irrational numbers.

   Any non-terminating non-recurring decimal is an irrational number.

6. **Real numbers: –** The set of natural numbers, integers, whole numbers, rational numbers, and irrational numbers constitute the set of real numbers.

7. **Even Numbers: –** The numbers that are divisible by 2 are called even numbers.

   Example: 2, 4, 6, 8, 16, 32 etc.

8. **Odd Numbers: –** The numbers that are not divisible by 2 are called odd numbers.

   Example: 3, 5, 7, 9, 15 etc.

9. **Prime Numbers: –** Those numbers which are divisible by themselves and 1 are called prime numbers or a number which has only two factors 1 and itself is called a prime number.

   Example: 2, 3, 5, 7 etc.

10. **Twin Primes: –** A pair of prime numbers when they differ by 2 is called twin prime numbers.

    Example: (3, 5), (5, 7), (11, 13), (17, 19) etc.

11. **Co-prime Numbers: –** A pair of two natural numbers (may or may not be prime number) are said to be co-prime if their G.C.D. or H.C.F. is 1.

    Example: H.C.F. (3, 4) = 1, H.C.F. (13, 15) = 1 then (3, 4) and (13, 15) are co-prime numbers.

12. **Composite Numbers: –** The natural numbers which are not prime numbers are called composite numbers OR numbers that have factors other than itself and 1, are called composite numbers.

    Example: 4, 6, 9, 16, 25 etc.

    Note: 1 is neither a composite number nor a prime number.

13. **Perfect Numbers: –** If the addition of all the factors of a number excluding the number itself happens to be equal to the number, it is called a perfect number.

    First perfect number is 6.

    Factors of 6 are 1, 2, 3, 6.

    Now add all the factors excluding 6.

    1+2+3 = 6, hence 6 is a perfect number.

    Example: 28, 496 and 8128.

14. **Complex Numbers: –** The number which have real and imaginary component is called a complex number.

    Example: 3+4*i*, 5+6*i*, where $i = \sqrt{-1} = a\ imaginary\ number$

15. **Face Value** of a digit in a number is its own value.

    Example: 6728, Face Value ⇒ 6 = 6, 7 = 7, 2 = 2 and 8 = 8

16. **Place Value** of a digit is given by multiplying it with value of place where it is placed.

    Example: 6729

Place Value of 9 ⇒ 9 × 1 = 9
Place Value of 2 ⇒ 2 × 10 = 20
Place Value of 7 ⇒ 7 × 100 = 700
Place Value of 6 ⇒ 6 × 1000 = 6000

17. **Fractions:** A fraction is a quantity which expresses a part of the whole,

Example: 1/4 means one fourth of the whole

Types of Fractions

i. Proper Fraction: is one whose numerator is less than its denominator
Example: 2/3 is proper fraction, as 2<3
ii. Improper Fraction is one whose numerator is equal to or greater than its denominator
Example: 3/2 is an improper fraction, as 3>2 ;

3/3 is an improper fraction, as 3=3

Some Important Points:

1. Addition or subtraction of any two odd numbers will always result in an even number or zero. *Example:* 1 + 3 = 4.
2. Addition or subtraction of any two even numbers will always result in an even number or zero. *Example:* 2 + 4 = 6.
3. Addition or subtraction of an odd number from an even number will result in an odd number. *Example:* 4 + 3 = 7.
4. Addition or subtraction of an even number from an odd number will result in an odd number. *Example:* 3 + 4 = 7.
5. Multiplication of two odd numbers will result in an odd number. *Example:* 3×3 = 9.
6. Multiplication of two even numbers will result in an even number. *Example:* 2×4 = 8.
7. Multiplication of an odd number by an even number or vice versa will result in an even number. *Example:* 3×2 = 6.
8. An odd number raised to an odd or an even power is always odd.
9. An even number raised to an odd or an even power is always even.
10. The standard form of writing a number is m × 10n where m lies between 1 and 10 and n is an integer.
    - If n is odd. $n(n^2 - 1)$ is divisible by 24.
      Take n = 5 ⇒ $5(5^2 - 1) = 120$, which is divisible by 24.
    - If n is odd prime number except 3, then $n^2 - 1$ is divisible by 24.
    - If n is odd. $2^n + 1$ is divisible by 3.
    - If n is even. $2^n - 1$ is divisible by 3.
    - If n is odd. $2^{2n} + 1$ is divisible by 5.
    - If n is even. $2^{2n} - 1$ is divisible by 5.
    - If n is odd. $5^{2n} + 1$ is divisible by 13.
    - If n is even. $5^{2n} - 1$ is divisible by 13
11. Some properties of Prime Numbers
    - The lowest prime number is 2.
    - 2 is also the only even prime number.
    - The lowest odd prime number is 3.
    - There are 25 prime numbers between 1 to 100.
    - The remainder of the division of the square of a prime number $p \geq 5$ divided by 24 or 12 is 1.

Divisibility Rules

Divisibility by	Criteria
2	A number is divisible by 2 when its units place is 0 or divisible by 2. Example: 130, 128 etc.
3	A number is divisible by 3 when the sum of its digits is divisible by 3. Example: 6561 ⇒ 6+5+6+1 = 18 is divisible by 3 17281 ⇒ 1+7+2+8+1 = 19 is not divisible by 3
4	When the last two digits of the number are 0's or divisible by 4. Example: 17400, 132, 12348 etc.
5	If the unit digit is 5 or 0, the number is divisible by 5. Example: 895, 100, 125, 625, 400 etc.
6	A number is divisible by 6, if it is divisible by both 2 and 3.
7	A number is divisible by 7, if and only if the number of tens added to 5 times the number of units, is divisible by 7 Example: 105 is divisible by 7, since 10+5*5= 10+25=35, which is divisible by 7.
8	If the last three digits of the number are 0's or divisible by 8, the number is divisible by 8. Example: 125128, 135000 etc.
9	If sum of digits is divisible by 9, the number is also divisible by 9. Example: 729 ⇒ 7+2+9 = 18 is divisible by 9. 46377 ⇒ 4+6+3+7+7 = 27 is divisible by 9.
10	A number is divisible by 10 if and only if the unit place digit is 0. Example: 100, 23450, 1100 etc.
11	When difference between sum of digits at odd places and sum of digits at even places is either 0 or 11, the number is divisible by 11. Example: 65967 ⇒ (6+9+7) – (5+6) = 22 – 11 = 11 is divisible by 11.

Important Results:

- $\Sigma n = \frac{n(n+1)}{2}$, Σn is the sum of first n natural numbers.
- $\Sigma n^2 = \frac{n(n+1)(2n+1)}{6}$, Σn^2 is the sum of first n perfect squares.
- $\Sigma n^3 = \frac{n^2(n+1)^2}{4} = (\Sigma n)^2$, Σn^3 is the sum of first n perfect cubes.

Recurring Decimals

A decimal in which a digit or set of digits is repeated continually is called a recurring decimal. Recurring decimals are written in a shortened form, the digits which are repeated being marked by dots placed over the first and the last of them, thus

8/3 =2.666….. = 2.6 or $2.\bar{6}$;

1/7 = 0.142857142857142857… = $0.\overline{142857}$

Example: Express $0.\bar{3}$ in the form of a fraction.

Solution: $0.\bar{3}$ = 0.3333 → (1)

As the period is of one digit, we multiply by 10^1

i.e. 10

∴ 10 x $0.\bar{3}$ = 3.333 → (2)

(2) – (1) gives

9 x $0.\bar{3}$ = 3 ⟹ $0.\bar{3}$ = 3/9 = 1/3

Pure Recurring Decimal: It is equivalent to a vulgar fraction which has the number formed by the recurring digits 9 called the period of the decimal) for its numerator, and for its denominator the number which has for its digits as many nines as their digits in the period.

Thus, $0.\overline{37}$ can be written as equal to 37/99

$0.\overline{225}$ can be written as equal to 225/999 which is the same as 25/111

$0.\overline{63}$ = 63/99 = 7/11

Mixed Recurring Decimal: In the numerator write the entire given number formed by the (recurring and non-recurring parts) and subtract from it the part of the decimal that is not recurring. In the denominator, write as many nines as the period (i.e., as many nines as the number of digits recurring) and then place next to it as many zeroes as there are digits without recurring in the given decimal.

i.e. $0.1\overline{56}$ = 156 -1/990 = 155/990 = 31/198

$0.7\bar{3}$ = 73-7/90 = 66/90 = 11/15

HCF and LCM

Factors and Multiples: If a number *a* divides another number*b* exactly, we say that *a* is a ***factor*** of*b*. In this case, *b* is called a ***multiple*** of*a*.

Highest Common Factor (H.C.F.) or Greatest Common Measure (G.C.M.) or Greatest Common Divisor (G.C.D.): The H.C.F. of two or more than two numbers is the greatest number that divides each of them exactly.

Least Common Multiple: The least number which is exactly divisible by each one of the given numbers is called their L.C.M.

H.C.F. and L.C.M. of Fractions:

$$\text{H.C.F.} = \frac{\text{H.C.F.of Numerators}}{\text{L.C.M.of Denominators}}$$

L.C.M. = $\frac{\text{L.C.M.of Numerators}}{\text{H.C.F.of Denominators}}$

The product of the two fractions is always equal to the product of LCM and HCF of the two fractions i.e. HCF * LCM = Product of two numbers

Example 1: Find the HCF of 24, 30 and 42.

Solution:

2	24	2	30	2	42
2	12	3	15	3	21
2	6	5	5	7	7
3	3		1		1
	1				

Factors of 24 = 2 × 2 × 2 × 3 = ($2^3 \times 3^1$)
Factors of 30 = 2 × 3 × 5 = ($2^1 \times 3^1 \times 5^1$)
Factors of 42 = 2 × 3 × 7 = ($2^1 \times 3^1 \times 7^1$)

∴ The product of common prime factors with the least powers = $2^1 \times 3^1 = 6$

Example 2: Find the HCF of 26 and 455.

Solution:

$$26\overline{)455}\,(17$$
$$\underline{26}$$
$$195$$
$$\underline{182}$$
$$13\overline{)26}\,(2$$
$$\underline{26}$$
$$X$$

∴ Required HCF = 13.

Example 3: Find the HCF of $\frac{36}{51}$ and $3\frac{9}{17}$.

Solution: Here, $\frac{36}{51} = \frac{12}{17}$ and $3\frac{9}{17} = \frac{60}{17}$

Now, we have to find the HCF of $\frac{12}{17}$ and $\frac{60}{17}$.

According to the formula,

HCF of fractions = $\frac{\text{HCF of Numerators}}{\text{LCM of Denominators}} = \frac{\text{HCF of 12 and 60}}{\text{LCM of 17 and 17}} = \frac{12}{17}$.

Some important Facts:

1. If a, b and c give remainders p, q and r respectively, when divided by the same number H, then H is HCF of (a-p), (b-q), (c-r).
2. If the HCF of two numbers ‘a’ and ‘b’ is H, then, the numbers (a+b) and (a-b) are also divisible by H.
3. If a number N always leaves a remainder R when divided by the numbers a, b and c, then N = LCM (or a multiple of LCM) of a, b and c + R.

4. If a Number when divided by a,b,c leaves a remainders of x,y,z respectively and a-x= b-y= c-z= P, then the smallest number satisfying this condition is L.C.M(a,b,c)- P.

Example: Which is the smallest numbers which leaves a common remainder of 4 when divided by 6, 7, and 9?
Solution: Here you should remember that the smallest number is 4.The next such number will be (LCM of 6,7,9) + 4 i.e. 126+4 or 130.

REMAINDERS

A number M when divided by N leaves remainder R, and quotient is Q can be represented by M=NQ + R. where M is dividend, N is divisor, Q is quotient and R is remainder. The above rule is what is commonly called as the Division algorithm.
The concepts required to solve the questions of remainders are enumerated below

- Reducing remainders
- Negative remainders
- Fermat's little theorem
- Chinese remainders
- Wilson's rule.
-

1. Reducing remainders
Some basic rules are given below:

Remainders (axb)/c= remainder(a/c) x remainder(b/c)
Remainder (a+b)/c= remainder (a/c) + remainder (b/c)
Remainder (a-b)/c=remainder (a/c) – remainder (b/c)

Example 1: (142+143+145)/7. What is the remainder.?
Solution: (2 + 3+ 5)/7 = remainder is 5

Example 2: (142x142x142x----------100 times) /7.what is the remainder?
Solution: (2x2x2x……..100 times)/7.
=> (8x8x8……33 times x2)/7
=> 2.
Keep on dividing the remainders till the final remainder is less than divisor.

2. Concept of Negative Remainder

Remainder 27/7 =6 or its conjugate -1
Remainder 26/7 =5 or its conjugate -2

Example: What is the remainder $15^{97}/8$?
Solution: (15x15x15x……97 times)/8
(-1x-1x-1x…… 97 times)/8
-1 or its conjugate7

3. Fermat's little theorem

Remainder (M^{N-1})/N =1
Where M and N are co-prime and N is a prime number.

Example 1: Find the remainder of $(2^{100})/101$?
Solution: $(2^{100})/101 = 1$ (using Fermat's Theorem)

Example 2: Find the remainder when (5^{1000}) is divided by 77?
Solution: $(5^{1000}) / (7x11)$

Using Fermat's rule $5^6 /7$ = remainder is 1 so $5^{30}/7$ (remainder) =1
Using Fermat's rule $5^{10}/11$= remainder 1 so $5^{30}/11$ (remainder) =1
$5^{30}/77$ remainder =1
$((5^{30})^{33} \times 5^{10}) /77$ = remainder 23;
Where ($5^{10}/77$) remainder is 23 has to be dealt separately by reducing remainders theory.

4. **Chinese remainders**

Remainder N/ (axb) $= apr_1 + bqr_2$:
Where remainder of $N/a = r_2$ and $N/b = r_1$ and $ap + bq = 1$.

Example: Find the remainder $(5^{1000}) /(7x11)$
Solution: remainder $(5^{1000})/7 = ((5^6)^{166} \times 5^4) /7 = 2$ (using Fermat's rule $5^6 /7$ =Remainder is 1.)
Remainder $(5^{1000})/ 11 = (5^{10})^{100} /11 = 1$ (using Fermat's rule $5^{10}/11$= remainder 1
$7p+11q=1$ for p= -3, q= 2
So the final remainder is = 7x-3x1 + 11x2x2 =23.

5. Wilson's rule:

Remainder ((N-1)!+1) when divided by N has a remainder of 0

Example: (4! + 1) / 5 = remainder is 0,
(6! + 1) /7 =remainder is 0.

Example: Find the remainder for (96!+1000)/97 :
(96! + 1) is divisible by 97
So final remainder is remainder 999/97 =29.

Important result:

- Theorem: $a^n + b^n$ is divisible by a + b when n is ODD.
- Theorem 2: $a^n - b^n$ is divisible by a + b when n is EVEN.
- Theorem 3: $a^n - b^n$ is ALWAYS divisible by a – b.

Cyclicity / Unit Digit

Number	^1	^2	^3	^4	Cyclicity
2	2	4	8	6	4
3	3	9	7	1	4
4	4	6	4	6	2
5	5	5	5	5	1
6	6	6	6	6	1
7	7	9	3	1	4
8	8	4	2	6	4
9	9	1	9	1	2

We can summarize it as:
Cyclicity of 2, 3, 7 and 8 is 4.
Cyclicity of 4 and 9 is 2.
Cyclicity of 0, 1, 5 and 6 is 1.

Steps to find unit digit

1. Consider only Unit Digit of a number. Divide power by the Cyclicity of unit digit of a number or by 4 and find the remainder.

Eg: Find the units place digit of 2^{99}

$2^{99/4}$ => 99/4 => remainder is 3

2. Make remainder as a power of a unit digit and consider only last digit.

2^3=8

So, unit digit of 2^{99}= 8

3. If remainder is 0, then Cyclicity will become the power of unit digit.

Example: Find the units place digit of 252^{84}?

Solution: Consider only unit digit of a number i.e. 2^{84}

84/4 = 0 (Remainder)

So, power of 2 will become its Cyclicity i.e. 4.

Therefore, Unit digit of 2^4 = 6.

Example: What is the unit digit in the product (3^{65} x 6^{59} x 7^{71})?

Solution: firstly, find the unit digit of 3^{65}

$3^{65/4} = 3^1 = 3$

Unit digit of 6^{59} = 6 (Cyclicity of 6 is 1 i.e. unit digit of 6 is always 6)

Unit digit of $7^{71} = 7^{71/4} = 7^3 = 3$

3*6*3=4

FACTORIAL

Factorial is an important topic in quantitative aptitude preparation. The factorial of a non-negative integer n is denoted as n! The notation was introduced by Christian Kramp in 1808.n! is calculated as the product of all positive integers less than or equal to n.

i.e 6! = 1 * 2 * 3 * 4 * 5 * 6 = 720

n! = 1 when n = 0, and n! = (n-1)! * n if n > 0

n! is the number of ways we can arrange n distinct objects into a sequence.

2! = 2 means numbers 1, 2 can be arranged in 2 sequences (1, 2) and (2, 1).

We can arrange 0 in one way. So 0! = 1, not zero. Now we know why, and no need to say “its like that” if someone asks ;-)

Find the highest power of a prime number in a given factorial

The highest power of prime number p in n! = [n/p1] + [n/p2] + [n/p3] + [n/p4] + ….. where [n/p1] denotes the quotient when n is divided by p

Example 1: The maximum power of 5 in 60!

Sol: 60! = 1 x 2 x 3 .....60 so every fifth number is a multiple of 5. So there must be 60/5 = 12

In addition to this 25 and 50 contribute another two 5's. so total number is 12 + 2 = 14

Short cut: [60/5]+[60/52]=12+2=14

Here [ ] Indicates greatest integer function.

Example 2: How many zero's are there at the end of 100!
Sol: A zero can be formed by the multiplication of 5 and 2. Since 100! contains more 2's than 5's, we can find the maximum power of 5 contained in 100!
⇒100/2+100/4+100/8+100/16+100/32+100/64 = 50 + 25 + 12 + 6 + 3 + 1 = 97
⇒100/5+100/25=20+4=24

LEVEL - I

1. Find the least value of * for which 4832*18 is divisible by 11.
   A] 5 B] 3 C] 7 D] 11

2. Is 52563744 divisible by 24?
   A] Yes B] No C] can't be determined D] None of these

3. What least number must be subtracted from 1672 to obtain a number which is completely divisible by 17?
   A] 5 B] 7 C] 3 D] 6

4. What least number must be added to 2010 to obtain a number which is completely divisible by 19?
   A] 5 B] 4 C] 19 D] None of these

5. On dividing 12401 by a certain number, we get 76 as quotient and 13 as remainder. What is the divisor?
   A] 163 B] 173 C] 183 D] None of these

6. On dividing a certain number by 342, we get 47 as reminder. If the same number is divided by 18, what will be the remainder?
   A] 7 B] 9 C] 11 D] 13

7. A number when successively divide by 3, 5 and 8 leaves remainders 1, 4 and 7 respectively. Find the respective remainders if the order of divisors be reversed.
   A] 5, 4, 2 B] 6, 4, 2 C] 1, 1, 3 D] None of these

8. What is the least perfect square divisible by 8, 9 and 10?
   A] 4000 B] 6400 C] 3600 D] 14641

9. 4a56 is a four-digit numeral divisible by 33. What is the value of a?
   A] 3 B] 4 C] 5 D] 6

10. The sum of five distinct whole numbers is 337. If 60 is the smallest of them, what is the maximum value the largest number can have?
    A] 91 B] 70 C] 97 D] 274

11. The number of 2 digit prime number is
    A] 25 B] 17 C] 21 D] None of these

12. If n^2 = 12345678987654321, what is n?
    A] 12344321 B] 1235789 C] 111111111 D] 11111111

13. 46917 × 9999 =?

A] 4586970843 B] 469123083 C] 4691100843 D] 584649125

14. Which of the following has fractions in ascending order?

A] $\frac{1}{3},\frac{2}{5},\frac{4}{7},\frac{3}{5},\frac{5}{6},\frac{6}{7}$ B] $\frac{1}{3},\frac{2}{5},\frac{3}{5},\frac{4}{7},\frac{5}{6},\frac{6}{7}$

C] $\frac{1}{3},\frac{2}{5},\frac{3}{5},\frac{5}{6},\frac{4}{7},\frac{6}{7}$ D] $\frac{2}{5},\frac{3}{5},\frac{1}{3},\frac{4}{7},\frac{5}{6},\frac{6}{7}$

15. Which of the following are in descending order or their value?

A] $\frac{5}{9},\frac{7}{11},\frac{8}{15},\frac{11}{17}$ B] $\frac{5}{9},\frac{8}{15},\frac{11}{17},\frac{7}{11}$

C] $\frac{11}{17},\frac{7}{11},\frac{8}{15},\frac{5}{9}$ D] $\frac{11}{17},\frac{7}{11},\frac{5}{9},\frac{8}{15}$

16. When $0.\overline{47}$ is converted into a fraction, the result is:

A] $\frac{46}{90}$ B] $\frac{46}{99}$ C] $\frac{47}{90}$ D] $\frac{47}{99}$

17. The value of $0.\overline{57}$ is:

A] $\frac{57}{10}$ B] $\frac{57}{99}$ C] $\frac{26}{45}$ D] $\frac{52}{9}$

18. The value of $4.1\overline{2}$ is:

A] $4\frac{11}{90}$ B] $4\frac{11}{99}$ C] $\frac{371}{900}$ D] None of these

19. The value of $2.1\overline{36}$ is:

A] $\frac{47}{220}$ B] $\frac{68}{495}$ C] $2\frac{3}{22}$ D] None of these

20. Reduce $\frac{391}{667}$ to lowest terms.

A] $\frac{17}{29}$ B] $\frac{11}{23}$ C] $\frac{13}{25}$ D] $\frac{14}{27}$

LEVEL – II

1. Find the HCF of $2^3 \times 3^2 \times 5 \times 7^5$; $2^2 \times 5^2 \times 7^3$ and $2^3 \times 5^3 \times 7^2$.
   A] 940 B] 980 C] 930 D] 925

2. Find the highest common factor of (34, 85)
   A] 4 B] 12 C] 17 D] 19

3. The LCM of (198, 252, 308) is:
   A] 2072 B] 2772 C] 2727 D] 2770

4. Which of the following is a pair of co-primes?
   A] (16, 62) B] (18, 24) C] (20, 27) D] (23, 92)

5. The HCF of $\left(\frac{3}{4}, \frac{5}{6}, \frac{6}{7}\right)$is
   A] $\frac{2}{93}$ B] $\frac{1}{84}$ C] $\frac{1}{83}$ D] $\frac{3}{91}$

6. The product of two numbers is 5476. If the HCF of these numbers is 37. The greater number is:
   A] 107 B] 111 C] 148 D] 185

7. The product of two numbers is 2028 and their HCF is 13. How many pairs of such numbers are possible?
   A] 1 B] 2 C] 3 D] 4

8. The greatest possible length which can be used to measure exactly the lengths: 20 m 6 cm, 11m 90 cm and 14 m 45 cm is:
   A] 17 B] 18 C] 19 D] 121

9. Find the greatest number that will divide 48, 97 and 188 and leaves the reminder 6 in each case.
   A] 4 B] 7 C] 2 D] 6

10. The greatest number, which when divides 1358, 1870, and 2766 leaves the same remainder 14 in each case, is:
    A] 124 B] 64 C] 156 D] 260

11. What will be the least number which when doubled becomes exactly divisible by 9, 15, 21, and 30?
    A] 196 B] 189 C] 630 D] 315

12. The least five digit number which is exactly divisible by 12, 18, and 21 is:
    A] 10010 B] 10015 C] 10080 D] 10020

13. The greatest four digit number which is divisible by 18, 25, 30, and 48 is:
    A] 9000 B] 9200 C] 7200 D] 9729

14. Find the least multiple of 23 which when divided by 24, 21, and 18 leaves the remainders 13, 10, and 7 respectively.
    A] 3004 B] 3024 C] 3013 D] 3026

15. The least number which when divided by 5, 6, 7, and 8 leaves the remainder 3. But when divided by 9 leaves no remainder, is:
    A] 1766 B] 1683 C] 2327 D] 1895

16. Four different devices beep after every half hour, 60 min, 1 and half hours, and 135 min respectively. All the devices beeped together at 12 noon. They will beep together again at:
    A] 12 midnight B] 6 AM C] 9 PM D] 7:30 AM

17. X, Y, Z start at the same time in the same direction to run around a circular stadium. X completes a round in 63 seconds, Y in 105 seconds and Z in 210 seconds. If they start at the same time, then at what time will they meet again at the starting point?
    A] 9 min 9 seconds B] 10 min 30 seconds
    C] 10 min 6 seconds D] 8 min 4 seconds

18. What is the unit digit in the product (684 x 759 x 413 x 676)?
    A] 6 B] 8 C] 2 D] None of these

19. What is the unit digit in the product$(3547)^{153} \times (251)^{72}$?
A] 1 B] 3 C] 7 D] None of these

20. What is the unit digit in$\{(264)^{102} + (264)^{103}\}$?
A] 0 B] 1 C] 2 D] 4

LEVEL – III

1. Find the total number of prime factors in the product$\{(4)^{11} \times (7)^5 \times (11)^2\}$.
A] 31 B] 10 C] 11 D] 29

2. Find the remainder when 2^{31} is divided by 5.
A] 1 B] 2 C] 3 D] 4

3. Find the Remainder of $\frac{2^{96}}{96}$
A] 16 B] 84 C] 64 D] None

4. Find the Remainder of $\frac{3^{1002}}{33}$
A] 1 B] 3 C] 9 D] 33

5. Find the Remainder of $\frac{100!}{101}$
A] 1 B] 0 C] 101 D] None of these

6. No. of zeros at the end of $(45!)^{450}$
A] 10 B] 450 C] 10^{45} D] 4500

7. No. of zeros at the end of (31)! × (42)! × (100!)
A] 48 B] 16 C] 6 D] 40

8. Remainder when (1! + 2! + 3! + ... + 4000!) is divided by 7
A] 7 B] 1 C] 5 D] None of these

9. What will be unit's digit in the expression 78^{5562} x 56^{256} x 97^{1250}?
A] 9 B] 4 C] 6 D] 3

10. Find the first non-zero digit of the number 80^{127} from right side.
A] 8 B] 4 C] 2 D] 6

11. Find the last digit of $1^5+2^5+3^5+....+99^5$
A] 1 B] 0 C] 3 D] 5

12. Find the unit's digit of 27^{23}-23^{27}
A] 6 B] 4 C] 2 D] 8

13. What is the sum of the factors of 221?
A] 222 B] 251 C] 252 D] 262

14. The number of Zeroes in 18! is:

A] 4 B] 6 C] 3 D] 8

15. The number of Zeroes in 29! is:

A] 4 B] 3 C] 6 D] 7

16. The digit in the unit place of the number represented by $(7^{95} - 3^{58})$ is :

A] 0 B] 7 C] 6 D] 4

17. If the number 42573* is exactly divisible by 72, then which of the following number should replace *?

A] 4 B] 5 C] 7 D] 6

18. How many numbers between 200 and 600 are divisible by 4, 5 and 6 ?

A] 5 B] 6 C] 7 D] 8

19. X, Y and Z are 3 distinct even integers ranging from 1 to 25. Which of the following is necessarily true?

1. X^Y/Z is an even integer.
2. $17XY^3$ is an even integer
3. $8\ Y^X/Z$ is an even integer
4. $3Y(Z^X)$ is an even integer

A] 1 only B] 2 only C] 4 only D] Both 2 & 4

20. Let x, y and z be distinct integers, that are odd and positive. Which one of the following statements cannot be true?

A] xyz^2 is odd`

B] $(x - y)^2 z$ is even

C] $(x + y + z)^2 (x + y)$ is even

D] $(x - y)(y + z)(x + y - z)$ Cannot be even

AVERAGE

Average is a very simple but effective way of representing an entire group of by a single value.
The term average is also referred to as 'Mean'. Basic formula to calculate the average is as follows

$$\text{Average} = \frac{\textbf{\textit{Sum of Observations}}}{\textbf{\textit{Number of Observations}}}$$

Average is used quite regular in our day to day life. For example to calculate the average marks of the students, Average height of a particular group etc.

Points to remember

(i) If the value of each item is increased by the same value P, then the average of the group or items will also increase by p.

(ii) If the value of each item is decreased by the same value p, then the average of the group or items will also decreased by p.

(iii) If the value of each item is multiplied by the same value, then the average of the group or items will also be multiplied by p.

(iv) If the value of each item is divided by the same value P ($P \neq 0$), then the average of the group or items will also be divided by p.

(v) The average of a group of items will always lie between the smallest value in the group and largest value in the group – i.e., the average will be greater than the smallest value and less than the largest value in the group

Example 1: What is the average of First 10 Prime numbers?

Solution: First 10 Prime numbers are 2,3,5,7,11,13,17,19,23,29.
Hence, Average = {2+3+5+7+11+13+17+19+23+29} / 10
= 129 / 10 = 12.90

Example 2: Four children have 30, 40, 50 and 60 toffees with them. What is the average number of toffees with them?

Solution: Average = (30 + 40 + 50 + 60) / 4 = 45
Using the above point, the average is (40+50)/2 = 45

Deviation Method for Calculation of Average

Now take a set of values which are typically cumbersome to deal with.

Example 3: Find average of 213, 227, 233, 223 and 229.

Solution: In the above case take the arbitrary number to be 220.

Then the average can be found as {220 + (-7+7+13+3+9)}/5 = 225.

Example 4: Find the average of 1093, 1103, 1109, 1089 and 1096?

Solution: This can be done as (1093 + 1103 + 1109 + 1089 + 1096) / 5

Or we observe that the numbers are close to 1100. Let us say, the numbers are

1093 = 1100 – 7; 1103 = 1100 + 3; 1109 = 1100 + 9

1089 = 1100 – 11; 1096 = 1100 – 4

Sum = 1100 x 5 – 10

So, average = (1100 x 5 – 10) / 5 = (1100/5) – 2 = 1098

This can be written as

$P = \boldsymbol{P} + \frac{\sum(\boldsymbol{Pi}-\boldsymbol{P})}{\boldsymbol{n}}$

Here it doesn't really make a difference whether we assume the mean as 1100 or 1095 etc.

This method would come in handy while dealing with weighted averages or in DI.

Weighted Average

When two groups of items are combined together, then we can talk of the average of the entire group. However, if we know only the average of the two groups individually, we cannot find out the average of the combined group of items.

For example, there are two sections A and B of a class where the average height of section A is 150 cm and that of section B is 160 cm. On the basis of this information alone, we cannot find the average of the entire class (of the two sections).

Important Formulae Related to Average of numbers

1. Average of first n natural number = (n+1)/2
2. Average of first n even number = (n+1)
3. Average of first n odd number = n
4. Average of consecutive number = (First number + Last number)/2
5. Average of 1 to n odd numbers = (Last odd number+1)/2
6. Average of 1 to n even numbers = (Last even number+2)/2
7. Average of squares of first n natural numbers = [(n+1) (2n+1)]/6
8. Average of the cubes of first n natural number = [n (n+1)^2]/4
9. Average of n multiples of any number = [Number*(n+1)]/2

Example 5: Find out the average of 2, 4, 6, 8, 10, 12 and 14.

Solution: As we know that average of 1^{st}′n′ even numbers = (n + 1)

∴ Required average = (7 + 1) = 8

Example 6: Calculate the average of 1, 3, 5, 7, 9, 11, 13, 15 and 17.

Solution: As we know, average of 1^{st}′n′ odd numbers = n

∴ Required average = 9

Example 7: What will be the average of 1, 2, 3, 4……51, 52, 53?

Solution: As we know, average of consecutive numbers = $\frac{\text{First Number+Last Number}}{2}$

Where first number = 1 and last number = 53

∴ Required average = $\frac{1+53}{2} = \frac{54}{2} = 27$

Example 8: Calculate the average of the squares of natural numbers from 1 to 25.

Solution: According to the formula, average of squares of first $'n'$ natural numbers = $\frac{(n+1)(2n+1)}{6}$

Where $n = 25$.

$\therefore$ Required average = $\frac{(25+1)(2\times25+1)}{6} = \frac{26\times51}{6} = \frac{1326}{6} = 221$

Example 9: The average weight of a group of 15 friends increases by 1 kg, when a person joins the group. Find the weight of the person who joins the group, if the initial average weight of the group is 48 kg.

Solution: Let the weight of the person joining the group be x kg.

Given, $(15 \times 48 + x) / 16 = 49$

$\Rightarrow x = 16 \times 49 – 15 \times 48 = 784 – 720 = 64$

Hence the weight of the new person is 64 kg.

Alternate Method:

When the new person joins group as the average weight of the group increases by 1 kg, we can understand that this person is bringing 1 kg additionally not only for himself but even for others. Hence his weight should be 48 + 1 (16) i.e., 64 kg

Example 10: In a class there are two sections –> A and B. Section A contains 50 students with an average of 30 marks in Maths. Section B contains 75 students with an average of 40 marks in Maths. What is the average mark of the whole class?

Solution: For finding out the average mark of the whole class we will need the sum of marks of the whole class.

The sum of marks of all students in section A is $50\times30 = 1500$
The sum of marks of all students in section B is $75\times40 = 3000$
Thus total sum of marks for the class is $(1500+3000) = 4500$
So the average mark of the class is $4500 / (50+75) = 36$

Example 11: The average age of a group of friends is 34 years. If five new friends with an average age of 30 years join the group, the average of the entire group becomes 32 years. How many people were there in the group initially?

Solution: Let there be 'n' people initially in the group. Then the total age of the group after the five new friends joined the group is 34n + (5 x 30)

But this is also equal to 32 (n + 5)
$\therefore 32(n+5) = 34n + 150 \Rightarrow n = 5$
So, there were 5 friends in the group initially.

Example 12: A batsman scored an average of 55 runs in the first 6 tests. If the first test is not counted and the seventh is counted then his average score goes, up to 57. If the score in the first test as 50 runs. Find his score in the seventh test.

Solution: Total score in the first sic tests = 6 x 55 = 330
Total score in the last six tests = 6 x 57 = 342
Score in all seven tests = Total score in the last
Six tests + score in the 1^{st} test = 342 + 50 = 392
$\therefore$ Score in the 7^{th} test = Total score in all 7 test – total score in the first 6 tests
= 392-330 = 62

Example 13: Twelve years ago, the average of the ages of the members of a joint family having ten members was 25 years. Four years later a member aged 50 years died and a child was born in the family that year. Four years after that, another member aged 50 years died and another child was born. Find the present average age of the members of the family (in years).

Solution: Had there been no alterations, the current average would have been 25 + 12 = 37.

The first person who goes out takes with him 50 years, Similarly, the second person who goes out takes with him another 50 years.

Present average = 37 - (50 + 50)/10 = 37 – 10

= 27 years.

Example 14: The average of five positive numbers is 213. The average of the first two numbers is 233.5 and the average of last two numbers is 271. What is the third number?

Solution: The sum of the five numbers = 5 × 213 =1065

The sum of the first two numbers = 2 × 233.5 = 467

The sum of the last two numbers = 542

Then the sum of the four numbers = 467 + 542 =1009

So, the third number will be = 1065 – 1009 = 56.

Example 15: The average marks of 65 students in a class were calculated as 150. It was later realized that the marks of one of the students was calculated as 142, whereas his actual average marks were 152. What is the actual average mark of the group of 65 students? (Rounded off to two digits after decimal)

Solution: Increase in total marks = 152 – 142 = 10

Therefore the New average = 150 + 10/65 = 150.15

Example 16: In a class there are 32 boys and 28 girls. The average age of the boys in the class is 14 years and the average age of the girls in the class is 13 years. What is the average age of the whole class? (Rounded off to two digits after decimal)

Solution: The sum of the ages of 32 boys = 32 × 14 = 448

The sum of the ages of 28 girls = 28 × 13 = 364

Therefore, the sum of the ages of the whole class of 60 students =812

The average age of the whole class of 60 students = 812/60 = 13.53

Example 17: Srikanth earned an average of Rs. 16,00 per month from January to June. Then, he earned Rs. 1500, Rs, 1800, Rs, 1900 and Rs. 2150 respectively during the months July, through October. During November he earned 5-% of what he earned in December. If his average earnings for the entire year is Rs. 1,600. Find his earnings in the month of November.

Solution: Let earnings for the month of November be ‘x’.

Then total annual earnings will be

(1600 x 6) + 1500 + 1800 +1900 + 2150 + 3X =16950 +3x

Total earnings for the entire year

= 12 x 1600 (given)

= 19200 which is equal to 16950 + 3x

16950 + 3x = 19200 $\Rightarrow$ 3x = 250

$\therefore$ x = Rs 750

Hence, the earnings in the month of November is Rs 750.

Level - I

1. The average of first five prime numbers is:
   A] 4.5 B] 5 C] 5.6 D] 7.5

2. The average of first five multiples of 3 is:
   A] 3 B] 9 C] 12 D] 15

3. The average height of 30 boys out of a class of 50 is 160 cm. If the average height of the remaining boys is 165 cm, the average height of the whole class (in cm) is:
   A] 161 B] 162 C] 163 D] 164

4. The average of three numbers is 20. If the two numbers are 16 and 22, the third number is:
   A] 22 B] 20 C] 19 D] 18

5. The average of five results is 46 and that of the first four is 45. The fifth result is:
   A] 1 B] 10 C] 12.5 D] 50

6. The average of Radhika's marks in 7 subjects is 75. His average in six subjects excluding science is 72. How many marks did he get in Science?
   A] 72 B] 90 C] 93 D] None of these

7. The average of eight numbers is 14. The average of six of these numbers is 16. The average of the remaining two numbers is:
   A] 4 B] 8 C] 16 D] Data inadequate

8. Average of four consecutive odd numbers is 106. What is the third number in ascending order?
   A] 107 B] 111 C] 113 D] cannot be determined

9. Of the three numbers, the average of the first and the second is greater than the average of the second and the third by 15. What is the difference between the first and the third of the three numbers?
   A] 15 B] 45 C] 60 D] None of these

10. The ratio of roses and lilies in a garden is 3:2 respectively. The average number of roses and lilies is 180. What is the number of lilies in the garden?
    A] 144 B] 182 C] 216 D] 360

11. The average price of three items of furniture is Rs. 15000. If their prices are in the ratio 3:5:7, the price of the cheapest item is:
    A] R9000 B] R15000 C] R18000 D] R21000

12. Of three numbers, second is twice the first and is also thrice the third. If the average of the three numbers is 44, the largest number is:
    A] 24 B] 36 C] 72 D] 108

13. The average of ten numbers is 7. If each number is multiplied by 12, then the average of new set of numbers is:
    A] 7 B] 19 C] 82 D] 84

14. The average age of 30 students of a class is 12 years. The average age of a group of 5 of the students is 10 years and that of another group of 5 of them is 14 years. What is the average age of the remaining students?
A] 8 years B] 10 years C] 12 years D] 14 years

15. The average of 50 numbers is 38. If two numbers 45 and 55 are discarded, the average of the remaining numbers is:
A] 36.5 B] 37 C] 37.5 D] 37.52

16. The mean of 100 observations was calculated as 40. It was found later on that one of the observations was misread as 83 instead of 53. The correct mean is:
A] 39 B] 39.7 C] 40.3 D] 42.7

17. The average of six numbers is 30. If the average of first four is 25 and that of last three is 35, the fourth number is:
A] 25 B] 30 C] 35 D] 40

18. The average of 11 observations is 60. If the average of first five observations is 58 and that of the last five is 56, the sixth observation is:
A] 90 B] 110 C] 85 D] 100

19. Harish has twice as much money as Rohan and Rohan has 50% more money than what Anita has. If the average money with them is Rs.110, then Harish has:
A] Rs.55 B] Rs. 60 C] Rs.90 D] Rs. 180

20. A motorist has travels to a place 150 km away at an average speed of 50 km per hour and returns at 30 km per hour. His average speed for whole journey in km per hour is
A] 35 B] 37 C] 37.5 D] 40

LEVEL – II

1. The average of 5 numbers is 7. When 3 new numbers are added, the average of the eight numbers is 8.5. The average of three new numbers is:
A] 11 B] 7.75 C] 8.5 D] 7

2. The average age of 30 students is 9 years. If the age of their teacher is included, it becomes 10 years. The age of the teacher (in years) is:
A] 27 B] 31 C] 35 D] 40

3. The average age of 24 boys and the teacher is 15 years. When the teacher's age is excluded, the average decreases by 1. What is the age of the teacher?
A] 38 years B] 39 years C] 40 years D] Data inadequate

4. The average salary per month of 30 employees in a company is Rs. 4000. If the manager's salary is added, the average salary increases to Rs. 4300, what is the salary of the manager?
A] Rs. 10000 B] Rs. 13000 C] Rs. 12000 D] Rs. 13300

5. The average age of 40 students of a class is 15 years. When 10 new students are admitted, the average is increased by 0.2 years. The average age of new students is:
A] 15.2 years B] 16 years C] 16.2 years D] 16.4 years

6. The average weight of 8 men is increased by 1.5 kg when one of the men who weigh 65 kg is replaced by a new man. The weight of the new man is:
A] 76 kg B] 76.5 kg C] 76.7 kg D] 77 kg

7. The average weight of 6 men decreases by 3 kg when one of them weighing 80 kg is replaced by a new man. The weight of the new man is:
A] 56 kg B] 58 kg C] 62 kg D] 76 kg

8. The average age of a committee of eight members is 40 years. A member aged 55 years retired and his place was taken by another member aged 39 years. The average age of the present committee is:
A] 39 years B] 38 years C] 36 years D] 35 years

9. A cricketer has a certain average for 9 innings. In the tenth innings, the score is 100 runs, thereby increasing his average by 8 runs. His new average is:
A] 20 runs B] 24 runs C] 28 runs D] 32 runs

10. A man whose bowling average is 12.4 takes 5 wickets for 26 runs and thereby decreases his average by 0.4. The number of wickets, taken by him before his last match is:
A] 85 B] 78 C] 72 D] 64

11. The mean temperature of Monday to Wednesday was 37ºC and of Tuesday to Thursday was 34ºC. If the temperature on Thursday was 4/5 that of Monday, the temperature on Thursday was:
A] 36.5ºC B] 36ºC C] 35.5ºC D] 34ºC

12. Three years ago, the average age of X, Y and Z was 27 years and that of Y and Z, 5 years ago was 20 years. X's present age is:
A] 30 years B] 35 years C] 40 years D] 48 years

13. Three years ago, the average age of a family of 5 members was 17 years. A baby having been born, the average age of the family is the same today. The present age of the baby is:
A] 2 years B] 2.4 years C] 3 years D] 1.5 years

14. The average monthly income of a family of four earning members was Rs.15130. One of the daughters in the family got married and left home, so the average monthly income of the family came down to Rs.14660. What is the monthly income of the married daughter?
A] Rs.15350 B] Rs.12000 C] Rs.16540 D] Cannot be determined

15. The average of four positive integers is 73.5. The highest integer is 108 and the lowest integer is 29. The difference between the remaining two integers is 15. Which of the following is the smaller of the remaining two integers?
A] 80 B] 86 C] 73 D] None of these

16. The average age of a woman and her daughter is 46 years. The ratio of their ages is 15:8 respectively. What will be the respective ratio of their ages after 8 years?
A] 8 : 5 B] 10 : 17 C] 17 : 10 D] 5 : 8

17. There are 50 boys in a class. One boy weighing 40 kg goes away and at the same time another boy joins the class. If the average weight of the class is thus decreased by 100 g, find the weight of the new boy.
A] 35 kg B] 43 kg C] 36 kg D] 30 kg

18. Kamlesh bought 65 books for Rs.1050 from one shop and 50 books for Rs.1020 from another. What is the average price he paid per book?
A] Rs. 36.40 B] Rs.18.20 C] Rs. 24 D] Rs.18

19. A car covers the first 39 kms of its journey in 45 minutes and covers the remaining 25 kms in 35 minutes. What is the average speed of the car?
A] 40 kms/hr B] 64 kms/hr C] 49 kms/hr D] 48 kms/hr

20. The average marks in Science subject of a class of 20 students is 68. If the marks of two students were misread as 48 and 65 of the actual marks 72 and 61 respectively, then what would be the correct average?
A] 68.5 B] 69 C] 69.5 D] 70

LEVEL – III

1. The average speed of a car is 75 kms/hr. What will be the average speed of the car if the driver decreases the average speed of the car by 40 percent?
A] 50 kms/hr B] 45 kms/hr C] 40 kms/hr D] 55 kms/hr

2. The average marks of a student in seven subjects are 41. After re-evaluation in one subject the marks were changed to 42 from 14 and in remaining subjects the marks remained unchanged. What are the new average marks?
A] 45 B] 44 C] 46 D] 47

3. The average marks of nine students in a group are 63. Three of them scored 78, 69 and 48 marks. What are the average marks of remaining six students?
A] 63.5 B] 64 C] 63 D] 62

4. Out of the three given numbers, the first number is twice the second and thrice the third. If average of the three numbers are 154. What is the difference between the first and the third number?
A] 126 B] 42 C] 52 D] 168

5. The average of four positive integers is 124.5. The highest integer is 251 and the lowest integer is 65. The difference between the remaining two integers is 26. Which of the following integers is higher of the remaining two integers?
A] 78 B] 102 C] 100 D] 104

6. In an examination, a student's average marks were 63. If he had obtained 20 more marks for his Geography and 2 more marks for his history, his average would have been 65. How many subjects were there in the examination?
A] 12 B] 11 C] 13 D] 14

7. The average age of a husband and his wife was 23 years at the time of their marriage. After five years they have a one year old child. What is the average age of the family?
A] 21 years B] 20 years C] 18 years D] 19 years

8. A painter is paid x rupees for painting every 10 metres of a wall and y rupees for painting every extra metre. During one week, he painted 10 metres on Monday, 13 metres on Tuesday, 12 metres on Wednesday, 11 metres on Thursday and 12 metres on Friday. What is his average daily earning in rupees for the five day week?
A] x + (8/5) y B] (5x + 9y)/5 C] 10x + (8/5)y D] 5x + 8y

9. In a class with a certain number of students, if one new student weighing 50 kg is added, then the average weight of the class increased by 1 kg. If one more student weighing 50 kg is added, then the average weight of the class increases by 1.5 kg over the original average. What is the original weight (in kg) of the class?
A] 46 B] 42 C] 27 D] 47

10. There was one mess for 30 boarders in a certain hostel. If the number of boarders was increased by 10, the expenses of the mess increased by Rs. 40 per month, while the average expenditure per head diminished by Rs. 2. Find the original monthly expenses.
A] Rs. 390 B] Rs. 360 C] Rs. 410 D] Rs. 480

11. There are three baskets of fruits. First basket has twice the number of fruits in the 2nd basket. Third basket has three-fourths of the fruits in the first. The average of the fruits in all brackets is 30. What is the number of fruits in the first basket?
A] 20 B] 30 C] 35 D] 40

12. The average weight of 3 men, X, Y and Z is 84 kg. Another man T joins the group and the average now becomes 80 kg. If another man S, whose weight is 3 kg more than that of T, replaces X than the average weight of Y, Z, T and S becomes 79 kg. The weight of X is:
A] 70 kg B] 72 kg C] 75 kg D] 80 kg

13. If the three numbers, the average of the first and the second is greater than the average of the second and the third by 15. What is the difference between the first and the third if the three numbers?
A] 15 B] 45 C] 60 D] None of these

14. Mr. Anant Roy, the renowned author, recently got his new novel released. To his utter dismay he found that for the 1,007 pages on an average there were 2 mistakes every page. While, in the first 612 pages there were only 434 mistakes, they seemed to increase for the latter pages. Find the average number of mistakes per page for the remaining pages.
A] 6 B] 4 C] 2 D] None of these

15. The average age of a couple is 25 years. The average age of the family just after the birth of the first child was 18 years. The average age of family just after the second child was born was 15 years. The average age of the family after the third and the fourth children (who are twins) were born was 12 years. If the present average age of the family of six persons is 16 years, how old is the eldest child?
A] 6 years B] 7 years C] 8 years D] 9 years

16. Eleven years earlier the average age of a family of 4 members was 28 years. Now the age of the same family with six members is yet the same, even when 2 children were born in this period. If they belong to the same parents and the age of the first child at the time of the birth of the younger child was same as there were total family members just after the birth of the youngest members of this family, then the present age of the youngest member of the family.
A] 3 years B] 5 years C] 6 years D] None of these

17. The average price of 3 diamonds of same weights is Rs. 5 crore, where the average price of the two costliest diamonds is double the price of the cheapest diamond. The price of the cheapest diamond is
A] 3 crore B] 5 crore C] 1.66 crore D] can't be determined

18. A set of consecutive positive integers beginning with 1 is written on the blackboard. A student came along and erased one number. The average of the remaining numbers is $35\frac{7}{17}$.
What was the number erased?
A] 7 B] 8 C] 9 D] None of these

19. In a class of 100 students the average marks obtained by a student in Maths in 44. If we remove the highest and the lowest the average of the class becomes 43.92. A total of three students get either highest or lowest. What is the average of these three students?
A] 73.33 B] 46.66 C] 59.99 D] cannot be determined

20. Neeta's attendance for first two semesters out of four was 60% and 70% respectively. What is the minimum attendance required in third semester so that her average attendance will be 80% throughout for semesters?
(Assume equal number of days among the four semesters)
A] 70 % B] 80% C] 90% D] None of these

ARITHMETICAL REASONING

MATHEMATICAL OPERATIONS

This section deals with questions on simple mathematical operations. Here, the four fundamental operations — addition, subtraction, multiplication and division and also statements such as less than\ 'greater than', 'equal to', 'not equal to, etc. are represented by symbols, different from the usual ones. The questions involving these operations are set using artificial symbols. The candidate has to substitute the real signs and solve the questions accordingly, to get the answer.

Different types of questions covered in this chapter are as follows

- Symbol Substitution
- Balancing the Equation
- Interchange of Signs and Numbers
- Trick Based Mathematical Operations

Note: While solving a mathematical expression, proceed according to the rule BODMAS — i.e., Brackets, Of, Division, Multiplication, Addition, Subtraction.

Example: (36 -12) ÷4 + 6 + 2 x 3 = 24 ÷ 4 + 6 + 2 x 3 (Solving Bracket)

= 6 + 6 + 2 x 3 (Solving Division)

= 6+6+6 (Solving Multiplication)

= 18 (Solving Addition)

Type 1: Symbol Substitution

In this type of question, a candidate is provided with substitutes for various mathematical symbols, followed by a question involving calculation of an expression or choosing the correct/ incorrect equation. The candidate is required to put in the real signs in the given equation and then solve the questions as required.

Example 1: if '×' means '-', '÷' means '+', + means '×', then 18 × 5 ÷ 5 +6 is equal to

A. 58
B. 49
C. 43
D. 37

Solution: C

Change of symbols according to the question,
18 × 5 ÷ 5 + 6 = 18 – 5 + 5 × 6
18 – 5 + 30 = (18 + 30) = 43

Type 2: Balancing the Equation

In this type of questions, the signs in one of the alternatives are required to fill up the blank spaces for the signs is order to balance the given equation

Example 2 : If the following equations has to be balance, then the signs of which of the following options will be used?
24 6 12 16 = 0

A. -, + and +
B. ÷, + and ÷
C. -, - and -
D. ÷, + and –

Solution: (d)

24÷6+12-16 = 4+12-16
=16-16=0=RHS

Type 3: Interchange of Signs and Numbers

In this type of questions, the given equation becomes correct and fully balanced when either two signs of the equation or both the numbers and the signs of the equation are interchanged. The candidate is required to find the correct pair of signs and numbers from the given alternatives.

Example 3: Which one of the given interchange in signs would make the given equation correct?
10– 2 +9 × 2 ÷ 4 = 19

A. - and ÷
B. - and +
C. ÷ and ×
D. × and ÷

Solution: (a)

Let us check the options one by one
From option (a), If we replace – by ÷ and ÷ by- we get,
10÷2+9×2-4
=5+18-4(BODMAS)
=19
As options (a) gives us the correct answer. Hence, there is no need to check other options.

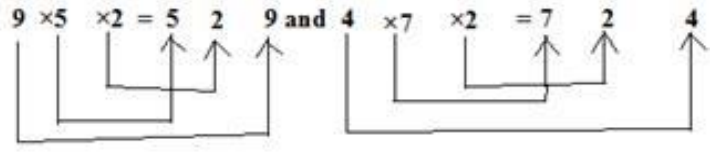
Type 4: Trick Based Mathematical Operations

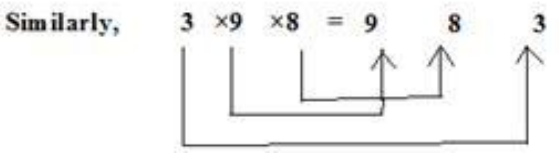
The questions are based on simple mathematical operations that do not come under any of the above given types covered here. These questions can be based on several different patterns.

Example 4: If 9 × 5 × 2 = 529 and 4 × 7 × 2 = 724, then 3 × 9 × 8 =?

A. 983
B. 839
C. 938
D. 893

Solution: (a)





LEVEL - I

1. Find out the two signs to be interchanged for making following equation correct
5 + 3 x 8 - 12 / 4 =3
A. + and - B. - and / C. + and x D. + and /

2. If × stands for 'addition', ÷ stands for 'subtraction', + stands for 'multiplication' and-stands for 'division', then 20 × 8 ÷ 8 - 4 + 2 = ?
A. 80 B. 25 C. 24 D. 5

3. If × means ÷, - means ×, ÷ means + and + means- than (3 - 15 ÷ 19) × 8 + 6 = ?
A. 8 B. 4 C. 2 D. -1

4. Select the correct set of symbols which will fit in the given equation?
5 0 3 5 = 20
A. x, x, x B. -, +, x C. x, +, x D. +, -, x

5. If Q means 'add to', J means 'multiply by', T means 'subtract from' and K means 'divide by' then 30 K 2 Q 3 J 6 T 5 = ?
A. 18 B. 28 C. 31 D. 103

6. 12:30 :: 14: ?
A) 36 B) 28 C) 35 D) 42

7. The value of -4-(-10) is how much greater than the value of -10-(-4)?
A) 10 B) 6 C) 12 D) 0

8. Find out the two signs to be interchanged for making following equation correct:
5 + 3 x 8 - 12 ÷ 4 = 20
A. + and - B. - and ÷ C. + and x D. + and ÷

Directions(9-13): If `+' is `x', `-' is `+', `x' is `÷' and '÷' is `-', then answer the following questions based on this information.
9. 9 ÷ 5 + 4 – 3 x 2 = ?
A. 2 B. -9 C. -3 D. None of these

10. 6 + 7 x 3 – 8 ÷ 20 = ?
A. -3 B. 7 C. 2 D. None of these

11. 3 x 2 + 4 – 2 ÷ 9 = ?
A. -1 B. 1 C. -2 D. None of these

12. 6 – 9 + 8 x 3 ÷ 20 = ?
A. -2 B. 6 C. 10 D. None of these

13. 5 x 4 – 6 ÷ 3 + 1 = ?
A. 5 B. 4 C. -1 D. None of these

Directions (14-16): If `+' is `x', `-' is `+', `x' is `÷' and '÷' is `-', then answer the following questions based on this information.
14. 15 x 5 ÷ 3 + 1 – 1 = ?
A. 1 B. -2 C. 3 D. None of these

15. 9 – 3 + 2 ÷ 16 x 2 = ?
A. 7 B. 5 C. 9 D. None of these

16. 21 ÷ 8 + 2 – 12 x 3 = ?
A. 14 B. 9 C. 13.5 D. 11

17. If '+' means 'minus', 'x' means 'divided by', '÷' means 'plus' and '-' means 'multiplied by', then which of the following will be the value of the expression 252 × 9 - 5 + 32 ÷ 92.
A. 192 B. 168 C. 95 D. 200

18. If + means x, x means -, ÷ means + and - means ÷, then which of the following gives the result of 175 - 25 ÷ 5 + 20 x 3 + 10.
A. 240 B. 160 C. 77 D. 2370

19. If L stands for +, M stands for -, N stands for ×, P stands for ÷, then 14 N 10 L 42 P 2 M 8 = ?
A. 216 B. 153 C. 251 D. 248

20. If '+' means 'divided by', '-' means 'added to', 'x' means 'subtracted from' and '÷' means 'multiplied by', then what is the value of 24 ÷ 12 - 18 + 9
A. -25 B. 290 C. 15.30 D. 0.72

LEVEL - II

1. If A + B = C + D and A + D > B + C, then which one of the following is definitely wrong
A. A > C B. A > B C. B > D D. C > D

2. If × means ÷ , - means ×, ÷ means + and + means -, then (3 – 15 ÷ 19) × 4 + 6 = ?
A. 4 B. 10 C. - 1 D. 8

3. If + means ÷, ÷ means -, - means ×, × means +, then 12 + 4 ÷ 3 – 2 × 8 =?
A. 5 B. 4 C. 2 D. – 2

4. If '-' stands for 'division, '+' for 'multiplication', '÷ ' for 'subtraction' and '×' for 'addition', which one of the following equations is correct
A. 6 + 20 - 12 ÷ 7 - 1 = 38 B. 6 ÷ 20 × 12 + 7 - 1 = 70
C. 6 + 20 - 12 ÷ 7 × 1 = 62 D. 6 - 20 ÷ 12 × 7 + 1 = 57

5. If '-' stands for 'division, '+' for 'multiplication', '÷ ' for 'subtraction' and '×' for 'addition', then which one of the following equations is correct.
A. 4 × 5 × 9 + 3 ÷ 4 = 11 B. 4 × 5 + 9 - 3 ÷ 4 = 15
C. 4 ÷ 5 + 9 - 3 + 4 = 18 D. 4 - 5 ÷ 9 × 3 - 4 = 17

6. If × means -, + means ÷, - means × and ÷ means +, then 15 - 2 ÷ 900 + 90 × 100 =?
A. 190 B. - 60 C. 90 D. 180

7. If + means -, - means ×, ÷ means + and × means ÷, then 15 - 3 + 10 × 5 ÷ 5 = ?
A. 52 B. 48 C. 22 D. 5

8. If + stands for ×, - for ÷, × for - and ÷ for +, find the value of 26 + 74 - 4 × 5 ÷ 2
A. 478 B. 376 C. 220 D. 488

9. If P means 'division', T means 'addition', M means 'subtraction' and D means 'multiplication', then what will be the value of the expression 12 M 12 D 28 P 7 T 15
A. 15 B. - 30 C. - 21 D. – 15

10. If 'when' means '×' 'you' means '÷', 'come' means '-' and 'will' means '+', then what will be the value of "8 when 12 will 16 you 2 come 10 "
A. 45 B. 112 C. 96 D. 94

11. If ÷ means ×, × means +, + means - and - means ÷, find the value of 16 × 3 + 5 - 2 ÷ 4
A. 25 B. 36 C. 29 D. 9

12. If 'x' represents 'addition', '÷' represents 'multiplication' '+' represents 'subtraction', and '–' represents 'division', then, find out the value of 24 + 36 − 12 × 8 ÷ 4
A. 23 B. 35 C. 53 D. 63

13. If '+' stand for 'greater than', '–' stand for less than', '×' stands for not greater than', '÷' stands for not less than', '▭' stands for 'not equal to' and 'Δ' stands for 'equal to', then, find out which of the following answer options doesn't agree with the question expression given below?
P ÷ Q × R
A. Q + R Δ P B. R + Q × P C. P Δ Q – R D. R Δ Q – P

14. If 'A' is represented by '×', 'B' is represented by '–', 'C' is represented by '÷' and 'D' is represented by '+', then, what would be the value of
20 B 12 C 4 A 6 D 5
A. 5 B. 7 C. 9 D. 11

15. In the following question, find out the pairs of mathematical operators and numbers respectively which when interchanged give the correct answer.
5 × 3 + 4 = 23
A. '×' and '+', '5' and '4' B. '×' and '+', '5' and '3'
C. '+' and '×', '4' and '3' D. '×' and '=', 23 and 3

16. If '20 − 10' meant 200, '8 ÷ 4' meant 12 '6 × 2' meant 4 and '12 + 3' meant 4, then what would be the value of
100 − 10 × 1000 ÷ 1000 + 100 × 10
A. 0 B. 110 C. 200 D. 900

17. Choose the correct combination of mathematical operators that replace the # signs and balance the following equation:
12 # 3 # 4 = 6 # 8 # 8
A. ×, –, ×, + B. ×, +, ×, – C. ×, +, –, × D. +, ×, –, ×

18. Complete the following equation with correct mathematical operators from the given alternatives.
(5 1) (4 2) = 30
A. +, +, + B. ÷, ×, + C. ×, +, × D. +, ÷, +

19. Choose the correct pair of mathematical operators from the given alternatives which, when interchange their positions, justify the equation.
9 + 5 ÷ 4 × 3 − 6 = 12
A. +, ÷ B. –, ÷ C. ×, ÷ D. +, –

20. If '–' means 'addition', '+' means 'multiplication', '×' means 'subtraction', then which of the following equation is not correct?
A. 22 + 7 − 3 × 9 = 148 B. 33 × 5 − 10 + 20 = 228
C. 7 + 28 − 3 × 52 = 127 D. 44 − 9 + 6 × 11 = 87

LEVEL - III

1. What should come in place of the question mark(?) in the following questions ?

$3\frac{1}{6} + 4\frac{1}{2} - 2\frac{2}{3} - 1\frac{11}{12} = ?$

A. 1 7/12 B. 1 5/12 C. 3 7/12 D. 3 1/12

2. What approximate value will come in place of question mark (?) in the following question?
(49.001)^2 = ?

A. 2500 B. 2400 C. 2600 D. 2300

3. Give interchanges:
Signs - and x and numbers 3 and 6.

A. 6 - 3 x 2 = 9 B. 3 - 6 x 8 = 10 C. 6 x 3 - 4 = 15 D. 3 x 6 - 4 = 33

4. If × stands for 'addition', ÷ stands for 'subtraction', + stands for 'multiplication' and - stands for 'division', then 20 × 8 ÷ 8 - 4 + 2 = ?

A. 80 B. 25 C. 24 D. 5

5. If A + B = 2C and C + D = 2A, then

A. A + C = B + D B. A + C = 2D C. A + D = B + C D. A + C = 2B

6. Given interchanges :
Signs + and - , numbers 4 and 8.

A. 4 + 8 - 12 = 12 B. 4 - 8 + 12 = 0 C. 8 + 4 - 12 = 24 D. 8 - 4 + 12 = 8

7. Given interchanges :
Signs + and x and numbers 4 and 5.

A. 5 x 4 + 20 = 40 B. 5 x 4 + 20 = 85 C. 5 x 4 + 20 = 104 D. 5 x 4 + 20 = 95

8. If A = 16, C = 8, D = 3, and B = 9 then C+A×B÷D =?

A. 27 B. 46 C. 72 D. None of these

9. If A stands for +, B stands for -, C stands for × then the value of (10 C 4) A (4 C 4) B 6 =?

A. 60 B. 56 C. 50 D. 46

10. If + means ×, ÷ means -, × means ÷ and -, and means + then the value of 58 – 6 × 3 + 4 ÷ 2 =?

A. 49 B. 64 C. 104 D. None of these

11. If + mens ×, - means ÷, × means -, and ÷ means +, then the value of 16 ÷ 64 – 8 × 4 + 2 =?

A. 12 B. 16 C. 18 D. 24

12. If '+' stands for multiplication, '×' stands for Division, '-' stands for Addition and '÷' stands for subtraction, what would the following equation stands for? 20 – 8 × 4 ÷ 3 + 2 =?

A. 41 B. 19 C. 16 D. 18

13. If '+' stands for division, '÷' stands for multiplication, '×' addition. Which one of the following equations is correct?

A. 18 ÷ 6 – 7 + 5 × 2 = 20 B. 18 + 6 ÷ 7 × 5 – 2 = 18
C. 18 × 6 + 7 ÷ 5 – 2 = 16 D. 18 ÷ 6 × 7 + 5 – 2 = 22

14. If '-' stands for division, '+' stands for multiplication '÷' stands for subtraction and '×' stands for addition, which one of the question is correct?

A. 18 ÷ 3 × 2 + 8 – 6 = 10 B. 18 – 3 + 2 × 8 ÷ 6 = 14
C. 18 – 3 ÷ 2 × 8 + 6 = 17 D. 18 × 3 + 2 ÷ 8 – 6 = 15

15. If 324 × 150 =54, 251 × 402 = 48 and 523 × 345 = 120 then 651 × 345 =?
A. 120 B. 85 C. 144 D. 60

16. Some equations are solved on the basis of certain system. Find out the correct answer for the unsolved equation on that basis of 12 × 7 = 408 and 9 × 8 = 207 then 13 × 7 =?
A. 190 B. 91 C. 109 D. 901

17. In a cricket match, five batsmen P, Q, R, S and T scored an average of 36 runs. S Scored 5 more than T; T scored 8 fewer than P; Q scored as many as S and T combined; and Q and R scored 107 between them. How many runs did T score ?
A. 20 B. 29 C. 28 D. 24

18. A sum of Rs.1890 has to be used to give 9 prizes to the customers of a super market for their overall academic purchases. If each prize is Rs.30 less than its preceding price, what is the least value of the price ?
A. 90 B. 95 C. 85 D. 80

19. In a group of buffaloes and ducks the number of legs are 24 more than twice the number of heads. What is the number of buffaloes in the group ?
A. 6 B. 18 C. 12 D. 24

20. In the following question you have to identify the correct response from given premises stated according to the following questions- If ÷ stands for 'greater then', × stands for 'addition', + stands for 'division, - stands for 'equal to', > stands for 'multiplication' = stands for 'less than', < stands for minus, then which of the following alternatives is correct?
A. 3 + 2 < 4 ÷6 > 3 × 2 B. 3 × 2 < 4 ÷6 + 3 < 2
C. 3 × 2 < 4 – 6 × 3 × 2 D. 3 × 2 × 4 = 6 + 3< 2

PERCENTAGE

In mathematics, a Percentage is a number or ratio expressed as a fraction of 100. Basically percent means per hundred. It is often denoted using the percent sign, "%".
Eg: If a person scores 96 out of 100 marks, his marks percentage is 96 percent.

Note: If you score 60 marks Information technology does that mean you score 60%. The answer is NO; as you don't know the base. Percentage is basically a game of base. If you don't know the base than you can't calculate the percentage.

Conversion of a Fraction into Percentage- To convert a fraction into percentage, multiply the fraction by 100 and put % sign.

Ex. If fraction is 1/4 then 1/4 x 100 = 25%

If fraction is 1/8 then 1/8 x 100 = 12.5%

Conversion of a Percentage into Fraction- To convert a percentage into fraction, replace the % sign with 1/ 100 and reduce the fraction into simplest form.

Ex. 10% = 10/100 = 1/10

75% = 75/100 = 3/4

300% = 300/100 = 3

Relation between Fraction and Percentage

Fraction	Percentage
½	50%
1/3	33.33%
1/4	25%
1/5	20%
1/6	$16.66\% = 16\frac{2}{3}\%$
1/7	$14.28\% = 14\frac{2}{7}\%$
1/8	$12.5\% = 12\frac{1}{2}\%$
1/9	$11.11\% = 11\frac{1}{9}\%$
1/10	10%
1/11	$9.09\% = 9\frac{1}{11}\%$
1/12	$8.33\% = 8\frac{1}{3}\%$

1/13	7.69% = $7\frac{9}{13}\%$
1/14	7.14 % = $7\frac{1}{7}\%$
1/15	6.67 % = $6\frac{2}{3}\%$
1/16	6.25 % = $6\frac{1}{4}\%$
1/17	5.88 % = $5\frac{15}{17}\%$
1/18	5.55% = $5\frac{5}{9}\%$
1/19	5.26 % = $5\frac{5}{19}\%$
1/20	5%

Commodity Price Increase/Decrease

- If the price of a commodity increases by R%, then the reduction in consumption so as not to increase the expenditure is = [(R / (100+R)) ×100] %
- If the price of the commodity decreases by R%, then to maintain the same expenditure by increasing the consumption is = [(R / (100−R)) ×100] %
- If A is R% more than B, then B is less than A by = [(R / (100+R))×100] %
- If A is R% less than B , then B is more than A by = [(R / (100−R))×100] %

Example 1: If A is 20% more than B, by what percent is B less than A?
Solution: Let B=100 and A = 120
Using formula, [20/120}*100 = 100/6 = 16.66%

Example 2: If the price of a commodity be raised by 20% then by how much % a house holder reduce his consumption so that the expenditure does not change?
Solution: Expenditure = rate x consumption
Here the expenditure remains constant in both the cases
Initially 1x1=1
After change 1.2 x a=1
This means 1.2a = 1 and a = .833 and hence decrease will be 16.66%

Example 3: Two numbers are 25% and 40% less than the third number. What % is the second of the first?
Solution: let three numbers be A, B and C. If C=100 it means B=60 and A=75
Hence B is 60/75 x 100 of A = 80%

Percentage Change
Percentage increase/decrease in a quantity = (change in quantity/original quantity) x 100 %

Example 4: Salary of Raja in 2001 was Rs 1000 per day and his salary in 2002 was Rs 1250 per day. Again in 2003 his salary was Rs 1000 per day

a. What is the % increase in salary in 2002?
b. What is the % decrease in salary in 2003 over 2002?

Solution: In a) part the increase is 125- 100 = 25 hence % increase will be 25/ 100 x 100 = 25%
In b) part the decrease is 125- 100 = 25 hence % decrease will be 25/ 125 x 100 = 20%

Results on Population Increase/Decrease

- If the original population is P and increase in population is at the rate of r % every year then, the population after n years will be = $P\ (1+r/100)^n$
- Similarly, If the original population is P and decrease in population is at the rate of r % every year then the population after n years will be = $P\ (1-r/100)^n$
- Let the population of the town be P now and suppose it increases at the rate of R% per annum, then = Population n years ago = $P / [1+(R / 100)]^n$

Results on Depreciation

Let the present value of a machine be P. Suppose it depreciates at the rate R% per annum. Then,

- Value of the machine after n years = $P\ [1-(R/100)]^n$
- Value of the machine n years ago = $P / [1-(R/100)]^n$

Example 5: If the present population of a town is 10000 and annual increase is 20%. Then what will be the population after 3 years?

Solution: Population after three years = 10000(1+20/100)3 = 10000(1.2)3 = 17280

Successive Percent changes

- If A is increase by x% in the first year and increase y % in the second year, then the net percentage change = +-x+-y+-xy/100.
  Where; + stands for increase and – stands for decrease
- Generalize, if a quantity increases by p% and then decreases by p% then there is net reduction of (p^2)/100 %.

Example 6: In an examination it is required to get 65% of the aggregate marks to pass. A student gets 522 marks and is declared failed by 7% marks. What are the maximum aggregate marks a student can get?

Solution: Pass marks of the examination = 65%
Student failed by 7%, so marks secured by student = 65% – 7% = 58%
58%=522; 100% =900

Example 7: Ajay spends 25 per cent of his salary on house rent, 5 per cent on food, 15 per cent on travel, 10 per cent on clothes and the remaining amount of ` 27,000 is saved. What is Ajay's income?

Solution: Ajay's total income be 100%
His total expenditure = 25% + 5% + 15% + 10% = 55%
Savings = 100% – 55% = 45%
45% = 27,000
Therefore, 100% = 27000 * 100/45 = 60,000

Example 8: When the price of eggs is reduced by 20%, it enables a man to buy 20 more eggs for 40. What is the reduced price per egg?

Solution: Saving due to reduction =20/ 100 * 40 =8So the sum of Rs 8 enables the man to purchase 20 more eggs at the reduced price (R.P); Reduced price per egg
=> 8/ 20 =0.4 = 40 paisa

Example 9: Two successive discounts of 10% and 20% are equal to a single discount of?

Solution: Discount is same as decrease of price. So, decrease =0.9×0.8
=0.72⇒28% decrease (Since only 72% is remaining)

Example 10: A fruit seller had some apples. He sells 40% apples and still has 420 apples. Originally, he had?

Solution: Suppose originally he had x apples.
Then, (100 - 40) % of x = 420
60/100 * x = 420
x =420 * 100/60 = 700.

Example 11: In a group of students, 70% can speak English and 65% can speak Hindi. If 27% of the students can speak none of the two languages, then what per cent of the group can speak both the languages?

Solution: 27% students speak neither of the languages.
Number of students speaking either of the languages = 100% – 22% = 73%
n(E U H) = 73% n(E) = 70% n(H) = 65% n(E∩H) = ?
n(EUH) = n(E) + n(H) – n(E∩H)
73 = 70 + 65 – n(E∩H)
n(E∩H) = 135 – 73 = 62

LEVEL – I

1. What is 30 % of 80?
   A] 30 B] 24 C] 27 D] 40

2. In a class of 50 students, 40 % are girls. Find the number of girls and number of boys in the class?
   A] 30, 20 B] 20, 30 C] 25, 25 D] 40, 10

3. Ron scored 344 marks out of 400 marks and his elder brother Ben scored 582 marks out of 600 marks. Who scored percentage is better?
   A] Ben B] Ram C] both same D] None of these

4. Victor gets 92 % marks in examinations. If these are 460 marks, find the maximum marks.
   A] 480 B] 600 C] 500 D] 700

5. The price of rice is increased from $10 to $12.50 per kg. Find the percentage increase in price?
   A] 30% B] 20% C] 25% D] 40%

6. The population in a small town increases from 20000 to 21250 in one year. Find the percentage increase in population?
   A] 10% B] 15% C] 12% D] 6.25%

7. By what number must the given number be multiplied to increase the number by 50 %?
   A] 3/2 B] 1/2 C] 1/4 D] 2/3

8. A television manufacturing company declares that a television is now available for $5600 as against $8400 one year before. Find the percentage reduction in the price of television offered by the company?
   A] 33.33% B] 20% C] 25% D] 66.67%

9. Find the number which when decreased by 12 % becomes 198?
   A] 300 B] 210 C] 250 D] 225

10. Aaron had $ 2100 left after spending 30 % of the money he took for shopping. How much money did he take along with him?
    A] 3000 B] 2100 C] 2500 D] 2200

11. A shopkeeper bought 600 oranges and 400 bananas. He found 15% of oranges and 8% of bananas were rotten. Find the percentage of fruits in good condition.
    A] 90% B] 80% C] 87.8% D] 66.67%

12. Mike needs 30% to pass. If he scored 212 marks and falls short by 13 marks, what was the maximum marks he could have got?
    A] 700 B] 750 C] 850 D] 725

13. A number is increased by 40 % and then decreased by 40 %. Find the net increase or decrease percent?
A] 10% B] 15% C] 16% D] 0%

14. Max scored 6 marks more than what he did in the previous examination in which he scored 30. Maria scored 30 marks more than she did in the previous examination in which she scored 60. Who showed less improvement?
A] Max B] Maria C] Both D] None

15. An alloy contains 26 % of copper. What quantity of alloy is required to get 260 g of copper?
A] 800 B] 750 C] 900 D] 1000

16. In a basket of apples, 12% of them are rotten and 66 are in good condition. Find the total number of apples in the basket.
A] 80 B] 75 C] 90 D] 100

17. An increase of 30% in the price of oranges enables a man to buy 6 kg less for Rs. 300. Find the increased price per kg.
A] 20 B] 15 C] 30 D] 10

18. Conclusion shows that an angle is 37(1/2) %. The size used by drawing and measurement is 36%. The error percentage scenario is?
A] 4 B] 1 C] 8 D] 9

19. A digit has increased 37(1/2) % gives 33. The actual digit is?
A] 35 B] 24 C] 15 D] 40

20. A particular digit is subtracting 15 from it, reduces to its 80%. What is 40% of that digit?
A] 30 B] 03 C] 35 D] 20

LEVEL - II

1. In an election, candidate A got 75% of the total valid votes. If 15% of the total votes were declared invalid and the total numbers of votes is 560000, find the number of valid vote polled in favour of candidate?
A] 375000 B] 357000 C] 325000 D] 350000

2. In an examination, 300 students appeared. Out of these students; 28 % got first division, 54 % got second division and the remaining just passed. Assuming that no student failed; find the number of students who just passed?
A] 80 B] 74 C] 60 D] 54

3. In an election, candidate A got 70 % of the total valid votes. 20 % of the total votes were declared invalid. If the total number of votes is 600000, find the number of valid votes polled in favour of the candidate.
A] 350000 B] 357000 C] 336000 D] 340000

4. In a college, among all students 48% comes by bus, 62% takes canteen lunch and 40% comes by bus and takes canteen lunch. Find the percentage of students neither having canteen lunch nor coming by bus.
A] 30% B] 42% C] 51% D] 32%

5. The difference between 78% of a number and 59% of the same number is 323. What is 62% of that number?
A] 1071 B] 1173 C] 1037 D] 1054

6. 40% of 60% of 3/5th of a number is 504. What is 25% of 2/5th of that number?
A] 180 B] 175 C] 360 D] 350

7. Tanya obtained 95% marks in Physics, Chemistry and Maths together and she obtained 225 marks in Social Science, English and Hindi together. If the maximum marks one can obtain in each of the subjects is 100, what is Tanya's overall percentage in all the six subjects together?
A] 80 B] 85 C] 90 D] 95

8. In a test consisting of 80 questions carrying one mark each, Arpita answers 65% of the first 40 questions correctly. What percent of the other 40 questions does she need to answer correctly to score 75% on the entire test?
A] 60 B] 80 C] 75 D] None of these

9. A sum of Rs.2236 is divided among A, B and C such that A receives 25% more than C and C receives 25% less than B, what is A's share in the amount?
A] Rs. 460 B] Rs. 890 C] Rs. 780 D] Rs. 900

10. Vaishali spent Rs.31897 on the air-conditioner for her home, Rs.38789 on buying plasma television and the remaining 23% of the total amount she had as cash with her. What was the total amount?
A] Rs.74625 B] Rs.86750 C] Rs.91800 D] None of these

11. In an examination it is required to get 40% of the aggregate marks to pass. A student gets 265 marks and is declared fail by 55 marks. What is the maximum aggregate marks a student can get?
A] 800 B] 750 C] 650 D] None of these

12. Ramu gave 35% of the amount he had to Shakeel. Shakeel in turn gave two-thirds of what he received from Ramu to Joseph. After spending Rs.150 on lunch out of the amount he got from Shakeel, Joseph now has Rs.550 left with him. How much amount did Ramu have?
A] Rs.2800 B] Rs.2000 C] Rs.3000 D] None of these

13. If the numerator of a fraction is increased by 200% and the denominator is increased by 300%, the resultant fraction is 15/26. What was the original fraction?
A] 8/11 B] 10/11 C] 9/13 D] 10/13

14. A cricketer has batted in 105 innings. He has scored 17 centuries, crossed the 50- run mark 28 times and crossed the 25-run mark 39 times. The no. of times he has scored below 25 is what percentage of the number of times he scored between 25 and 49 (both 25 and 49 included)?
A] 450% B] 600% C] 500% D] None of these

15. Sunil scored 54 percent marks in a test. Ravi scored 450 marks in the same test which is 300 less than Sonu. Sunil's score is 60 more than Sonu. If Ram scored 900 marks in the test, what is Ram's percentage?
A] 80 B] 65 C] 75 D] 60

16. In a school there are 800 students out of whom 45 percent are girls. Monthly fee of each boy is Rs.600 and monthly fee of each girl is 30 percent less than each boy. What is the total monthly fee of girls and boys together?
A] Rs.425400 B] Rs.414600 C] Rs.419600 D] None of these

17. In a class of 50 students and 5 teachers, each student got sweets that are 12% of the total number of students and each teacher got sweets that are 20% of the total number of students. How many sweets were there?
A] 345 B] 365 C] 350 D] 330

18. In a school there are 250 students out of whom 12 per cent are girls. Each girl's monthly fee is Rs.450/- and each boy's monthly fee is 24 percent more than a girl. What is the total monthly fee of girls and boys together?
A] Rs.136620/- B] Rs.136260/- C] Rs.132660/- D] Rs.132460/-

19. If the height of a triangle is decreased by 40% and its base is increased by 40%, what will be the effect on its area?
A] No change B] 16% decrease C] 8% decrease D] 16% increase

20. An HR Company employs 4800 people, out of which 45 per cent are males and 60 per cent of the males are either 25 years or older. How many males are employed in HR Company who is younger than 25 years?
A] 864 B] 2160 C] 1296 D] 2640

LEVEL – III

1. Six-eleventh of a number is equal to twenty two per cent of second number. Second number is equal to the one-fourth of third number. The value of the third number is 2400. What is the 45% of first number?
A] 108.9 B] 111.7 C] 117.6 D] 123.4

2. Raman scored 456 marks in an exam and Seeta got 54 percent marks in the same exam which is 24 marks less than Raman. If the minimum passing marks in the exam is 34 per cent, then how much more marks did Raman score than the minimum passing marks?
A] 184 B] 196 C] 190 D] 180

3. The length, breadth and height of a room in the shape of a cuboid are increased by 10%, 20% and 50% respectively. Find the percentage change in the volume of the cuboid.
A] 77% B] 75% C] 88% D] 98%

4. The price of the sugar is reduced by 25% but inspite of the decrease, Aayush ends up increasing his expenditure on sugar by 20%. What is the percentage change in his monthly consumption of sugar?
A] +60% B] -10% C] +33.33% D] -50%

5. The population of the village of Gavas is 10,000 at this moment. It increases by 10% in the first year. However, in the second year, due to immigration, the population drops by 5%. Find the population at the end of the third year if in third year the population increase by 20%
A] 12,340 B] 12,540 C] 1, 27, 540 D] 12, 340

6. Ram spends 20% of his monthly income on his household expenditure, 15% of the rest on books, 30% of the rest on clothes and saves the rest. On counting, he comes to know that he has finally saved Rs. 9520. Find his monthly income.
A] 10000 B] 15000 C] 20000 D] 12000

7. The population of a village is 5500. If the number of males increases by 11% and the number of females increases by 20%, then the population becomes 6330. Find the population of females in the town.
A] 2500 B] 3000 C] 2000 D] 3500

8. Last, year the Indian Cricket team played 40 one-day cricket matches out of which they managed to win only 40%. This year, so far it has played some matches, which made it mandatory for it to win 80% of the remaining matches to maintain its exiting winning percentage. Find the number of matches played by India so far this year.
A] 30 B] 25 C] 28 D] Data Insufficient

9. In the recent, climate conference in New York, out of 700 men, 500 women, 800 children present inside the building premises, 20% of the men, 40% of the women and 10% of the children were Indians. Find the percentage of people who were not Indian.
A] 73% B] 77% C] 79% D] 83%

10. In an examination, 48% students failed in Hindi and 32% students in History, 20% students failed in both the subjects. If the number of students who passed the examination was 880, how many students appeared in the examination if the examination consisted only of these two subjects?
A] 2000 B] 2200 C] 2500 D] 1800

11. A machine depreciates in value year at the rate of 10% of its previous value. However, every second year there is some maintenance work so that in that particular year, depreciation is only 5% of its previous value. If at the end of the fourth year, the value of the machine stands at Rs. 1,46,205; then find the value of machine at the start of the first year.
A] Rs. 1, 90, 000 B] Rs. 2, 00, 000 C] Rs. 1, 95, 000 D] 2,10,000

12. After three successive equal percentage rise in the salary the sum of 100 rupees turned into 140 rupees and 49 paisa. Find the percentage rise in the salary.
A] 12% B] 22% C] 66% D] 82%

13. King Dashratha, at his eleventh hour, called his three queens and distributed his gold in the following way: HE gave 50% of his wealth to his first wide, 50% of the rest to his second wife and again 50% of the rest to his third wife. If their combined share is worth 1,30,9000 kilograms of gold, find the quantity of gold King Dashratha was having initially?
A] 1, 50, 000 kg B] 1,49,600 kg C] 1,51,600 kg D] 1,52,600 kg

14. The population of New Foundland increases with a uniform rate of 8% per annum, but due to immigration, there is a further increase of population by 1% (however, this 1% increase in population is to be calculated on the population after the 8% increase and not on the previous years population). Find what will be the percentage increase in population after 2 years.
A] 18.984 B] 18.081 D] 18.24 D] 17.91

15. A's salary is first increased by 25% and then decreased by 20%. The result is the same as B's salary increased by 20% and then reduced by 25%. Find the ratio of B's salary to that of A's.
A] 4 : 3 B] 11 : 10 C] 10 : 9 D] 12 : 13

16. In order to maximize his gain, a theatre owner decides to reduce the price of tickets by 20% and as a result of this, the sales of tickets increase by 40%. If, as a result of these changes, he is able to increase his weekly collection by Rs. 1,68,000. Find by what value did the gross collection increase per day.
A] 14,000 B] 18,000 C] 24,000 D] 20,000

17. In a town consisting of three localities A, B and C, the population of the three localities A, B and C are in the ratio 9 : 8 : 3. In locality A, 80% of the people are literate, in locality B, 30% of the people are illiterate. If 90% people in locality C are literate, find the percentage literacy in that town.
A] 61.5% B] 78 % C] 75 % D] None of these

18. The population of a town increase by 5% annually frails present population is 64000. What will it be in 3 years' time?
A] 72044 B] 74088 C] 75042 D] None of these

19. Let A and B be two solid spheres such that the surface area of B is 300% higher than the surface area of A. the volume of A is found to be k% lower than the volume of B. the value of k must be?

A] 85.5 B] 92.5 C] 90.5 D] 87.5

20. In a factory there are three types of Machines M1, M2 and M3 which produces 25%, 35% and 40% of the total products respectively. M1, M2 and M3 produce 2%, 4% and 5% defective products, respectively. What is the percentage of non-defective products?

A] 89% B] 97.1% C] 96.1% D] 86.1%

PROFIT AND LOSS

Cost Price: The price (amount) paid to purchase a product or the cost incurred in manufacturing a product is known as the cost price (CP) of that product.
Selling Price: The price at which a product is sold is called the selling price (SP) of the product.
List Price: List price or the tag price is the price that is printed on the tag of the article. For all practical purposes, we assume it to be same as the marked-price.
Margin: The profit percentage on selling price is known as MARGIN.

Profit
If the Selling Price exceeds the Cost Price, then there is Profit.
Profit or gain = SP – CP
Profit % = Profit / (CP) × 100
S P = (100+gain %) / 100 × C P
C P = 100 / (100+gain %) × S P

Loss
If the overall Cost Price exceeds the selling price of the buyer then he is said to have incurred loss.
Loss = C P – S P
Loss % = Loss / (CP) × 100
S P = (100 - loss %) / 100 × CP
C P = 100 / (100 - loss %) × SP

Mark-up Price
Generally the SP is less than the marked price (MP) the difference MP – SP is known as discount, D.
Discount = M P – S P
Discount %, D% = (Discount) / (MP) ×100

$$\textbf{Mark up percentage} = \frac{\text{MP} - \text{CP}}{\text{CP}} \times 100$$

Successive Discount
Sometimes more than one discount is offered by the shopkeeper on a single item or article. When two or more discounts are applicable successively to the list price of an article, they form the discount series.
When there are two successive Profit of x % and y % then the resultant profit percent is given by

$$\left[x + y + \frac{xy}{100}\right]$$

If there is a Profit of x% and loss of y % in a transaction, then the resultant profit or loss% is given by

$$\left[x - y - \frac{xy}{100}\right]$$

Note: For profit use sign + in previous formula and for loss use – sign.
If resultant came + then there will be overall profit, if it came – then there will be overall loss.

False Weight Problems
Shown or indicate weight is always equivalent to selling price, and actual/true weight is equivalent to cost price.

If a trader professes to sell his goods at cost price, but uses false weights, then

$$Gain\% = \left(\frac{Error}{True\ value - Error}\right) \times 100 \%$$

If a cost price of m articles is equal to the selling Price of n articles, then Profit percentage

$$\frac{m-n}{n} \times 100\%$$

Solved Examples

Example 1: Marked price of a dining table is Rs 1350. It is sold at Rs. 1188 after allowing certain discount. Find the rate of discount.

Solution: MP of the dining table = Rs. 1350
SP of the dining table = Rs. 1188
Discount allowed = Rs. (1350 - 1188) = Rs. 162
Discount percent =162/1350×100=12
This the rate of discount is 12%

Example 2: If two articles are sold at same selling price one at 30% profit another at 30% loss then what is his overall percentage profit or loss?

Solution: Overall loss = - $x^2/100$ %
= - 900/100 = -9% loss

Example 3: A shopkeeper takes 20%, extra quantity while purchasing the milk, and gives 25% less than the indicated weight while selling the milk. Find the profit percentage of he sells at the cost price only.

Solution: Suppose the price of milk = 1 Rs per ml shopkeeper takes 120 ml, and pays only Rs. 100
While selling he gives only 75 ml and shows 100 ml.
Total selling price of 120 ml
100/75×120 = 160, hence percentage profit = 60%

Example 4: A sells an item at a profit of 20% to B and B sells it to C at a profit of 10%. Find the resultant profit percent?

Solution: When there are two successive profit of x% and y% , net profit percentage
= {x+y+(xy/100)}
= 20+ 10 + {(20 x 10)/100} = 32%

Example 5: The cost price of 25 articles is equal to selling price of 20 ar-ticles. The gain percent is?

Solution: Profit percentage = (x-y/y) * 100%
%Gain = {(25-20)/20} x100 = 5/20 x 100 = 25%

Example 6: A man sold an article at a loss of 20%. If he has sold that article for Rs. 12 more he would have gained 10%. Find the cost price of that article

Solution: Let the CP be x
SP at 20% loss = Rs 0.8x
0.8x + 12 = 1.1x

=>0.3x = 12
=> x = Rs 40

Example 7: In a transaction, the profit is 80% of the cost. If the cost further increases by 20% but the selling price remain the same, how much is the decrease in profit percentage?

Solution: Let us assume CP = Rs. 100.
Then Profit = Rs. 80 and selling price = Rs. 180.
The cost increases by 20% → New CP = Rs. 120, SP = Rs. 180.
Profit % = 60/120 * 100 = 50%.
Therefore, Profit decreases by 30%.

Example 8: A man bought some toys at the rate of 10 for Rs. 40 and sold them at 8 for Rs. 35. Find his gain or loss percent.

Solution: Cost price of 10 toys = Rs. 40 → CP of 1 toy = Rs. 4.
Selling price of 8 toys = Rs. 35 → SP of 1 toy = Rs. 35/8
Therefore, Gain = 35/8 – 4 = 3/8.
Gain percent = (3/8)/4 * 100 = 9.375%

Example 9: A shopkeeper allows a discount of 10% on the marked price and still gains 17% on the whole. Find at what percent above the cost price he marked his goods.

Solution: Let the cost price be 100. Then SP = 117.
Let the marked price be x.
So, 90% of x = 117 → x = 130.
Therefore, he marked his goods 30% above the cost price.

Example 10: A shopkeeper offers a discount of 20% on the selling price. On a special sale day, he offers an extra 25% off coupon after the first discount. If the article was sold for Rs. 3600, find
I. The marked price of the article and
II. The cost price if the shopkeeper still makes a profit of 80% on the whole after all discounts are applied.

Solution: Let the marked price of the article be x.
First a 20% discount was offered, on which another 25% discount was offered.
So, 75% of 80% of x = 3600
75/100 * 80/100 * x = 3600 → x = 6000.
So the article was marked at Rs. 6000.
Cost price of the article = [100 / (100+80)]*3600 = Rs. 2000.

LEVEL – I

1. Alfred buys an old scooter for Rs. 4700 and spends Rs. 800 on its repairs. If he sells the scooter for Rs. 5800, his gain percent is?
A. 4 4/7% B. 5 5/11% C. 10% D. 12%

2. The cost price of 20 articles is the same as the selling price of x articles. If the profit is 25%, then the value of x is?
A. 15 B. 16 C. 18 D. 25

3. If selling price is doubled, the profit triples. Find the profit percent?
A. 200/3 B. 105/3 C. 100 D. 120

4. In a certain store, the profit is 320% of the cost. If the cost increases by 25% but the selling price remains constant, approximately what percentage of the selling price is the profit?
A. 30% B. 70% C. 100% D. 250%

5. A vendor bought toffees at 6 for a rupee. How many for a rupee must he sell to gain 20%?
A. 3 B. 4 C. 5 D. 6

6. The percentage profit earned by selling an article for Rs. 1920 is equal to the percentage loss incurred by selling the same article for Rs. 1280. At what price should the article be sold to make 25% profit?
A. Rs. 2000 B. Rs. 2200 C. Rs. 2400 D. Data inadequate

7. A shopkeeper expects a gain of 22.5% on his cost price. If in a week, his sale was of Rs. 392, what was his profit?
A. Rs. 18.20 B. Rs. 70 C. Rs. 72 D. Rs. 88.25

8. A man buys a cycle for Rs. 1400 and sells it at a loss of 15%. What is the selling price of the cycle?
A. Rs. 1090 B. Rs. 1160 C. Rs. 1190 D. Rs. 1202

9. Sam purchased 20 dozens of toys at the rate of Rs. 375 per dozen. He sold each one of them at the rate of Rs. 33. What was his percentage profit?
A. 3.5 B. 4.5 C. 5.6 D. 6.5

10. Some articles were bought at 6 articles for Rs. 5 and sold at 5 articles for Rs. 6. Gain percent is:
A. 30% B. 33 1/3 % C. 35% D. 44%

11. A shopkeeper sells one transistor for Rs. 840 at a gain of 20% and another for Rs. 960 at a loss of 4%. His total gain or loss percent is?
A. 5 15/17% gain B. 20/3 C. 5 15/23 loss D. None of these

12. A trader mixes 26 kg of rice at Rs. 20 per kg with 30 kg of rice of other variety at Rs. 36 per kg and sells the mixture at Rs. 30 per kg. His profit percent is:
A. No profit, no loss B. 15% C. 8% D. 5%

13. When a plot is sold for Rs. 18,700, the owner loses 15%. At what price must that plot be sold in order to gain 15%?

A. Rs. 21,000 B. Rs. 22,500 C. Rs. 25,300 D. Rs. 25,800

14. 100 oranges are bought at the rate of Rs. 350 and sold at the rate of Rs. 48 per dozen. The percentage of profit or loss is:

A. 14 2/7 % gain B. 15% gain C. 14 2/7 % loss D. 15 % loss

15. On selling 17 balls at Rs. 720, there is a loss equal to the cost price of 5 balls. The cost price of a ball is?

A. Rs. 45 B. Rs. 50 C. Rs. 55 D. Rs. 60

16. By selling 45 lemons for Rs 40, a man loses 20%. How many should he sell for Rs 24 to gain 20% in the transaction?

A. 16 B. 18 C. 20 D. 22

17. A shopkeeper cheats to the extent of 10% while buying and selling, by using false weights. His total gain is.

A. 20% B. 21% C. 22% D. 23%

18. If the cost price of 12 pens is equal to the selling price of 8 pens, the gain percent is?

A. 12% B. 30% C. 50% D. 60%

19. The cost price of 24 articles is the same as the selling price of x articles. If the profit is 20%, then the value of x is?

A. 15 B. 20 C. 18 D. 25

20. If books bought at prices ranging from Rs. 200 to Rs. 350 are sold at prices ranging from Rs. 300 to Rs. 425, what is the greatest possible profit that might be made in selling eight books?

A. 600 B. 1200 C. 1800 D. none of these

LEVEL – II

1. How much percent more than the cost price should a shopkeeper mark his goods so that after allowing a discount of 25% on the marked price, he gains 20%?
A. 60% B. 55% C. 70% D. 50%

2. A dishonest dealer professes to sell his goods at the cost price but uses a false weight of 850 g instead of 1 kg. His gain percent is?
A. 71 11/17% B. 11 11/17% C. 17 12/17% D. 17 11/17%

3. In a certain store, the profit is 320% of the cost. If the cost increases by 25% but the selling price remains constant, approximately what percentage of the selling price is the profit?
A. 30% B. 70% C. 100% D. 250%

4. The profit earned by selling an article for Rs. 832 is equal to the loss incurred when the same article is sold for Rs. 448. What should be the sale price for making 50% profit?
A. Rs. 920 B. Rs. 960 C. Rs. 1060 D. Rs. 1200

5. 100 oranges are bought at the rate of Rs. 350 and sold at the rate of Rs. 48 per dozen. The percentage of profit or loss is:
A. 14 2/7% gain B. 15% gain C. 14 2/7 % loss D. 15 % loss

6. A trader mixes 26 kg of rice at Rs. 20 per kg with 30 kg of rice of other variety at Rs. 36 per kg and sells the mixture at Rs. 30 per kg. What is his profit percentage?
A. 6% B. 5% C. 4% D. 7%

7. A trader gives 12% additional discount on the discounted price, after giving an initial discount of 20% on the labelled price of an item. The final sale price of the item is Rs.704. Find out the labelled price?
A. 1000 B. 2000 C. 1200 D. 920

8. A milkman buys some milk contained in 10 vessels of equal size. If he sells his milk at Rs 5 a litre, he loses Rs 200; while selling it at Rs6 a litre, he would gain Rs150 on the whole. Find the number of litres contained in each vessel.
A. 30 B. 35 C. 40 D. 45

9. A watch passes through three hands and each gain 25%. If the third sells it for Rs250, what did the first pay for it?
A. 128 B. 130 C. 145 D. 150

10. If by selling an article for Rs 60, a person loses 1/7 of outlay (cost), what would he have gained or lost per cent by selling it for Rs77?
A. 5% B. 10% C. 11% D. 15%

11. I sold a book at a profit of 7%. Had I sold it for Rs 7.50 more, 22% would have been gained. Find the cost price?
A. 25 B. 30 C. 50 D. 55

12. A reduction of 40 per cent in the price of bananas would enable a man to obtain 64 more for Rs40. What is the reduced price per dozen?

A. 3 B. 6 C. 5 D. 4

13. A man purchased an article at 3/4 th of the list price and sold at half more than the list price. What was his gain per cent?

A. 25% B. 50% C. 75% D. 100%

14. I lose 9 per cent selling pencils at the rate of 15 a rupee. How many for a rupee must I sell them to gain 5 per cent?

A. 10 B. 13 C. 15 D. 18

15. Goods are sold so that when 4 per cent is taken off the list price, a profit of 20% is made. How much per cent is the list price more than the cost price?

A. 25% B. 50% C. 75% D. 100%

16. A man sells an article at 5% profit. If he had bought it at 5% less and sold it for Re 1 less, he would have gained 10%. Find the cost price.

A. 100 B. 150 C. 200 D. 250

17. A profit of 20% is made on goods when a discount of 10% is given on the marked price. What profit per cent will be made when a discount of 20% is given on the marked price?

A. 6 2/3% B. 7 2/3% C. 3 1/4% D. 7 4/5%

18. A dealer sells a table for 400, making a profit of 25%. He sells another table at a loss of 10%, and on the whole he makes neither profit nor loss. What did the second table cost him?

A. 700 B. 800 C. 900 D. 950

19. Each of the two horses is sold for Rs720. The first one is sold at 25% profit and the other one at 25% loss. What is the % loss or gain in this deal?

A. 7.25% B. 6.25% C. 8.5% D. 9.25%

20. Each of the two cars is sold at the same price. A profit of 10% is made on the first and a loss of 7% is made on the second. What is the combined loss or gain?

A. 150/203 % B. 160/203 % C. 180/203% D. 170/203 %

LEVEL – III

1. A Camera shop allows a discount of 10% on the advertised price of a camera. What price must be marked on the camera that costs him Rs. 600, so that he makes a profit of 20%?
A. Rs. 800 B. Rs. 720 C. Rs. 750 D. Rs. 850

2. In the land of the famous milkman Merghese Durian, a milkman sells his buffalo for Rs. 720 at some profit. Had he sold his buffalo at Rs. 510, the quantum of the loss incurred would have been double that of the profit earned. What is the cost price?
A. Rs. 600 B. 625 C. 675 D. None of these

3. A trader purchases apples at Rs. 60 per hundred. He spends 15% on the transportation. What should be the selling price per 100 to earn a profit of 20%?
A. Rs. 72 B. Rs. 81.8 C. Rs. 82.8 D. Rs. 83.8

4. A tradesman fixed his selling price of goods at 30% above the cost price. He sells half the stock at this price, one-quarter of his stock at a discount of 15% on the original selling price and rest at a discount of 30% on the original selling price. Find the gain percent altogether.
A. 14.875% B. 15.375% C. 15.575% D. 16.375%

5. The profit earned by selling an article for Rs. 900 is double the loss incurred when the same article is sold for Rs. 450. At what price should the article be sold to make 25% profit?
A. Rs. 600 B. Rs. 750 C. Rs. 800 D. Data inadequate

6. Tarun got 30% concession on the labelled price of an article and sold it for Rs. 8750 with 25% profit on the price he bought. What was the labelled price?
A. 10000 B. 12000 C. 13000 D. 14000

7. The spring balance of a trader shows 1 kg for an actual weight of 750 gm. Find the profit or loss percentage if the trader marks the price at 10% above the cost price.
A. 46.67% profit B. 46.67% loss C. 43.33% profit D. 43.33% loss

8. A milkman makes a profit of 10% on the sale of milk. If we were to add 10% water to milk, what is the percentage increase in profit %, assuming water is free of cost?
A. 21% B. 10% C. 11% D. 110%

9. A shopkeeper marks articles at 30% above than the cost price. He offers 20% discount for sale on cash and 10% discount for sale on credit. If he sells70% of the articles on cash and remaining on credit then what is his profit percent over the total business?
A. 4.2% B. 8.4% C. 7.9% D. 7.6%

10. Some lollipops are bought at 11 for a rupee and the same number at 9 for a rupee. If the whole is sold at 10 for a rupee, find the gain or loss percent.
A. 1% gain B. No profit no loss C. 2% loss D. 1% loss

11. A table is offered for R300 with 20% and 10% off. If in addition, a discount of 5% is offered on cash payment, then the cash price of the table is:

A. Rs240 B. Rs216 C. Rs210 D. Rs205.20

12. The difference between a discount of 40% on Rs500 and two successive discounts of 36% and 4% on the same amount is:
A. Nil B. Rs2 C. Rs7.20 D. Rs1.93

13. A dealer marks his goods 20% above C.P. he then allows some discount on it and makes a profit of 8%. The rate of discount is:
A. 4% B. 6% C. 10% D. 12%

14. Nandlal purchased 20 dozen notebooks at Rs. 48 per dozen. He sold 8 dozen at 10% profit and the remaining 12 dozen with 20% profit. What is his profit percentage in this transaction?
A. 15% B. 16% C. 7.68% D. 19.2%

15. An article when sold for Rs. 840 earns a profit which is double the amount of loss when the same article is sold for Rs. 600, what is the C.P. of the article?
A. Rs. 500 B. Rs. 680 C. Rs. 720 D. Data inadequate

16. A milkman has 20 liters of milk. If he mixes 5 liters of water, which is freely available in 20 liters of pure milk. If the cost of pure milk is Rs. 18 per litre, then the profit of the milkman, when he sells all the mixture at Â cost price, is:
A. 20% B. 25% C. 33.33% D. 18%

17. Profit earned by selling an article for Rs. 1060 is 20% more than the loss incurred by selling the article for Rs. 950. At what price should the article be sold to earn 20% profit?
A. Rs. 980 B. Rs. 1080 C. Rs. 1800 D. None of these

18. A man bought an article and sold it at a gain of 5 %. If he had bought it at 5% less and sold it for Re 1 less, he would have made a profit of 10%. The C.P. of the article was
A. Rs 100 B. Rs 150 C. Rs 200 D. Rs 250

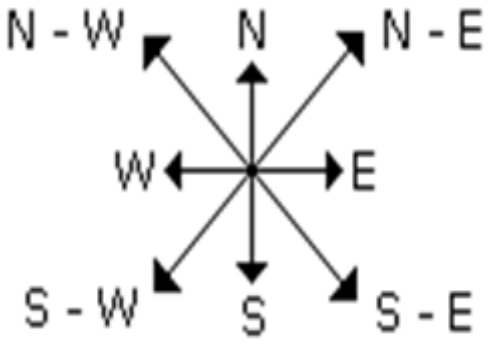
19. Ashok bought an article and spent Rs. 110 on its repairs. He then sold it to Bhushan at a profit of 20%. Bhushan sold it to Charan at a loss of 10%. Charan finally sold it for Rs. 1188 at a profit of 10%. How much did Ashok pay for the article.
A. Rs. 890 B. Rs. 1000 C. Rs. 780 D. 840

20. A merchant bought two transistors, which together cost him Rs. 480. He sold one of them at a loss of 15% and other at a gain of 19%. If the selling price of both the transistors are equal, find the cost of the lower priced transistor.
A. Rs. 300 B. Rs. 180 C. Rs. 200 D. Rs. 280

DIRECTION SENSE

The Concept behind the Directions is same that we use in our day to day life. This direction sense test is nothing but a precise of sensing the direction. To solve the direction sense test first you need to make a sketch of the data provided. Directions questions asked in the exam are based on two principles- Distance and Direction.

The first step for solving the questions using the concept of 'directions' is to understand the direction chart, which has 8 directions. Take a look at the direction chart given below:

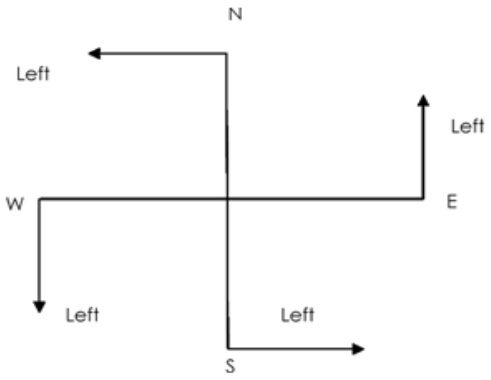


The first point you need to remember is that each main direction change undergoes a 90° change in direction e.g. from North to West/East it will be 90° change. But the change between North and North-east is only 45°.

Left Right Movement

A person facing north, on taking left will face towards west and on taking the right turn towards east. A person facing west, on taking left will face towards south and on taking right turn towards north.

When a question says moved towards left or right side, we assume that the movement is at an angle of 90 degrees.



Hence, we can sum up the above points as:

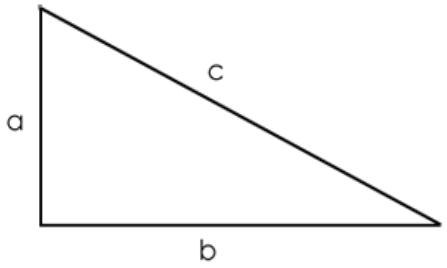
- Whenever a person moves to his left side, he will move towards anti- clockwise direction.
- Whenever a person moves to his right side, he will move towards clockwise direction.

Concept of Pythagoras Theorem

We'll use the concept of Pythagoras theorem to solve the questions on directions.

In a right angled triangle, the square of the hypotenuse is equal to the sum of the squares of the other two sides.

$c^2=a^2 + b^2$

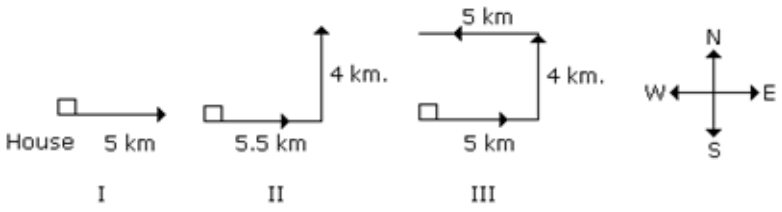


Points to Remember

- At the time of sunrise if a man stands facing the east, his shadow will be towards the west.
- At the time of sunset the shadow of an object is always in the east.
- If a man stands facing the North, at the time of sunrise his shadow will be towards his left and at the time of sunset it will be towards his right.
- At 12:00 noon, the rays of the sun are vertically downward hence there will be no shadow.

Example 1: A man starting from his home walks 5 km towards East, and then he turns left and goes 4 km. At last, he turn to his left and walks 5 km. Now find the distance between the man and his home and also find at which direction he is facing?

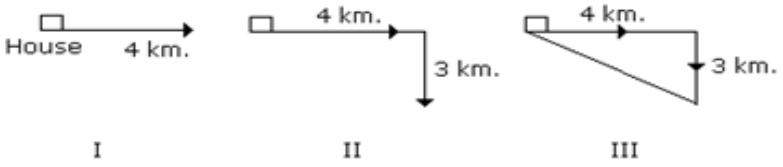
Solution:



From the above diagram we can find he is 4 km from his house and facing the West Direction.

Example 2: A man starting from his home moves 4 km towards East, then he turns right and moves 3 km. Now what will be the minimum distance covered by him to come back to his home?

Solution:



$$\text{Minimum distance} = \sqrt{(4)^2 + (3)^2}$$

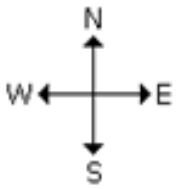
$$= \sqrt{16 + 9}$$

$$= \sqrt{25}$$

$$= 5 \text{ km.}$$

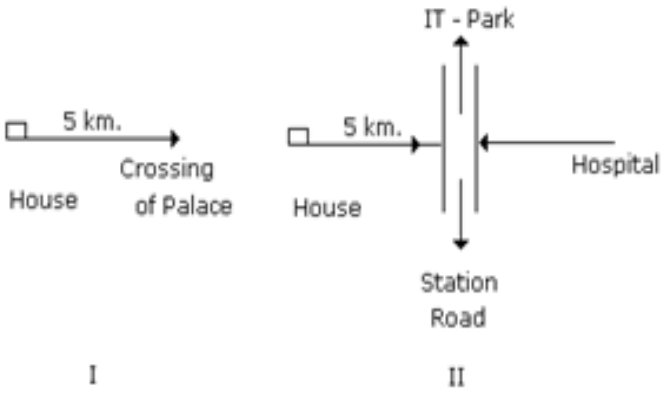
Example 3: After Sunrise, Prakash while going to college suddenly met with Lokesh at a crossing point. Lokesh's Shadow was exactly to right of Prakash. If they were facing each other on which direction was Prakash facing?

Solution: Always Sun rises in the East Direction. So Shadow falls towards West



Example 4: Prem started from his home and moved 5 km to reach the crossing point of the palace. In which direction was Prem going, if the road opposite to his direction goes to the hospital. The road to the right of Prem goes to the station. If the road which goes to station is just opposite to the road of the IT-Park, then in which direction is Prem which leads to the IT- Park?

Solution: From the below diagram its shows that the road which goes towards the IT-Park is left of Prem.



Example 5: A child is looking for his father. He went 90 metres in the East before turning to his right. He went 20 meters before turning to his right again to look for his father at his uncle's place 30 metres from this point. His father was not there. From here he went 100 metres to the North before meeting his father in a street. What is the smallest distance between the starting point and his father's position?

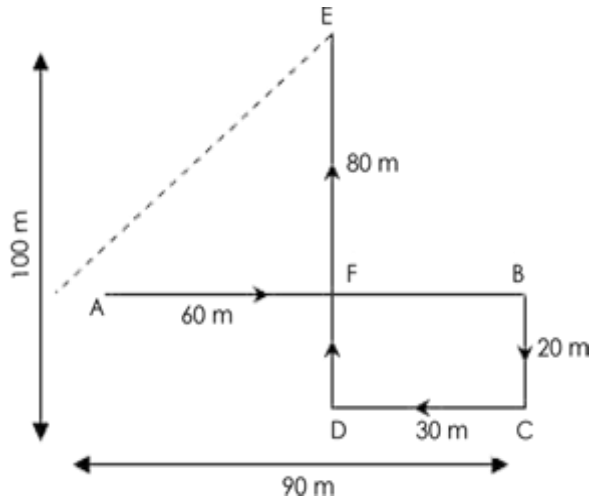
Solution: The movement of the child from A to E is as shown in fig.

Clearly, the child meets his father at E.

Now, AF = (AB - FB) = (AB - DC) = (90 - 30) m = 60 m.

EF = (DE - DF) = (DE - BC) = (100 - 20) m = 80 m.

Now the distance is square root of (602 + 802), which will be 100 metres.



LEVEL – I

1. Siva Reddy walked 2 km west of his house and then turned south covering 4 km. Finally, He moved 3 km towards east and then again 1 km west. How far is he from his initial position?
A. 10 km B. 9 km C. 2 km D. 4 km

2. A man went 10 kms towads South. Then turned East and covered 10 kms and turned to the right. Again after 10 kms, he turned to left and covered 10 kms to reach the destination. How far is he from his starting point?
A. 18.8 km B. 28.28 km C. 16 km D. 20 km

3. Rajesh's school bus is facing North when reaches his school. After starting from Rajesh's house, it turning twice right and then left before reaching the school. What direction the bus facing when it left the bus stop in front of Rajesh's house?
A. East B. North C. South D. West

4. Anil wants to go the university. He starts from his house which is in the East and comes to a crossing. The road to his left ends in a theatre, straight ahead is the hospital. In which direction is the University?
A. East B. North C. South D. West

5. If South-East becomes North, North-East becomes West and so on, what will West become?
A. North B. East C. South-East D. North-West

6. A man walks 1 km towards East and then he turns to South and walks 5 km. Again he turns to East and walks 2 km,after this he turns to North and walks 9 km .Now, how far is he from his starting point?
A. 10 km B. 9 km C. 5 km D. 4 km

7. I am facing South. I turn right and walk 20 m .Then I turn right again and walk 10 m .Then I turn left and walk 10 m and then turning right walk 20 m. Then, I turn right again and walks 60 m. In which direction am I from the starting point?
A. North-East B. North-West C. North D. West

8. Dharma walks 10 km toward North. From there, he walks 6 km towards South .Then, he walks 3 km towards East. How far and in which direction is he with reference to his starting point?
A. 2 km South-East B. 5 km South-East C. 5 km North-East D. 5 km West

9. Kumar walks 10 meters in front and 10 meters to the right. Then every time turning to his left he walks 5, 15 and 15 meters respectively. How far is he now from his starting point?
A. 15m B. 10m C. 12m D. 5m

10. The time on the watch is quarter to three. If the minute-hand points to North-East, in which direction does the hour hand point?
A. South-West B. South-East C. North-West D. North-East

11. Starting from a point X, Ravi walked 20 m towards South. He turned left and walked 30m. He then turned left and walked 20 m. He again turned left and walked 40 m and reached at a point Y.

How far and in which direction is the point Y from the point X?
A. 15m East of X B. 10m West of X C. 15m West of X D. 10m East of X

12. Lakshman went 15 kms to the West of his house, then turned left and walked 20 kms. He then turned East and walked 25 kms and finally turning left covered 20 kms. How far was he from his house?
A. 5 kms B. 10 kms C. 40 kms D. 80 kms

13. Ravi started walking towards North. After walking 30 m, he turned left and walked 40 m. He then turned left and walked 30 m. He again turned left and walked 50 m. How far was he from his original position?
A. 50m B. 30m C. 10m D. 60m

14. I am standing at the center of a circular field .I go down south to the edge of the field and then turning left Iwalk along the boundary of the field equal to three-eighth of its length .Then I turn west and go right across to the opposite point on the boundary .In which direction am I from the starting point?
A. South-West B. West C. North-West D. North

15. A villager went to meet his uncle in another village situated 5 km away in the North-East direction of his own village. From there he came to meet his father-in-law living in a village situated 4 km in the south of his uncle village. How far away and in what direction is he now?
A. 4 km in the East B. 3 km in the East C. 4 km in the west D. 3 km in the North

16. Dhanumjay walks 10 m towards the South .Turning to the left , he walks 20 m and then moves to his right. After moving a distance of 20 m , he turns to the right and walks 20 m. Finally, he turns to the right and moves a distance of 10 m .How far and in which direction is he from the starting point?
A. 20 m North B. 20 m South C. 10 m North D. 10 m South

17. Arjun walked 30 m towards East, took a right turn and walked 40 m .Then he took a left turn and walked 30 m .In which direction is he now from the starting point?
A. South-East B. South C. North-East D. East

18. A man leaves for his office from his house. He walks towards East. After moving a distance of 20 m, he turns South and walks 10 m. Then he walks 35 m towards the West and further 5 m towards the North .He then turns towards East and walks 15 m .What is the straight distance between his initial and final positions?
A. 0 B. 5 C. 10 D. 15

19. Murari walked 40 m towards North, took a left turn and walked 20 m .He again took a left turn and walked for 40 km. How far and in which direction is he from the starting point?
A. 20 m West B. 20 m South C. 20 m East D. 20 m North

20. Nishitha walks 14 m towards west, then turns to her right and walks 14 m and then turns to her left and walks 10 m. Again turning to her left she walks 14 m .What is the shortest distance between her starting point and the present position?
A. 14 B. 24 C. 34 D. 44

LEVEL – II

1. One morning Udai and Vishal were talking to each other face to face at a crossing. If Vishal's shadow was exactly to the left of Udai, which direction was Udai facing?
A. East B. West C. North D. South

2. Y is in the East of X which is in the North of Z. If P is in the South of Z, then in which direction of Y, is P?
A. North B. South C. South-East D. None of these

3. If South-East becomes North, North-East becomes West and so on. What will West become?
A. North-East B. North-West C. South-East D. South-West

4. A man walks 5 km toward south and then turns to the right. After walking 3 km he turns to the left and walks 5 km. Now in which direction is he from the starting place?
A. West B. South C. North-East D. South-West

5. Rahul put his timepiece on the table in such a way that at 6 P.M. hour hand points to North. In which direction the minute hand will point at 9.15 P.M.?
A. South-East B. South C. North D. West

6. Rasik walked 20 m towards north. Then he turned right and walks 30 m. Then he turns right and walks 35 m. Then he turns left and walks 15 m. Finally he turns left and walks 15 m. In which direction and how many metres is he from the starting position?
A. 15 m West B. 30 m East C. 30 m West D. 45 m East

7. Two cars start from the opposite places of a main road, 150 km apart. First car runs for 25 km and takes a right turn and then runs 15 km. It then turns left and then runs for another 25 km and then takes the direction back to reach the main road. In the meantime, due to minor break down the other car has run only 35 km along the main road. What would be the distance between two cars at this point?
A. 65 km B. 75 km C. 80 km D. 85 km

8. Starting from the point X, Jayant walked 15 m towards west. He turned left and walked 20 m. He then turned left and walked 15 m. After this he turned to his right and walked 12 m. How far and in which directions is now Jayant from X?
A. 32 m, South B. 47 m, East C. 42 m, North D. 27 m, South

9. One evening before sunset Rekha and Hema were talking to each other face to face. If Hema's shadow was exactly to the right of Hema, which direction was Rekha facing?
A. North B. South C. East D. Data is inadequate

10. A boy rode his bicycle Northward, then turned left and rode 1 km and again turned left and rode 2 km. He found himself 1 km west of his starting point. How far did he ride northward initially?
A. 1 km B. 2 km C. 3 km D. 5 km

Directions to Solve (11-12): Dev, Kumar, Nilesh, Ankur and Pintu are standing facing to the North in a playground such as given below:
Kumar is at 40 m to the right of Ankur.
Dev is are 60 m in the south of Kumar.
Nilesh is at a distance of 25 m in the west of Ankur.
Pintu is at a distance of 90 m in the North of Dev.

11. Which one is in the North-East of the person who is to the left of Kumar?
A. Dev B. Nilesh C. Ankur D. Pintu

12. If a boy starting from Nilesh, met to Ankur and then to Kumar and after this he to Dev and then to Pintu and whole the time he walked in a straight line, then how much total distance did he cover?
A. 215 m B. 155 m C. 245 m D. 185 m

Directions (13-15): These questions are based on the following information:
Seven villages A, B, C, D, E, F and G are situated as follows:
E is 2 km to the west of B.
F is 2 km to the north of A.
C is 1 km to the west of A.
D is 2 km to the south of G.
G is 2 km to the east of C.
D is exactly in the middle of B and E.

13. A is in the middle of
A. E and C B. E and G C. F and G D. G and C

14. Which two villages are west of G?
A. D and C B. F and E C. C and A D. G and E

15. How far is E from D (in km)?
A. 1 B. $\sqrt{20}$ C. 5 D. $\sqrt{26}$

16. A man is facing west. He turns 45 degree in the clockwise direction and then another 180 degree in the same direction and then 270 degree in the anticlockwise direction. Find which direction he is facing now?
A. South-West B. West C. South D. East-South

17. A man is facing north. He turns 45 degree in the clockwise direction and then another 180 degree in the same direction and then 45 degree in the anticlockwise direction. Find which direction he is facing now?
A. North B. East C. West D. South

18. One day, Raviraj left home and cycled 20 Km southwards, turned right and cycled 10 km and turned right and cycled 20 Km and turned left and cycled 20 Km. How many kilometres will he have to cycle to reach his home straight?
A. 50 Km B. 30 Km C. 40 Km D. 60 Km

19. Kunal walks 10 km towards North. From there he walks 6 Km towards South. Then, he walks 3 Km towards east. How far and in which direction is he with reference to his starting point?
A. 5 Km North B. 5 Km South C. 5 Km East D. 5 Km North-East

20. Gaurav walks 20 metres towards North. He then turns left and walks 40 metres. He again turns left and walks 20 metres. Further, he moves 20 metres after turning to the right. How far is he from his original position?
A. 40 metres B. 50 metres C. 60 metres D. 70 metres

LEVEL - III

Directions to Solve (1-3): Each of the following questions is based on the following information:
A # B means B is at 1 metre to the right of A.
A $ B means B is at 1 metre to the North of A.
A * B means B is at 1 metre to the left of A.
A @ B means B is at 1 metre to the south of A.
In each question first person from the left is facing North.

1. According to X @ B * P, P is in which direction with respect to X?
A. North B. South C. North-East D. South-West

2. According to M # N $ T, T is in which direction with respect to M?
A. North-West B. North-East C. South-West D. South-East

3. According to P # R $ A * U, in which direction is U with respect to P?
A. East B. West C. North D. South

Directions to Solve (4-7): Each of the following questions is based on the following information:
Six flats on a floor in two rows facing North and South are allotted to P, Q, R, S, T and U.
Q gets a North facing flat and is not next to S.
S and U get diagonally opposite flats.
R next to U, gets a south facing flat and T gets North facing flat.

4. If the flats of P and T are interchanged then who's flat will be next to that of U?
A. P B. Q C. R D. T

5. Which of the following combination get south facing flats?
A. QTS B. UPT C. URP D. Data is inadequate

6. The flats of which of the other pair than SU, is diagonally opposite to each other?
A. QP B. QR C. PT D. TS

7. Whose flat is between Q and S?
A. T B. U C. R D. P

8. A child is looking for his father. He went 90 meters in the east before turning to his right. He went 20 meters before turning to is right again to look for his father at his uncle's place 30 meters from this point. His father was not there. From there, he went 100 meters to his north before meeting his father in a street. How far did the son meet his father from starting point?

A. 80 metre B. 90 metre C. 100 metre D. 110 metre

9. Rohit walked 25 metres towards South. Then he turned to his left and walked 20 metres. He then turned to his left and walked 25 metres. He again turned to his right and walked 15 metres. At what distance is he from the starting point and in which direction?

A. 35 metre, North B. 30 metre, South C. 35 metre, East D. 30 metre, North

10. Starting from a point P, Sachin walked 20 metres towards South. He turned left and walked 30 metres. He then turned left and walked 20 metres. He again turned left and walked 40 metres and reached a point Q. How far and in which direction is the point Q from the point P?

A. 30 metres, West B. 10 metres, West C. 30 metres, North D. 10 metres, North

11. Amit starts from a point A and walks 5 m towards North-East direction and reaches point B .From here he travels 8 m in East direction and reaches point C. From C he travels towards South-West direction and reaches point D after traveling a distance equal to AB. At last, he turns towards West direction and reaches point A. How much distance has been covered by Amit and which geometrical figure has been formed by path travelled by him?

A. 26m, square B. 26m, parallelogram
C. 26m, trapezium D. 16m, parallelogram

12. Vinod starts from his house and travels 4 km in East direction, after that he turns towards left and moves 4 km. Finally, he turns towards left and moves 4 km. At what distance and in which direction he finally stands from his original point?

A. North, 4 km B. North-East, 4 km
C. South, 12 km D. West, 4 km

13. A and B starts from a point in opposite directions. A travels 3 km and B also travels 3 km. Then, A turns towards right and travels 4 km and B turns towards right and travels 4 km. What is the distance between A and B?

A. 8 km B. 10 km C. 12 km D. 14 km

14. An object is projected from South-East direction to North-West direction with a certain force. Air exerts an equal force from South-West direction to North-East direction. What will be the new direction of the object?

A. Towards South-East B. Towards North-East
C. Towards East D. None of these.

Directions (15-18): Each of the following questions is based on the following information:
All the roads of the city is either parallel or perpendicular to each other. A, B, C, D and E are parallel to each other. Roads G, H, I, J, K and M are parallel to one another.

I. Road A is 1 km east of Road B.
II. Road B is 1/2 km west of Road C.
III. Road D is 1 km west of Road E.
IV. Road G is 1/2 km south of Road H.

V. Road I is 1 km north of Road L.
VI. Road K is 1/2 km north of Road L.
VII. Road K is 1 km south of Road M.

15. Which is essentially true?
A. E and B intersect
B. D is 2 km west of B
C. D is at least 2 km west of A
D. M is 1.5 km north of L

16. If E is between B and C, then which of the option is false?
A. D is 2 km west of A
B. C is less than 1.5 km from D
C. E is less than 1 km from A
D. D is less than 1 km from B.

17. If E is between B and C, then distance between A and D is
A. 1/2 km
B. 1 km
C. 1.5 km
D. 1.5 – 2 km

18. Which of the possibilities would make two roads coincide?
A. L is ½ km north of I
B. C is 1 km west of D
C. D is ½ km east of A
D. E and B are ½ km apart

Directions (19-20): Each of the following questions is based on the following information:
I. There are 6 check-posts A, B, C, D, E and F.
II. Check-post F is 25 kms to the north of D which is 35 kms to the north-east of B.
III. Check-post A is 15 kms west of E and 35 kms to the south-west of C.
IV. B, A and E are in straight line.
V. The check-post B and E are 70 kms apart from each other.

19. Which check-post is the farthest to the south-west of D?
A. A
B. B
C. C
D. D

20. Which check-post is the nearest to the north-east of E?
A. A
B. B
C. C
D. D

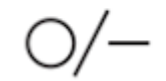
BLOOD RELATION

Blood relation is an important topic keeping in view the competitive exams. Blood relation shows the different relations among the members of a family. Based on the information given, we have to find relation between particular members of the family.
Now, take a look at below given "Generation Table" which will help you to understand the different relationship.

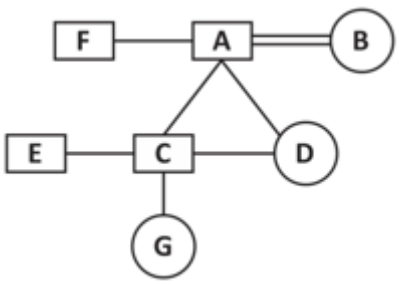
Generation	Male	Female
Three generations above	Great Grandfather, Maternal great Grandfather, Great Grandfather-in-law	Great Grandmother, Maternal great Grandmother, Great Grandmother-in-law
Two generations above	Grandfather Maternal Grandfather Grandfather-in-law	Grandmother Maternal Grandmother Grandmother-in-law
One generation above	Father, Uncle Maternal Uncle Father-in-law	Mother, Aunt, Maternal Aunt Mother-in-law
current generation (self)→	Husband, Brother Cousin, Brother-in-law	Wife, Sister, Cousin, Sister-in-law
One generation below ↓	Son Nephew Son-in-law	Daughter Niece Daughter-in-law
Two generations below ↓↓	Grandson Grandson-in-law	Granddaughter Granddaughter-in-law
Three generations below ↓↓↓	Great Grandson Great Grandson-in-law	Great Granddaughter Great Granddaughter-in-law

The questions of Blood Relations can be solved easily with the help of "Generation Tree".
Different pictorial form, which are used to define the relationship among them.


These two pictorials from are used for males.


These two pictorials from are used for females

Representation of different relations:



From given generation tree we can deduce some important relationship between family members:
1. A is Father of C, E and D
2. B is Mother of C, E and D
3. F is Brother of A
4. F is Brother in law of B
5. A is Husband of B
6. B is Wife of A
7. F is Uncle of E, C and D
8. C and E are Son of A and B
9. D is Daughter of A and B
10. D is Sister of E and C
11. E is Brother of C and D
12. C is Brother of E and D
13. A is Grandfather of G
14. B is Grandmother of G
15. G is Granddaughter of A and B.

Types of questions asked from Blood Relations:
1. Based on Dialogue or Conversation
2. Based on Puzzles
3. Based on Symbolically coded

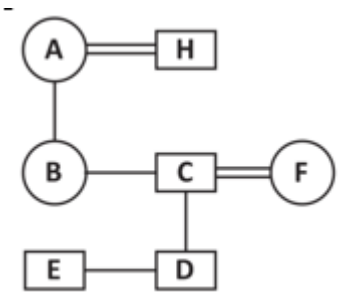
Based on Conversation or Dialogue- In this type of questions, the one person talking to or doing chit-chat with other person giving information by pointing to some picture or person.

Example 1: Pointing to a lady on the stage, Monika said, "She is the sister of the son of the wife of my husband." How is the lady related to Monika?
Solution: Find who you can easily relate to and be that person-then go about creating one relation after another.
In this question, be Monika-then start from the end of the sentence.
"My husband" = Monika's husband
'Wife of my husband' = is me = Monika
'Son of the wife of my husband' = My Son
'Sister of the Son of the wife of my Husband' = My Son's Sister = My daughter
'She' is the sister of the son of the wife of my husband' = the lady on the stage = the lady being pointed out = my daughter.
So, lady on the stage is Monika's daughter.

Based on Puzzles: In this type of question, you have to conclude the relations between two given person based on more than one information given in the question.

Example 2: A is the mother of B. B is the sister of C. D is the son of C. E is the brother of D. F is the mother of E. H has only two children B and C. How is F related to E?
Solution: In this question, first we will drew the generations tree:

-



So, F is mother of E.

Based on Symbols: In this type of question, information are coded in the form of symbols life □, #, $, % ..... etc.

Example 3: Direction: Read the following information carefully and then answer the question given below:
(a) A □ B means A is mother of B.
(b) A $ B means A is sister of B.
(c) A * B means A is father of B.
(d) A # B means A is brother of B.

Question: Which of the following means R is uncle of T?
(a) R*P #S□Q$T (b) S * P # R * U # T
(c) P*R#SSSSSSQ$S*T (d) P * R $ Q $ S * T
(e) None of these
Solution: From option, C, we will get R is uncle of T.

LEVEL – I

1. Q is the brother of R; P is the sister of Q; T is the brother of S; S is the daughter of R. How is Q related to T?
A. Uncle B. Father C. Brother-in-law D. Nephew

2. Z; the son-in-law of K, is the brother-in-law of G who is the brother of E.E is the daughter of K. How is G related to K?
A. Brother B. Son C. Father D. Data inadequate

3. Pointing to a lady in the photograph, Monika said, "Her son's father is the son-in-law of my mother." How is Monika related to the lady?
A. Aunt B. Sister C. Mother D. Cousin

4. Anil introduces Akash as the son of the only brother of his father's wife. How is Akash related to Anil?
A. Cousin B. Son C. Uncle D. Son-in-law

5. Shikha told Aarushi, "The girl I met, yesterday at the beach was youngest daughter of the brother-in-law of my friend's mother." How is the girl related to Shikha's friend?
A. Cousin B. Daughter C. Niece D. Friend

6. Pointing to a man on the stage, Natasha said, "He is the brother of the daughter of the wife of my husband." How is the man on the stage related to Natasha?
A. Son B. Husband C. Cousin D. Nephew

7. Pointing to a man in a photograph, Aarohi said, "His mother's only daughter is my mother." How is Aarohi related to that man?
A. Nephew B. Sister C. Wife D. Niece

8. Pointing to a girl in the photograph, Umesh said, "Her mother's brother is the only son of my mother's father." How is the girl's mother related to Umesh?
A. Mother B. Sister C. Aunt D. Grandmother

9. X introduces Y saying "He is the husband of the granddaughter of the father of my father". How is Y related to X?
A. Brother B. Son C. Brother-in-law D. Nephew

10. Pointing to a woman, Manish said, "She is the daughter of the only child of my grandmother." How is the woman related to Manish?
A. Sister B. Niece C. Cousin D. Data inadequate

11. Pointing to a person, a man said to a woman, "His mother is the only daughter of your father." How was the woman related to the person?
A. Aunt B. Mother C. Wife D. Daughter

12. K and L are brothers. M and N are sisters. K's son is N's brother. How is L related to M?
A. Father B. Brother C. Grandfather D. Uncle

13. Pointing to a person, Deepak said, "His only brother is the father of my daughter's father". How is the person related to Deepak?

A. Father B. Grandfather C. Uncle D. Brother-in-law

14. Pointing to a photograph Anjali said, "He is the son of the only son of my grandfather." How is the man in the photograph related to Anjali?

A. Brother B. Uncle C. Son D. Data is inadequate

15. Amit said - "This girl is the wife of the grandson of my mother". How is Amit related to the girl?

A. Brother B. Grandfather C. Husband D. Father-in-law

16. Pointing towards a man, a woman said, "His mother is the only daughter of my mother." How is the woman related to the man?

A. Mother B. Grandmother C. Sister D. Daughter

17. Introducing Sonia, Aamir says, "She is the wife of only nephew of only brother of my mother." How Sonia is related to Aamir?

A. Wife B. Sister C. Sister-in-law D. Data is inadequate

Directions(18-20): A is the son of B. C, B's sister has a son D and a daughter E. F is the maternal Uncle of D.

18. How is A related to D?

A. Cousin B. Nephew C. Uncle D.Brother

19. How is E related to F?

A. Sister B. Daughter C. Niece D. Wife

20. How many Nephews does F have?

A. None B. One C. Two D. Three

LEVEL – II

Directions (Questions 1 to 5): Read the following information carefully and answer the questions given below it:
In a family, there are six members A, B, C, D, E and F. A and B are a married couple, A being the male member. D is the only son of C, who is the brother of A. E is the sister of D. B is the daughter-in-law of F, whose husband has died.

1. How is F related to A?
A. Mother B. Sister-in-law C. Sister D. Mother-in-law

2. How is E related to C?
A. Sister B. Daughter C. Cousin D. Aunt

3. Who is C to B?
A. Brother B. Brother-in-law C. Nephew D. Son-in-law

4. How Many male members are there in the family?
A. One B. Two C. Three D. Four

5. How is F related to C?
A. Mother-in-law B. Sister-in-law C. Mother D. Aunt

Directions (Questions 6 to 10): Read the following information and answer the questions given below it:
'A+B means 'A is the daughter of B'
'A*B' means 'A is the son of B'
'A-B' means 'A is the wife of B'

6. If P*Q-S, which of the following is true?
A. S is wife of Q B. S is father of P
C. P is daughter of Q D. Q is father of P

7. If T-S*B-M, which of the following is not true?
A. B is mother of S B. M is husband of B
C. T is wife of S D. S is daughter of B

8. If Z*T-S*U+P, what is U to Z?
A. Mother B. Grandmother
C. Father D. Cannot be determined

9. If 'P $ Q' means 'P is father of Q'; 'P # Q' means 'P is mother of Q'; 'P * Q' means 'P is sister of Q', then how is D related to N in N#A$B*D ?
A. Nephew B. Grandson
C. Grand-daughter D. Data inadequate

10. If ‘P*Q’ means ‘P is the daughter of Q’; ‘P+Q’ means ‘P is the father of Q’; ‘P@Q’ means ‘P is the mother of Q’ and ‘P-Q’ means ‘P is the brother of Q’, then in the expression A@B+C-E*F, how is A related to F ?

A. Mother B. Aunt C. Daughter-in-law D. None of these

Directions(11-15):

A $ B means A is mother of B
A # B means A is father of B
A @ B means A is husband of B
A % b means A is daughter of B

11. P @ Q $ M # T indicates what relation of P with T?

A. Paternal grandmother B. Maternal grandmother
C. Paternal grandfather D. Maternal grandfather

12. Which of the following expressions indicates R is the sister of H

A. H $ D @ F # R B. R % D @ F $ H
C. R $ D @ F # H D. H % D @ F $ R

13. If F @ D % K # H, then how F related to H

A. Brother- in-law B. Sister
C. Sister-in-law D. Cannot be determined

14. Which of the following expressions indicates H is the brother of N

A. H # R $ D $ N B. N % F @ D $ H # R
C. N % F @ D $ H D. N % F @ D % H

15. If G $ M @ K, how is K related to G

A. Daughter-in-law B. Mother-in-law
C. Daughter D. None of these

Directions (16-18): Six persons A, B, C, D, E and F are travelling together. B is the son of C but C is not the mother of B. A and C are married couple. E is the brother of C. D is the daughter of A and F is the brother of B.

16. How many male members are there in the Family?

A. 1 B. 2 C. 3 D. 4

17. Who is the mother of B?

A] D B. F C. E D. A

18. How many children does A have?

A. One B. Two C. Three D. Four

19. Rita told Mani, “The girl I met yesterday at the beach was the youngest daughter of the brother-in-law of my friend’s mother.” How is the girl related to Rita’s friend?

A. Cousin B. Daughter C. Niece D. Friend

20. Pointing to a photograph a woman says “This man’s son’s sister is my mother-in-law” How is the woman’s husband related to the man in this photograph?
A. Grandson B. Son C. Son-in-law D. Nephew

LEVEL – III

Directions (1-5):
P = Q means Q is the father of P
P * Q means P is the sister of Q
P ? Q means Q is the mother P
P $ Q means P is the brother of Q
P @ Q means Q is son of P
P # Q means P is the daughter of Q

1. Which of the following is not correct?
A. R # S ? T means R is granddaughter of T
B. P = Q ? R means R is grandmother of P
C. L $ M * O means O is sister of L
D. All are correct

2. Which of the following is correct?
A. V # T * P means P is maternal uncle of V
B. D ? V # T means D is granddaughter of T
C. L @ M $ R means R is paternal uncle of L
D. M @ R * D ? V means M is son of V

3. Which of the following indicates A is grandfather of B?
A. M # A = N = B B. B $ L # Q # A
C. B # L # A D. L * B = S $ Q =A

4. Which of the following means F is paternal uncle of G?
A. G # L $ F $ N B. N $ F $ L # G
C. G # M * F $ L D. L = F $ Q @ G

5. S # M * B @ L = F?Q reveals which of the following relations?
A. F and B are brother and sister
B. B is paternal uncle of S
C. L is grandmother of Q
D. M is maternal aunt of L

Directions (6-10): Study the following information carefully and answer the questions that follow:
A ÷ B means A is son of B
A × B means A is sister of B
A + B means A is brother of B
A – B means A is mother of B

6. How is G related to H in the expression 'G × R + V ÷ H'?
A. Sister B. Daughter C. Son D. Mother

7. Which of the following expressions represents 'B is the husband of A'?
A. A × I – E + B B. A – I + E ÷ B
C. A + I ÷ E × B D. A ÷ I × E + B

8. How is V related to T in the expression 'T ÷ R + V × N'?
A. Niece B. Father C. Uncle D. Aunt

9. How is P related to J in the expression 'J × K ÷ M – P'?
A. Sister B. Brother C. Father D. Either (a) or (b)

10. Which of the following expressions represents 'J is wife of E'?
A. E ÷ F × G + H – J B. E × G ÷ H + F – J
C. J – H × G ÷ E + F D. Both (a) and (b)

Directions (11-13): Study the following information carefully and answer the questions given below:
'Q ÷ R' means 'Q is father of R'
'Q × R' means 'Q is wife of R'
'Q + R' means 'Q is son of R'
'Q – R' means 'Q is sister of R'

11. How is C related to A, in the given expression A – B + C × D?
A. Father B. Mother C. Sister D. Daughter

12. Which of the following statements is true if the given expression is true?
M × L + N –O
A. M is daughter of O B. L is father of O
C. N is husband of L D. L is son of N

13. What will come in place of question mark (?) if it is given that V is mother-in-law of W in the following expression?
W ÷ P + C – T ? V – Q
A. ÷ B. + C. × D. –

Directions (14-15): These questions are based on the following information.
'P@Q' means 'P is the mother of Q'
'P$Q' means 'P is the husband of Q'
'P#Q' means 'P is the sister of Q'
'P*Q' means 'P is the son of Q'.

14. If F#J*T$R@L, then which of the following is definitely true?
A. L is the brother of F B. F is the sister of L
C. F is the brother of J D. L is the brother of J

15. Which of the following indicates the relationship ‘R’ is the daughter of T’?

A. R#F*B@T
B. R#F*B$T
C. T@B#R*F
D. T@B#F*R

Directions (16-20): A, B, C, D, E, F, G and H are sitting around a circle facing the centre but not necessarily in the same order. Each of them has a relationship with A.

G is sitting second to the left of father of A. F is immediate neighbour of A. D, mother of A is sitting opposite to the sister of A. B is sitting to the immediate right of wife of A. E who is a male is sitting second to the right of mother of C. Brother of A is sitting third to right of B. Daughter of A is sitting to third to right of sister of A. A is sitting second to the right of daughter of E. E is sitting to the immediate left of sister of A.

16. Who is the mother of H?

A. F
B. G
C. C
D. D

17. Who is the grand-daughter of E?

A. B
B. C
C. D
D. G

18. Who is sitting second to the right of F’ sister?

A. wife of A
B. brother of C
C. daughter of A
D. father of B

19. How many persons are sitting between A’s wife and D’s husband when counted from right of A’s wife?

A. None
B. One
C. Two
D. Three

20. What is the position of G’s daughter with respect to D’s daughter?

A. third to left
B. second to left
C. third to right
D. second to right

LOGICAL REASONING – I

STATEMENT AND ARGUMENTS

A Statement is followed by two Arguments. An Argument maybe in favour of or against the statements. One has to check the strength of the argument. This cannot be misconstrued as considering only favourable arguments.
Preliminary Screening: Read the argument and discard it if it is:

a) Ambiguous: The argument should have clarity in the reason suggested in it. The argument should be contextual and express its support or opposition to the given statement in explicit terms.
Example:
Statement: Should India wage war against Pakistan?
Argument: No, both India and Pakistan are at fault.
Analysis: Here, though the argument refers to the subject in the statement, it has no clarity. Thus, the argument is ambiguous.

b) Disproportionate: The reasons given in the argument, in support or against the given statement, should be comparable to the magnitude of the situation given in the statement.
Example:
Statement: Should every citizen be asked to use only pencil to write instead of pen?
Argument: Yes, usage of pencil leads to reduction in wastage of paper. This helps in protection of environment.
Analysis: The argument links usage of pencil to protection environment., because errors can be rectified on the same paper. This measure, in practice, makes little difference to the environment, hence, the argument is rejected.

c) Irrelevant: The argument should relate its reasoning to the context given in the statement.
Example:
Statement: Should the syllabus for primary classes be reduced, to enable the students to understand the concepts piece meal?
Argument: 1. No, it gives more leisure to students, which may lead to juvenile delinquency.
2. No, the syllabus should include subjects that help in increasing IQ levels of students.
Analysis: The reason given in argument (1) is out of context when compared to the statement. Hence, this argument is irrelevant.

d) Comparative: The argument should suggest why or why not the proposed action be implemented, basing on favourable or adverse results that follow after implementation.
Example:
Statement: Should India reform its taxation policy?
Argument: 1. Yes, it helps in rationalisation of taxes.
2. Yes, many countries are doing so.
Analysis: Argument (1) is a valid argument because it is based on a positive result that would follow the suggested action.
Argument (2) is not based on any resulting effect of the suggested action .
Hence, this is not a valid argument.

e) Simplistic: These kind of arguments, though they are related to the statements, make a simple assertion or there is no substantiation to strengthen the argument.
Example:
Statement: Should India wage war against Pakistan?
Argument: 1. Yes, it should be done immediately.
Argument: 2. No, it is not going to help.
Analysis: Argument (1) simply suggests that it should be done immediately. Hence, this argument is too simple.
Argument (2) does not show how it is not going to help. Hence, argument (2) is also simplistic.

Example 1:
Statement: Should Yoga be introduced as a part of the curriculum by schools?
Argument 1: Yes: This will help students improve their mental ability.
Argument 2: No: This will not help students to improve studentship qualities but will burden them with extra school-hours.
Options:
(1) if only argument I is strong.
(2) if only argument II is strong.
(3) if either I or II is strong.
(4) if neither I nor II is strong.
(5) if both I and II are strong.
Answer: Option (5)
Solution: Both the statements, if true, are valid and strong arguments.

Example 2:
Statement: Should we switch to a green fuel (fuel extracted from food grains)?
Arguments:
I. Yes, it does not pollute the environment.
II. No, it will increase the prices of food products.
Options:
(1) if only argument I is strong.
(2) if only argument II is strong.
(3) if either I or II is strong.
(4) if neither I nor II is strong.
(5) if both I and II are strong.
Answer: Option (1)
Solution: I is based on a positive result and desirable. Hence I is strong. II is not strong because there can be separate production for this purpose. Only I is strong.

LEVEL – I

Directions (1-5): The question below is followed by two arguments numbered I and II. You have to decide which of the given arguments is/are 'strong'.

a) Only I is strong.
b) Either I or II is strong.
c) Only II is strong.
d) Neither I nor II is strong.
e) Both I and II are strong

1. Should the fees of all private professional colleges be made equal to those of government professional colleges?
Arguments:
I. No, private colleges need additional funds to maintain quality of education.
II. Yes, otherwise a large number of meritorious students will not be able to study in these colleges due to exorbitantly high fees.

2. Question: Should the press in India be given full freedom?
Arguments:
I. Yes, because only then people will become politically enlightened.
II. No, because full freedom to press will create problems.

3. Statement:
Bank 'A' has announced reduction of half percentage on the interest rate on retail lending with immediate effect.
Arguments:
I. Other banks may also reduce their retail lending rates to be in competition.
II. The bank 'A' may be able to attract more customers for availing retail loans.

4. Should the oil companies be allowed to fix the price of petroleum products depending on market conditions?
Arguments:
I. Yes, this is the only way to make the oil companies commercially viable.
II. No, this will put additional burden on the retail prices of essential commodities and will cause a lot of hardships to the masses.

5. Should all the profit making public sector units be sold to private companies?
Arguments:
I. Yes, as this will help the Government to augment its resources for implementing the development programmes.
II. No, as the private companies will not be able to run these units effectively.

6. Question: Should road repair work in big cities be carried out only late at night?
Arguments:
(A) No, this way the work will never get completed.
(B) No, there will be unnecessary use of electricity.
(C) Yes, the commuters will face a lot of problems due to repair work during the day.

a) None is strong.
b) Only (A) is strong
c) Only (C) is strong.
d) Only (B) and (C) are strong.
e) Only (A) and (B) are strong.

7. Question: Should there be a restriction on the construction of high rise buildings in big cities in India?
Arguments:
(A) No, big cities in India do not have adequate open land plots to accommodate the growing population.
(B) Yes, only the builders and developers benefit from the construction of high rise buildings.
(C) Yes, the Government should first provide adequate infrastructural facilities to existing buildings before allowing the construction of new high rise buildings.

a) Only (B) is strong.
b) Only (C) is strong.
c) Both (A) and (C) are strong
d) Only (A) is strong.
e) None of these

8. Question: Should the government stop giving subsidy to loss-making public sector units?
Arguments:
I. Yes, as subsidies can never cure the ailment in loss-making public sector units.
II. No, as public sector units have carved out a niche for themselves in India's developmental process and they should be sustained at all costs.

9. Question: Should there be only one rate of interest for term deposits of varying durations in banks?
Arguments:
I. No, people will refrain from keeping money for longer duration resulting into reduction of liquidity level of banks.
II. Yes, this will be much simple for the common people and they may be encouraged to keep more money in banks.

10. Question: Should all the drugs patented and manufactured in western countries be first tried out on sample basis, before giving license for sale to general public in India?
Arguments:
I. Yes, many such drugs require different doses and duration for Indian population and hence, it is necessary.
II. No, this is just not feasible and hence, cannot be implemented.

11. Question: Should there be a restriction on the migration of people from one state to another in India?
Arguments:
I. No, any Indian citizen has the basic right to stay at any place of his/her choice and hence, he/she cannot be stopped.
II. Yes, this is the way to affect an equitable distribution of resources across the states in India.

12. Question: Should government close down loss-making public sector enterprises?
Arguments:
I. No, all employees will lose their jobs, security and earning and what would they do?
II. Yes, in a competitive world, the rule is `survival of the fittest'.

13. Question: Should all the professional colleges in India be encouraged to run their own courses without affiliation to any university?
Arguments:
I. Yes, this is the only way to create more opportunities for those who seek professional training.
II. No, this will dilute the quality of professional training as all such colleges may not be equipped to conduct such courses.

14. Question: Should there be a complete ban on tobacco products in India?
Arguments:
I. No, it will render a large number of people unemployed.
II. No, the government will have a large amount of loss in money as it will not be earned by taxes on these products.

15. Question: Should all students passing out from the government-run colleges and desirous of settling abroad be asked to pay back the cost of their education to the government?
Arguments:
I. Yes, such students who study on the resources of the exchequer should be discouraged to leave the country.
II. No, every citizen has the right to select his place of further study or work and therefore, such a condition is unjustified.

LEVEL – II

16. Question: Should those who manufacture spurious life saving drugs be given capital punishment?
Arguments:
I. No, nobody has the right to take people's lives as we cannot give life to anybody.
II. Yes, those people are more dangerous than those who are convicted for homicide as the extent of damage to human life is incalculable.

17. Question: In India, should income tax be abolished?
Arguments:
I. Yes, because it is an unnecessary burden on the wage earners.
II. No, because it is a good source of revenue.

18. Question: Should the public sector undertakings be allowed to adopt hire and fire policy?
Arguments:
I. Yes, this will help the public sector undertakings to get rid of non-performing employees and will also help to reward the performing employees.
II. No, the management may not be able to implement the policy in an unbiased manner and the employees will suffer due to the high-handedness of the management.

19. Question: Should there be only one rate of interest for term deposits of varying durations in banks?
Arguments:
I. No, people will refrain money for longer duration resulting into reduction of liquidity level of banks.
II. Yes, this will be much simpler for the common people and they may be encouraged to keep more money in banks.

20. Question: Should there be capital punishment for those who are found guilty of rape charges?
Arguments:
I. Yes, this is the only way to eliminate such atrocities on women.
II. No, this will lead to more violence as culprits may even kill the rape victims.

21. Question: Should there be compulsory medical examination of both the man and the woman before they marry each other?
Arguments:
I. No, this is an intrusion into the privacy of an individual and hence, cannot be tolerated.
II. Yes, this will substantially reduce the risk of giving birth to children with serious ailments.

22. Question: Should all those who are found guilty of committing homicide be given either capital punishment or kept in jail for the entire life?
Arguments:
I. Yes, only such severe punishments will make people refrain from committing such heinous acts and the society will be safer.
II. No, those who are repentant for the crime they committed should be given a chance to lead a normal life outside the jail.

23. Question: Should India become a permanent member of UN's Security Council?
Arguments:
I. Yes, India has emerged as a country that loves peace and amity.
II. No, let us first solve problems of our own people like poverty, malnutrition.

24. Question: Should all the criminals convicted for committing murder be awarded capital punishment?
Arguments:
I. Yes, this will be a significant step towards reducing cases of murder in future.
II. No, nobody has the right to take any person's life irrespective of the acts of such individuals.

25. Question: Should government freeze pay-scales and salary of all private and public sectors and its own employees to contain inflation?
Arguments:
I. Yes, all over the world this is considered as a sure way to contain inflation.
II. No, the government should control market forces to keep check on the prices.

26. Question: Should there be a compulsory military training for every college student in India?
Arguments:
I. No, this goes against the basic democratic right of an individual to choose his/her own programs.
II. Yes, this is the only way to build a strong and powerful nation.

27. Question: Should the retirement age of all government employees in India is to be made 55 years?
Arguments:
I. Yes, this will help government to offer employment to youth at lower cost and with higher productivity.
II. No, the government will be deprived of the expertise of the experienced employees and this will have adverse effect on the productivity.

28. Question: Should there be a restriction on the number of ministers in each cabinet of India?
Arguments:
I. Yes, as a result of this, a lot of money will be saved and the same can be used in developmental programmes.
II. No, there should not be such restrictions on democratically elected representatives and it should be left to the judgement of the leader of the council of ministers.

29. Statement: Should the in-charge of all the police stations in the country be transferred every two years?
Arguments:
I. No, every transfer creates a lot of administrative hassles and also causes a lot of inconvenience to the police officers.
II. Yes, this is the only way to eradicate the nexus between police officers and anti-social elements.

30. Question: Should mutual funds be brought under strict government control?
Arguments:
I. Yes, that is one of the ways to protect the interest of the investors.
II. No, strict government controls are likely to be counterproductive.

STATEMENT AND ASSUMPTIONS

Assumption: An assumption is the hidden part of the statement which is assumed/supposed and taken for granted. Something that is not clearly mentioned in the statement, but is an integrated part of it. when somebody says something he does not put everything, every aspect of his idea into words. There is a lot which he leaves unsaid. That which he leaves unsaid, that which he takes for granted, may be defined as an assumption.

Important Notes:
(1) Always check whether an assumption is implicit or not by "keeping yourself in the shoes of the subject".
(2) Think from the perspective of the person saying the line in the statement, the person giving the advertisement, the person advising someone etc.
(3) Always be careful of the key words used in the sentence, such as, most, only, all, best, definitely etc. The statement is supposed to be read carefully to pick the right assumption.

Some important key points which will help you to analyse the assumption in less time:
(1) Some words like only, each, any, every, all, question indicating words (why, what), answer indicating words (therefore), Definitely, But, Certainly exist in the assumption and that assumption will always be explicit (False)
(2) Some words like some, to large extent, many much exist in the assumption and that will always be implicit (True).
(3) Any assumption that is conveying the message of advertisement, notice and appeal, that assumption will always be implicit (True).
(4) Any assumption that's talking about the social welfare (positive), govt. policies that assumption will always be implicit (True).
(5) If any assumption showing the word like suggestion, order, request that will always be implicit (True).

Example 1: Statement: "Hungry stomachs do not understand high values and economic ethics. They will vote a man who gives them rice". – A political analyst on why a particular party won the election.
Assumptions:
I. A lot of people are hungry.
II. Rice was not available previously.
III. Rice was available only in limited quantity.
Solution: The analyst talks of hungry stomachs, so people with hungry stomachs must be existing. It means that 1st is implicit. II is not implicit although it looks otherwise. Some rice must have been available only in limited amount (otherwise people wouldn't have been hungry). Hence, III is implicit.

Example 2: Statement: An advertisement in a newspaper – "wanted unmarried, presentable matriculate girls between 18 and 21, able to speak fluently in English, to be hired as models".
Assumptions:
I. Fluency in English is a prerequisite for good performance a model.
II. Height does not matter in performing as a model.
Solution: Since the advertisement wants girls "able to speak fluently in English" it must have assumed that fluency in English is a requirement for a good model. But height as a criteria is not described in the statement so, only 1st assumption will implicit.

LEVEL – I

Directions: A statement is given followed by two assumptions numbered I and II. An assumption is something supposed or taken for granted. You have to consider the statement and the following assumptions to decide which of the assumptions is/are implicit in the statement.

a) Only assumption I is implicit.
b) Only assumption II is implicit.
c) Either assumption I or II is implicit
d) Both the assumptions I and II are implicit.
e) Neither assumption I nor II is implicit.

1. Statement: Our bank provides all your banking requirements at one location. – An advertisement of a bank.
Assumptions:
I. Customers prefer to carry out all banking transactions at one place.
II. People may get attracted by the advertisement and carry out their transactions with this bank.

2. Statement: The X-airlines has decided to increase the passenger fare by 15 percent with immediate effect.
Assumptions:
I. The demand for seats of the X-airlines may remain unchanged even after the hike in fare.
II. Other airline companies may also hike the passenger fares.

3. Statement:
Multinational fast food chains are opening up a large number of Plus Coffee Shops with piped modern music in different cities of India and these are serving various snacks with coffee.
Assumptions:
I. A large number of people may become regular customers of these coffee shops.
II. People will like to enjoy the comfortable environment while drinking coffee with snacks.

4. Statement:
Railway officials have started ten new trains and increased the frequency of fourteen running trains.
Assumptions:
I. The existing trains are not sufficient to provide accommodation to all the passengers.
II. The new and additional trains would have sufficient passengers, so that they will be economically viable.

5. Statement:
Bank 'A' has announced reduction of half percentage on the interest rate on retail lending with immediate effect.
Assumptions:
I. Other banks may also reduce the retail lending rates to be in competition.
II. Bank 'A' may be able to attract more customers for availing retail loans.

6. Statement: The government has decided to hold the employers responsible for deducting tax at source for all their employees.
Assumptions:
I. The employers may still not arrange to deduct tax at source for their employees.
II. The employees may not allow the employers to deduct tax at source.

7. Statement: The regulatory authority has set up a review committee to find out the reasons for unstable stock prices.
Assumptions:
I. The investors may regain confidence in the stock market by this decision.
II. The review committee has the expertise to find out the causes for volatility in the stock market.

8. Statement: Get rid of your past for the future and get our new generation fridge at a discount in exchange of the old one. (An advertisement)
Assumptions:
I. The sales of the new fridge may increase in the coming months.
II. People prefer to exchange future with past.

9. Statement: The government has decided to overhaul the structure of school fee by linking the school fee with the incomes of parents.
Assumptions:
I. Parents will furnish right information about their incomes to schools.
II. Parents will agree to pay the fee after the overhauling of the fee structure.

10. Statement: The 'M' Cooperative Housing Society has put up a notice at its gate that salespersons are not allowed inside the society.
Assumptions:
I. All the salespersons will stay away from the 'M' Cooperative Housing Society.
II. The security guard posted at the gate may be able to stop the salespersons from entering the society.

11. Statement: An advertisement - “If you want to follow the footprints of an ideal leader, wear 'X' brand of shoes.”
Assumptions:
I. Most people like to become ideal leaders.
II. One cannot become an ideal leader unless one wears 'X' brand of shoes.

12. Statement: The Union Government has decided to withdraw existing tax relief on various small savings schemes in a phased manner to augment its tax collection.
Assumptions:
I. People may still continue to keep money in small savings schemes and also pay taxes.
II. The total tax collection may increase substantially.

13. Statement: Every citizen must be committed to the social cause; if he is not, his citizenship should be cancelled.
Assumptions:
I. It is possible to find out whether a citizen is committed to the social cause or not.
II. Citizenship of any citizen can be cancelled.

14. Statement: The government has decided to levy 2 percent surcharge on tax amount payable for funding drought relief programmes.
Assumptions:
I. The government does not have sufficient money to fund drought-relief programmes.
II. The amount collected by way of surcharge may be adequate to fund these drought-relief programmes.

15. Statement:
An advertisement: Now you can own a new car in just Rs. 1,999 per month.
Assumptions:
I. People do not want to buy used cars.
II. Many people can afford to pay Rs. 1,999 per month for a new car.

LEVEL – II

16. Statement: The 'X' Housing Finance Company has offered its services to search suitable home at no extra cost for those who avail housing loan from it.
Assumptions:
I. Customers may prefer to take housing loan from `X' Housing Finance Company as they can save a lot of their time and money spent in searching a suitable home.
II. No other housing finance company has offered any such extra service with a housing loan.

17. Statement: Beware of dogs. Our dogs do not bark but they are trained to distinguish between genuine guests and intruders.
Assumptions:
I. Barking dogs rarely bite.
II. Our dogs could be dangerous for intruders.

18. Statement:
World Health Organisation has decided to double its assistance to various health programmes in India as per capita expenditure on health in India is very low compared to many other countries.
Assumptions:
I. The announced assistance may substantially increase the per capita expenditure on health in India and bring it on par with other countries.
II. The government funding is less than adequate to provide basic medical facilities in India.

19. Statement:
Without reforming the entire administrative system, we cannot eradicate corruption and prejudice from the society.
Assumptions:
I. The existence of corruption and prejudice is good.
II. There is enough flexibility to change the administrative system.

20. Statement: The managing committee of Galaxy Housing Society has requested all its members to segregate the biodegradable garbage and put them in different containers.
Assumptions:
I. Other housing societies may follow the same practice as this will help conserve environment equilibrium.
II. The members of Galaxy Housing Society may respond positively to the request made by the managing committee.

21. Statement: The 'X' group of employees' association has opposed Voluntary Retirement Scheme to the employees of some organisations.
Assumptions:
I. Only those employees who are not efficient may opt for the scheme.
II. The response of the employees may be lukewarm towards the scheme and it may not benefit the organisation to the desired level.

22. Statement: Learn computer at no cost and make your life more meaningful. – An advertisement.
Assumptions:
I. People prefer to join courses without any fees.
II. Knowledge of computer makes life more meaningful.

23. Statement: In view of the statement on the on-going strike by the employees, the government has agreed to work out an effective social security programme.
Assumptions:
I. The striking employees may not be satisfied with the announcement and continue the agitation.
II. The striking employees may withdraw their agitation with immediate effect and start working.

24. Statement: The government has decided to launch food-for-work programme in all the drought affected areas.
Assumptions:
I. The government has the machinery to implement the food-for-work programme in all the drought affected areas.
II. There is enough food in stock to implement the programme successfully.

25. Statement: The head of the organisation congratulated the entire staff in his speech for their sincere effort to bring down the deficit and urged them to give their best for attaining a more profitable position in future.
Assumptions:
I. The employees may get motivated and maintain, and if possible, enhance their present level of work.
II. The employees may now relax and slow down in their day-to-day work as there is no immediate threat of huge deficit.

26. Statement: The head of the organisation has decided to reward those employees who will help reducing expenditure substantially by suggesting innovative techniques.
Assumptions:
I. The employees may be able to come out with innovative ideas.
II. The employees may be encouraged to apply their mind to earn the reward.

27. Statement:
The demonetisation of high denomination currency notes is expected to reduce the financial liability of the central bank, although the legitimate holders of currency can exchange their holding at the bank counters.
Assumptions:
I. A significant part of the currency is not likely to come back into the banking system.
II. The central bank is duty bound to honour all its financial commitments to the legitimate holders of high denomination currency notes.

28. Statement: The civic authority has advised the residents in an area to use mosquito repellents or sleep inside nets as large number of people are suffering from malaria.
Assumptions:
I. Local residents have enough money to arrange for the repellents or nets.
II. People may ignore and continue to get mosquito bites as they have other pressing needs.

29. Statement: The government has set up a fact-finding mission to look into the possible reasons for the recent violence in the area.
Assumptions:
I. The mission may be able to come up with credible information about the incident.
II. The people in the area may cooperate with the mission and come forward to give detailed information related to the incident.

30. Statement: If you are intelligent, we are right people for improving your performance. -- An advertisement of a coaching class.
Assumptions:
I. Brilliant students may prefer to join coaching classes.
II. Coaching classes help students improve their performance.

STATEMENTS AND COURSE OF ACTION

A course of Action is a step or administrative decision to be taken up for improvement or follow – up for further action in regard to the problem, policy etc. on the basis of the information given in statement.
Normally there will be two broad types of pattern in such questions:

1. Problem and Solution based: When the presented situation talks of a problem and the suggested course of action talk of a solution.

- It solves / reduces of minimize the problem
- The solution or course of action is practically Possible.
- A suggested course of actions can be said to solve/reduce/minimize, the problem.

Example:
Statement: A large number of people in ward X of the city are diagnosed to be suffering from a fatal malaria type.
Courses of Action: I. The city municipal authority should take immediate steps to carry out extensive fumigation in ward X.
II. The people in the area should be advised to take steps to avoid mosquito bites.
1. Only I follows 2. Only II follows 3. Either I or II follows
4. Neither I nor II follows 5. Both I and II follow
Answer is (5) – Clearly, prevention from mosquitoes and elimination of mosquitoes are two ways to prevent malaria. The action will reduce the problem. So, both the courses follow.

2. Fact and Improvement based: When the presented situations talks of a simple fact (not a problem, just a situation) and the suggested courses of action suggest ways of improvement.
Format of the Problem: These types of questions contain two or more statement and these statements are followed by the number of Courses of Action. You have to find which Course of Action will logically follow from the given statement.
Example:
Statement: Exporters in the capital are alleging that commercial banks are violating a Reserve Bank of India directive to operate a post shipment export credit denominated in foreign currency at international rates from January this year.
Courses of Action: I. The officers concerned in the commercial banks are to be suspended.
II. The RBI should be asked to stop giving such directives to commercial banks.
1. Only I follows 2. Only II follows 3. Either I or II follows
4. Neither I nor II follows 5. Both I and II follow
Answers (4) – The statement mentions that the commercial banks violate a directive issued by the RBI. The remedy is only to make the banks implement the Act. So, none of the course of action follows.

Steps to Solve:
1. Don't make your individual perception.
2. Act according to the rules of any organization.
3. Go for impartial and personal thinking.
4. Existing practices are not effective Course of Action.
5. Whenever problem arises, it is always sensible course of action to find out the cause.

Important Points to proceed step by step to reach final courses of action:

1. Extreme or strict action is not valid course of action.
2. The actions should be a positive step towards the solution of the problem, rather harsh and undemocratic.
3. Analyses course of action whether it will solve the problem or lessen it. For proper analysis check with
(i) Universal truth
(ii) Experience
(iii) Logic
4. Check out practical course of action. Simple problem must have simple course of action, not a complex one which might create more problem than to solve or reduce.
5. In most of the cases, a situation has more than one course of action. But they are never exclusive to each other. So our answer should be always "both follow" and not "either of them follows".
6. If course of action and problems are properly balanced and if the course of action is also feasible than that action can be followed.

Example 1: Statement: Rapid growth of urban population has led to a severe shortage of living space resulting in a drop in living conditions.
Courses of Action:
I) The Government should draw plans for urban re planning and development.
II) All village to town migrations should be stopped.
II) The Government should demolish the five-star hotels and build peoples cottages there.
(1) Only I follows (2) Only III follows (3) I & III follow
(4) I & II follow (5) All follow
Ans (1) Only I follows.
Solution: I is a positive step towards the solution of the problem. III is rather harsh and undemocratic. II too is an extreme action. Both II & III would violate the Fundamental Rights of the Indian Constitution.

Example 2: Statement: Although advancement medical science has raised life expectancy, the rate of child mortality remains high in India.
Courses of Action:
I) Efforts should be made to lower life expectancy.
II) Medical scientists should be asked to give up their jobs.
III) Efforts should be made to decrease the rate of child mortality.
(1) I & II follow (2) II & III follow (3) I & III follow
(4) Only I follows (5) Only III follows
Ans (5) Only III follows.
Solution: I is an absurd suggestion. II is an extreme action not required in the present circumstances. III is undeniably a proper course of action.

LEVEL – I

Directions: In the question given below, a statement followed by two courses of action numbered I and II is given. Course of action is a step for administrative decision to be taken for improvement, follow-up or further action in regard to the problem, policy etc. On the basis of the information given in the statement, you have to assume everything in the statement to be true and then decide which of the suggested courses of action logically follow(s).

a) Only I follows
b) Either I or II follows
c) Only II follows
d) Both I and II follow
e) Neither I nor II follows

1. Statement: There has been a significant drop in the water level of all the lakes supplying water to the city.
Courses of action:
I. The water supply authority should impose a partial cut in supply to tackle the situation.
II. The government should appeal to all the residents through mass media for minimal use of water.

2. Statement: There has been an unprecedented increase in the number of requests for berths in most of the long distance trains during current holiday season.
Courses of action:
I. The railway authority should immediately increase the capacity in each of these trains by attaching additional coaches.
II. The people seeking accommodation should be advised to make their travel plan after the holiday.

3. Statement: Due to availability of air tickets at cheaper rates from various airlines, large numbers of people now a days prefer to travel by air than travelling by train.
Courses of action:
I. Railway ministry has to do its best efforts to improve the quality of rail journey in respect of facilities and also the punctuality.
II. Airlines should not be allowed to introduce various schemes offering concessional fares.

4. Statement: Reading habits in the children of coming generations is diminishing day by day.
Courses of action:
I. Access to various electronic gadgets such as television, computer and particularly the internet should be controlled.
II. Parents should ensure and cultivate reading habits among their children.

5. Statement: Mr. Manohar Jalan, an employee of company X, shows no interest in his work anymore.
Courses of action:
I. The personnel officer should look into Mr. Jalan's problems and try to sort them out.
II. The company should depute Mr. Jalan to some other work for a period of time.

6. Statement: The Indian Constitution is not suitable for the needs of the country anymore.
Courses of action:
I. A review of the Constitution should be taken up.
II. The Constitution should be thrown away.

7. Statement: Many people have encroached onto government property and built their houses and business establishments.
Courses of action:
I. The government should take immediate steps to remove all unauthorised constructions on government land.
II. All the encroachers should immediately be put behind bars and also be slapped with a hefty fine.

8. Statement: A major part of the local market in the city was gutted due to a short circuit causing extensive damage to goods and property.
Courses of action:
I. The Government should issue strict guidelines for all establishments regarding installation and maintenance of electrical fittings.
II. The Government should relocate all the markets to the outskirts of the city.

9. Statement: A software manufacturing company found out that a product it has launched, recently, has a few bugs.
Courses of action:
I. Take the product off the market and apologize to customers.
II. Apologize and fix up the bug for all customers.

10. Statement: The slum population is constantly increasing, it has doubled in the past two decades.
Courses of action:
I. Government should adopt rigid labour laws warranting employers to build labour settlement colonies.
II. Government should adopt forceful resettlement and rehabilitation of slum dwellers by offering subsidised housing.

11. Statement: While laying pipes for one of the utility companies, a huge fire broke out due to damage done to the pipeline.
Courses of action:
I. The licence of the utility company should immediately be suspended, pending enquiry into the incidence.
II. People residing in the area should be advised to stay indoors to avoid burn injuries.

12. Statement: The board of directors of company 'K' has decided in principle to wind up or sell off its business in all but not in core competency areas.
Courses of action:
I. The top management will have to first identify core competency areas of its operation.
II. The top management will have to identify and shift its best people from core competency areas to non-core areas.

13. Statement: The prices of food grains and vegetables have substantially increased due to a prolonged strike call given by the truck owners association.
Courses of action:
I. Government should immediately make alternative arrangement to ensure adequate supply of food grains and vegetables in the market.
II. Government should take steps to cancel the licences of all vehicles belonging to the association.

14. Statement:
A country cannot develop without fast and easy communication.
Courses of action:
I. Government should provide communication facilities to the public at a cheaper rate.
II. More private companies should be permitted to enter into the field of communication to strengthen the network.

15. Statement:
Proportion of females compared to that of males in the population of our country has drastically gone down in the recent past.
Courses of action:
I. Social workers should take up the task of emphasising the importance of having at least one female child in each family in both rural and urban areas of the country.
II. Government should severely punish the persons involved in the practice of female foeticide.

LEVEL – II

16. Statement: Nuclear power cannot make a country secure.
Courses of action:
I. We should also spend on defence recourses other than nuclear power.
II. We must destroy our nuclear capability.

17. Statement: Almost ninety percent of the flights of one of a private airline were cancelled for the fourth consecutive day as the pilots refused to join their duties in protest against sacking of two of their colleagues by the airline management.
Courses of action:
I. The management of the airline company should be ordered by the Government to immediately reinstate the sacked pilots to end the crisis.
II. Government should immediately take steps to end the impasse between the management and the pilots to help the hapless passengers.

18. Statement: The number of dropouts in the government schools has significantly increased in the urban areas over the past few years.
Courses of action:
I. Government should immediately close down all such schools in the urban areas, where the dropout goes beyond 20 percent.
II. The parents of all the students who dropped out of the government schools in urban areas should be punished.

19. Statement: The main cause of global warming is the increase of greenhouse gases in the atmosphere and deforestation.
Courses of action:
I. Incentive should be given to the local communities involved in protection and management of forests.
II. A national forest carbon accounting programme should be institutionalised to keep carbon check.

20. Statement: In response to the published tender notice, company 'Z' has received 57 sealed tenders.
Courses of action:
I. The concerned department has to open the tenders and scrutinise them as per the procedure.
II. The purchase committee will meet and recommend to the management, the parties identified for allotting tenders.

21. Statement:
There have been a large number of cases of internet hacking in the recent months creating panic among the internet users.
Courses of action:
I. The government machinery should make an all-out effort to nab those who are responsible and put them behind bars.
II. The internet users should be advised to stay away from internet banking till the culprits are caught.

22. Statement: In response to the published tender notice, the company 'Z' has received 57 sealed tenders.
Courses of action:
I. The department concerned has to open the tenders and scrutinise them as per the procedure.
II. The purchase committee will have to meet and recommend to the management the parties identified for allotting tenders.

23. Statement: While laying pipes for one of the utility companies, a huge fire broke out due to damage done to the pipeline.
Courses of action:
I. All the licences of the utility company should immediately be suspended.
II. People residing in the area should be advised to stay indoors to avoid burn injuries.

24. Statement: A company `X' has decided to give 10% increase in salary to its employees from next month.
Courses of action:
I. The accounts department will have to prepare new salary statements for all employees before due date.
II. Employees association should ask for more rises in the salary, considering the market condition.

25. Statement: There has been a large number of cases of internet hacking in the recent months, creating panic among the internet users.
Courses of action:
I. The government machinery should make an all-out effort to nab those who are responsible and put them behind bars.
II. The internet users should be advised to stay away from using the internet till the culprits are caught.

26. Statement: The board of directors of the company `K' has decided to wind up or sell off its business in all but the core competency areas.
Courses of action:
I. The top management will have to first identify the core competency areas of its operation.
II. It will have to identify and shift its best people from core competency areas to non-core areas.

27. Statement: There is an unprecedented increase in the number of successful students in this year's School Leaving Certificate Examination.
Courses of action:
I. The government should make arrangement to increase the number of seats of intermediate courses in existing colleges, if feasible.
II. The government should take active steps to open new colleges to accommodate all these successful students.

28. Statement: The state `K' is exporting bumper crop of rice this year under its `Rice Purchase Guarantee Scheme'.
Courses of action:
I. Other farmers should also start cultivation of rice from the next year.
II. The price of rice will increase in the open market.

29. Statement: After an inadequate monsoon last year, the meteorological department has forecast scanty monsoon this year as well.
Courses of action:
I. The government should immediately set up a water authority for proper management of water resources.
II. The water supply authorities should be asked to implement reduction in regular water supply to tackle the situation.

30. Statement: The eligibility for appearing in Common Entrance Test (CET) for engineering in state `M' is now raised to 60% from earlier 50% at HSC examination.
Courses of action:
I. Many candidates from state `M' may not appear for CET this year and may appear for CET examinations of other states.
II. At pre-examination screening, candidates obtaining less than 60% at HSC will have to be eliminated.

STATEMENT AND CONCLUSION

A statement is a group of words arranged to form a meaningful sentence.
A conclusion is a judgment or decision reached after consideration about the given statement. A conclusion is an opinion or decision that is formed after a period of thought or research on some facts or sentence stated by someone. A consequent effect has always to be analysed before reaching to the final result or conclusion of a given premise. This requires a very systematic and logical approach.
To reach to a conclusion think only about the information given in the statement. There is no need to use, assume anything else or add any further or extra information from outside but the established facts cannot be denied like the Sun always rises in the East, a day consists of 24 h etc.

Points to Remember:

• If statement is formed with two or more sentences, then there should be no mutual contradiction in sentence.
• Statements and conclusion should not go against established facts and prevailing notious of truth.
• If definitive words like all, always, atleast, only, exactly and so on are used, then such words make the conclusion invalid or ambiguous.
• Always read very carefully and try to find key words as key words play an important role in analysing valid and invalid conclusions.
• If the conclusion is provided with a stated example, then the conclusion is invalid.

Type 1: One Statement with two Conclusions Based
In these types of questions, a statement is given followed by two conclusions. The candidate is required to find out which of conclusion follows the given statement and select the correct option accordingly.
Directions: In each of the following questions, a statement is followed by two Conclusions I and II. Give answer
(a) if only Conclusion I follows
(b) if only Conclusion II follows
(c) if either I or II follows
(d) if neither I nor II follows

Example 1:
Statement: Parents are prepared to pay any price for an elite education to their children.
Conclusion
I. All parents these days are very well off.
II. Parents have an obsessive passion for perfect development of their children through good schooling.
Solution: (b)
It may be conclusion from the statement that since parents want a perfect development of their children through good schooling therefore they are prepared to pay any price for a good education but the statement does not give sense of the parents being very well off. Hence, only Conclusion II follows.

Type 2: More Than Two Statements and Conclusion Based
In this type of questions, a statement / statements I / are given followed by some conclusion. Choose the conclusion which follows the given statement.

Directions: Which of the conclusion can be drawn from the statement?

Example 2:

Statement: Many business offices located in buildings having two to eight floors. If a building has more than three floors, it has a lift.

Conclusions:

(a) All floors may be reached by lifts

(b) Only floors above the third floor have lifts

(c) Fifth floor has lifts

(d) Second floors do not have lifts

Solution: (c)

It is clear from the given statement.

LEVEL – I

In each question below is given a statement followed by two conclusions numbered I and II. You have to assume everything in the statement to be true, then consider the two conclusions together and decide which of them logically follows beyond a reasonable doubt from the information given in the statement.

Give answer:

- (A) If only conclusion I follows
- (B) If only conclusion II follows
- (C) If either I or II follows
- (D) If neither I nor II follows and
- (E) If both I and II follow.

1. Statements: In a one day cricket match, the total runs made by a team were 200. Out of these 160 runs were made by spinners.
Conclusions:
1. 80% of the team consists of spinners.
2. The opening batsmen were spinners.

2. Statements: The old order changed yielding place to new.
Conclusions:
1. Change is the law of nature.
2. Discard old ideas because they are old.

3. Statements: Government has spoiled many top ranking financial institutions by appointing bureaucrats as Directors of these institutions.
Conclusions:
1. Government should appoint Directors of the financial institutes taking into consideration the expertise of the person in the area of finance.
2. The Director of the financial institute should have expertise commensurate with the financial work carried out by the institute.

4. Statements: Population increase coupled with depleting resources is going to be the scenario of many developing countries in days to come.
Conclusions:
1. The population of developing countries will not continue to increase in future.
2. It will be very difficult for the governments of developing countries to provide its people decent quality of life.

5. Statements: Prime age school-going children in urban India have now become avid as well as more regular viewers of television, even in households without a TV. As a result there has been an alarming decline in the extent of readership of newspapers.
Conclusions:
1. Method of increasing the readership of newspapers should be devised.
2. A team of experts should be sent to other countries to study the impact of TV. on the readership of newspapers.

6. Statements: In Japan, the incidence of stomach cancer is very high, while that of bowel cancer is very low. But Japanese immigrate to Hawaii, this is reversed - the rate of bowel cancer increases but the rate of stomach cancer is reduced in the next generation. All this is related to nutrition - the diets of Japanese in Hawaii are different than those in Japan.
Conclusions:
1. The same diet as in Hawaii should be propagated in Japan also.
2. Bowel cancer is less severe than stomach cancer.

7. Statements: The Government run company had asked its employees to declare their income and assets but it has been strongly resisted by employees union and no employee is going to declare his income.
Conclusions:
1. The employees of this company do not seem to have any additional undisclosed income besides their salary.
2. The employees union wants all senior officers to declare their income first.

8. Statements: Monitoring has become an integral part in the planning of social development programmes. It is recommended that Management Information System be developed for all programmes. This is likely to give a feedback on the performance of the functionaries and the efficacy with which services are being delivered.
Conclusions:
1. All the social development programmes should be evaluated.
2. There is a need to monitor the performance of workers.

9. Statements: The T.V. programmes, telecast specially for women are packed with a variety of recipes and household hints. A major portion of magazines for women also contains the items mentioned above.
Conclusions:
1. Women are not interested in other things.
2. An average woman's primary interest lies in home and specially in the kitchen.

10. Statements: The distance of 900 km by road between Bombay and Jafra will be reduced to 280 km by sea. This will lead to a saving of Rs. 7.92 crores per annum on fuel.
Conclusions:
1. Transportation by sea is cheaper than that by road.
2. Fuel must be saved to the greatest extent

11. Statements: The manager humiliated Sachin in the presence of his colleagues.
Conclusions:
1. The manager did not like Sachin.
2. Sachin was not popular with his colleagues.

12. Statements: Women's organisations in India have welcomed the amendment of the Industrial Employment Rules 1946 to curb sexual harassment at the work place.
Conclusions:
1. Sexual harassment of women at work place is more prevalent in India as compared to other developed countries.
2. Many organisations in India will stop recruiting women to avoid such problems.

13. Statements: Nation X faced growing international opposition for its decision to explode eight nuclear weapons at its test site.
Conclusions:
1. The citizens of the nation favoured the decision.
2. Some powerful countries do not want other nations to become as powerful as they are.

14. Statements: In a highly centralised power structure, in which even senior cabinet ministers are prepared to reduce themselves to pathetic countries or yesmen airing views that are primarily intended to anticipate or reflect the Prime Minister's own performances, there can be no place for any consensus that is quite different from real or contrived unanimity of opinion, expressed through a well-orchestrated endorsement of the leader's actions.
Conclusions:
1. The Ministers play safe by not giving anti-government views.
2. The Prime Minister does not encourage his colleagues to render their own views.

15. Statements: National Aluminium Company has moved India from a position of shortage to self-sufficiency in the metal.
Conclusions:
1. Previously, India had to import aluminium.
2. With this speed, it can soon become a foreign exchange earner.

LEVEL – II

16. Statements: Jade plant has thick leaves and it requires little water.
Conclusions:
1. All plants with thick leave require little water.
2. Jade plants may be grown in places where water is not in abundance.

17. Statements: Use "Kraft" colours. They add colour to our life. - An advertisement.
Conclusions:
1. Catchy slogans do not attract people.
2. People like dark colours.

18. Statements: All those political prisoners were released on bail who had gone to jail for reasons other than political dharnas. Bail was not granted to persons involved in murders.
Conclusions:
1. No political - prisoner had committed murder.
2. Some politicians were not arrested.

19. Statements: Modern man influences his destiny by the choice he makes unlike in the past.
Conclusions:
1. Earlier there were fewer options available to man.
2. There was no desire in the past to influence the destiny.

20. Statements: Water supply in wards A and B of the city will be affected by about 50% on Friday because repairing work of the main lines is to be carried out.
Conclusions:
1. The residents in these wards should economise on water on Friday.
2. The residents in these wards should store some water on the previous day.

21. Statements: People who speak too much against dowry are those who had taken it themselves.
Conclusions:
1. It is easier said than done.
2. People have double standards.

22. Statements: The national norm is 100 beds per thousand populations but in this state, 150 beds per thousand are available in the hospitals.
Conclusions:
1. Our national norm is appropriate.
2. The state's health system is taking adequate care in this regard.

23. Statements: Our securities investments carry market risk. Consult your investment advisor or agent before investing.
Conclusions:
1. One should not invest in securities.
2. The investment advisor calculates the market risk with certainty.

24. Statements: Money plays a vital role in politics.
Conclusions:
1. The poor can never become politicians.
2. All the rich men take part in politics.

25. Statements: Vegetable prices are soaring in the market.
Conclusions:
1. Vegetables are becoming a rare commodity.
2. People cannot eat vegetables.

26. Statements: The serious accident in which a person was run down by a car yesterday had again focused attention on the most unsatisfactory state of roads.
Conclusions:
1. The accident that occurred was fatal.
2. Several accidents have so far taken place because of unsatisfactory state of roads.

27. Statements: In a recent survey report, it has been stated that those who undertake physical exercise for at least half an hour a day are less prone to have any heart ailments.
Conclusions:
1. Moderate level of physical exercise is necessary for leading a healthy life.
2. All people who do desk-bound jobs definitely suffer from heart ailments.

28. Statements: A bird in hand is worth two in the bush.
Conclusions:
1. We should be content with what we have.
2. We should not crave for what is not.

29. Statements: This world is neither good nor evil; each man manufactures a world for himself.
Conclusions:
1. Some people find this world quite good.
2. Some people find this world quite bad.

30. Statements: The eligibility for admission to the course is minimum second class Master's degree. However, the candidates who have appeared for the final year examination of Master's degree can also apply.
Conclusions:
1. All candidates who have yet to get their Master's degree will be there in the list of selected candidates.
2. All candidates having obtained second class Master's degree will be there in the list of selected candidates.

RATIO AND PROPORTION

The ratio of two quantities *a* and *b* in the same units, is the fraction $\frac{a}{b}$ and we write it as *a* : *b*.
Ratio of any number is expressed after removing all the common factors in the terms. For example, if there are two quantities having values of 8 and 6, then their ratios will be "4 : 3" because a common factor of 2 was removed from both the terms.

- In the ratio a : b, we call a as the first term or antecedent and b, the second term or consequent.
  Eg: In the ratio 5 : 9, antecedent = 5 and consequent = 9.
- The multiplication or division of each term of a ratio by the same non-zero number does not affect the ratio.
  Eg. 4 : 5 = 8 : 10 = 12 : 15. Also, 4 : 6 = 2 : 3.

Types of Ratio

1. **Duplicate Ratio**: If a: b is a ratio, then its duplicate ratio is a^2: b^2
   Example: If 2: 3 is a ratio, then its duplicate ratio is 2^2: 3^2 i.e. 4:9
2. **Sub-duplicate Ratio**: If a: b is a ratio, then its sub-duplicate ratio is √ a: √b
   Example: If 16: 25 is a ratio, then its sub-duplicate ratio is √16: √25 = 4: 5
3. **Triplicate Ratio**: If a: b is a ratio, then its triplicate ratio is a^3: b^3
   Example: If 2: 3 is a ratio, then its triplicate ratio is 2^3: 3^3 = 8: 27
4. **Sub-triplicate Ratio**: If a: b is a ratio, then its sub-triplicate ratio is a1/3: b1/3
   Example: If 8: 27 is a ratio, then its sub-triplicate ratio is 81/3: 271/3 = 2: 3
5. **Inverse or Reciprocal Ratio**: The inverse ratio of a: b is 1/a: 1/b
   Example: If 2: 3 is a ratio, then its inverse ratio is (1/2) : (1/3)
6. **Compounded Ratio**: Compound ratio is the ratio of the products, of the corresponding terms of two or more simple ratios.
   Example: The compounded ratio of the ratios: (A : B), (C : D), (E : F) is (ACE : BDF).

Proportion

The equality of two ratios is called proportion.
If a : b = c : d, we write a : b :: c : d and we say that a, b, c, d are in proportion.
Here a and d are called ***extreme terms***, while b and c are called ***mean terms***.
Product of mean terms = Product of extreme terms.
Thus, a : b :: c : d => (b x c) = (a x d).
If a/b=c/d, then:

i. Invertendo - b:a = d:c
ii. Alternendo - a:c = b:d
iii. Componendo - (a+b):b = (c+d):d
iv. Dividendo - (a-b):b = (c-d):d
v. Componendo & Dividendo - (a+b)(a-b) = (c+d)(c-d)

Types of Proportions

1. Fourth Proportional: If a : b = c : d, then d is called the fourth proportional to a, b, c.
2. Third Proportional: If a : b = c : d, then c is called the third proportion to a and b.
Similarly, If the given proportion is a : b :: b : c then c is said to be the third proportion of a and b.
3. Mean Proportional: If the given ratio is a : b :: b : c , then b is said to be the mean proportion.
b= √ac

Example 1: If a : b = 2 : 3 and b : c = 4 : 3, then find a : b : c ?
Solution: a : b = 2 : 3
b : c = 4 : 3 = (4∗(3/4) : 3 ∗ (3/4)) = 3 : (9/4)
a :b : c=2 : 3 : (9/4) = 8 : 12 : 9

Example 2: The sum of two numbers is 72. If the two numbers are in the ratio of 5:3. Find the two numbers.
Solution: As discussed in the theory of this topic, if the two numbers are in the ratio 5:3, let the actual number is 5k and 3k. the sum of two numbers is 72. We have,
5k + 3k = 72
K = (72/8) = 9
Hence 5k = 45 and 3k = 27

Example 3: A number is divided into parts such that 4 times the first part, 3 times the second part, 6 times the third part and the 8 times the four parts are all equal. In what ratio is the number divided?
Solution: Let the four parts into which the number is divided is a, b, c and d.
4a = 3b = 6c = 8d= e (let)
A = (e/4), b = (e/3), c = (e/6), d = (e/8)
Hence, a : b : c : d = (e/4) : (e/3) : (e/6) : (e/8)
= (1/4) : (1/3) : (1/6) : (1/8)
= (24/4) : (24/3) : (24/6) : (24/8)
= 6 : 8 : 4 : 3

Example 4: a : b = 3: 4; b : c = 6 : 7. Find a : b : c?
Solution:

a	b	c
3	4	
	6	7

a : b : c = 3 × 6 : 6 × 4 : 4 × 7 = 9 : 12 : 14

Example 5: 36% of first number is 28% of the second number. What is the respective ratio of the first number to the second number?
Solution: Let the numbers be x and y.
36% of x = 28% of y
$\frac{x}{y}=\frac{28}{36}=\frac{7}{9}$
$\therefore$ x : y = 7 : 9

Example 6: The average of their ages is 30 years. If their present ages are in ratio 7:3. What will be the ratio of their ages after 4 years?
Solution: Average age = 30 years
Total age = 2 × 30 = 60 years.
Let their present ages be 7x and 3x years
$\therefore$ 7x + 3x = 60 $\Rightarrow$ x = $\frac{60}{10}$ = 6
$\therefore$ Their present ages are 7 × 6 and 3 × 6 = 42 and 18.
$\therefore$ Their ages after 4 years
= 42 + 4 and 18 + 4 = 46 and 22 years

$\therefore$ ratio = 46 : 22 = 23 : 11

Example 7: In a bowl there is 30 litre mixtures of milk and water. The ratio of milk and water is 7:3. How much water must be added to it so that the ratio of milk to the water be 3:7?
Solution: Milk quantity in the mixture
$= \frac{7}{10} \times 30 = 21$ litres
$\therefore$ Water = 30 - 21 = 9 litres
New ratio = 3 : 7
$\therefore$ 3 parts of milk is 21 litres (There is no difference in the milk quantity of new mixture)
$\therefore$ Water quantity in the mixture
$= \frac{7}{3} \times 21 = 49$ litres
$\therefore$ 49 - 9 = 40 litres water is to be added in the new mixture

Example 8: A bag contains of one rupee, 50 paise and 25 paise coins. if these coins are in the ratio of 5 : 6 : 8, and the total amount of coins is Rs. 210, find the number of 50 paise coins in the bag.
Solution: Let the number of one rupee, 50 paise, 25 paise coins be 5, 6 and 8 respectively
The value of one rupee coins
= Rs. 1×5 = Rs. 5
The value of fifty paise coins
= Rs. 0.50×6 = Rs. 3
The value of twenty five paise coins
= Rs. 0.25×8 = Rs. 2
Total value = 5 + 3 + 2 = Rs. 10
If the total value is Rs. 10
there are 6 coins of fifty paise
if the total value is Rs. 210, then the number of 50 coins = $\frac{210}{10} \times 6 = 126$

VARIATION

Direct Variation
One quantity A is said to vary directly as another quantity B if the two quantities depend upon each other in such a manner that if B is increased in a certain ratio, A also increases in the same ratio.
This is denoted as A α B (A varies directly as B).
If A α B then A = kB, where k is a constant. It is called the constant of proportionality.

Inverse Variation
A quantity A is said to vary inversely as another quantity B if the two quantities depend upon each other in such a manner that if B is increased in a certain ratio, A gets decreased in the same ratio and if B is decreased in a certain ratio, then A gets increased in the same ratio.
It is the same as saying that A varies directly with 1/B. It is denoted as A α 1/B i.e., A = k/B where k is k the constant of proportionality.
.

Joint Variation
If there are three quantities A, B and C such that A varies with B when C is constant and varies with C when B is constant, then A is said to vary jointly with B and C when both B and C are varying i.e. A

α B when C is constant and A α BC A α BC $\Rightarrow$A = kBC where k is the constant of proportionality.

Examples 9: The volume of a cylinder varies jointly as its height and the area of its base. When the area of the base is 64 sq. ft. and the height is 10 ft., the volume is 640 cu. ft.. What is the height of the cylinder, whose volume is 360 cu. ft. and area of the base is 72 sq.ft.

Solution: Let V be the volume, a be the area of the base and h be the height.

V = m a h (m is a proportionality constant)

We know a = 64, h = 10 and V = 640

640 = m (64) (10)

m = 1; V = ah

Therefore, 360 = 72×h

=> h = 360/72 = 5 ft.

Hence the height of the cylinder is 5 ft**.**

Examples 10: If x varies directly as y^4+9 and $x=3$ when $y=3$, find x when $y=9$.

Solution: $x \propto (y^4+9).$

$$c=\frac{x}{y^4+9}.$$

when $x=3, y=3$ (given)

Hence $c=\frac{3}{3^4+9}=\frac{3}{90}=\frac{1}{30};$

and $x=\frac{1}{30}(y^4+9)$

When $y=9$

$$x=\frac{1}{30}(y^4+9)=\frac{1}{30}(6561+9)=219.$$

PARTNERSHIP

When two or more than two persons run a business jointly, they are called partners and the deal is known as partnership. The money put in by each of the partners is called his "investment or capital".

Ratio of Division of Gains:

1. If the partners invest *different* amounts each for the *same* period of time, then the profits at the end of the year are shared in the ratio of their investments

Suppose A and B invest Rs x and Rs y respectively for a year in a business, then at the end of the year: (A's share of profit) : (B's share of profit) = x : y

2. If the partners invest the *same* amounts for *different* periods of time, then the profits at the end of the year are shared in the ratio of the time periods for which respectively investments have been in business.

Suppose A and B invest Rs x and Rs x respectively for a time period t1 and t2 in a business, then at the end of the year: (A's share of profit) : (B's share of profit) = t1 : t2

3. If the partners invest *different* amounts and the time period for which their investments are in the business are also *different*, then the profits at the end of the year are shared in the ratio of the product (investment x time period) for each partner.

Suppose A invests Rs x for p months and B invests Rs y for q months, then

(A's share of profit) : (B's share of profit) = xp : yq

4. Working and sleeping partners: A partner who manages the business is known as working partner and the one who simply invests the money is a sleeping partner.

Example 11: P and Q started a business investing Rs 85,000 and Rs 15,000 respectively. In what ratio the profit earned after 2 years be divided between P and Q respectively?
Solution: As time period is same for both, ratio of profit is directly proportional to investment
85,000 : 15,000 = 17 : 3

Example 12: A,B and C started a business by investing Rs 1,20,000, Rs 1,35,000 and Rs 1,50,000.Find the share of each ,out of an annual profit of Rs 56,700?
Solution: Ratio of shares of A, B and C=Ratio of their investments
120,000:135,000:150,000 =8:9:10
A's share=Rs 56,700*(8/27) = Rs 16,800
B's share =Rs 56,700*(9/27) = Rs 18,900
C's share =Rs 56,700*(10/27) = Rs 21,000

Example 13: Ram and Krishna entered into a partnership with Rs 50,000 and Rs 60,000, after 4 months Ram invested Rs 25,000 more while Krishna withdrew Rs 20,000. Find the share of Ram in the annual profit of Rs 289,000.
Solution: Ram : Krishna=50,000*4+75,000*8: 60,000*4+40,000*8 =10:7
Ram's annual profit=289000*(10/17) = Rs 170,000

Example 14: Prerna starts a business with Rs.45,000. Three months later Sanjna joins her with Rs, 30,000. At the end of the year in what ratio should they shared profits?
Solution: Sharing of profits will be in the ratio of investments multiplied by the time period.
Hence the ratio is
(45,000 x 12) : (30,000 x 9) = 2: 1

Example 15: The working partner of a business gets as his commission 10% of the profits left after his commission is paid. If the working partner's commission is Rs. 30,000 then, find the total profit.
Solution: Let total profit be P.
The profit left after the working partner's commission of Rs. 30,000 is (P - 30,000).
10% of this is the working partner's commission. So we have (0.1) (P – 30,000) = 30,000
$\Rightarrow$(0.1)P = 33,000
$\therefore$ P = Rs. 3,30,000

LEVEL – I

1. If 15% of x is the same as 20% of y, then x : y is?
   A] 3 : 4 B] 17 : 16 C] 4 : 3 D] 16 : 17

2. In a college, the ratio of the number of boys to girls is 8 : 5. If there are 160 girls, the total number of students in the college is:
   A] 100 B] 260 C] 250 D] 416

3. The ratio of income of A to that of B is 5 : 4 and the expenditure of A to that of B is 3: 2. If at the end of the year, each saves Rs, 800, the income of A is:
   A] Rs. 1600 B] Rs. 2000 C] Rs. 1800 D] Rs. 2200

4. If p : q = 3 : 4 and q : r= 8 : 9, then p : r is:
   A] 1: 3 B] 2 : 3 C] 3 : 2 D] 1: 2

5. If a+b : b+c : c+a = 6 : 7 : 8 and a + b + c = 14, then the value of c is : .
   A] 6 B] 8 C] 7 D] 2

6. Two numbers are respectively 20% and 50% more than a third number. The ratio of the two numbers is?
   A] 5:4 B] 3:2 C] 4:5 D] 2:3

7. If three numbers in the ratio 3 : 2: 5 be such that the sum of their squares is 1862, the middle number will be?
   A] 7 B] 21 C] 14 D] 35

8. A certain amount was divided between Salim and Rahim in the ratio of 4 : 3. If Rahim's share was Rs. 2400, the total amount was.
   A] Rs. 5600 B] Rs. 9600 C] Rs. 3200 D] Rs. 16800

9. A profit of Rs. 30000 is to be distributed among A, B, C in the proportion 3 : 5 : 7. What will be the difference between B's and C's shares?
   A] Rs. 2000 B] Rs. 10000 C] Rs. 4000 D] Rs. 14000

10. An amount of money is to be distributed among P, Q and R in the ratio 3 : 5 : 7. If Qs share is Rs. 1500, what is the difference between Ps and Rs shares?
    A] Rs. 1200 B] Rs. 1600 C] Rs, 1500 D] Rs. 1900

11. Rs. 120 are divided among A, B, C such that A's share is Rs. 20 more than B's and Rs. 20 less than C's. What is B's share?
    A] Rs. 10 B] Rs. 20 C] Rs. 15 D] Rs. 25

12. The compounded ratio of (2 : 3), (6: 11) and (11 :2) is.
    A] 1: 2 B] 11: 24 C] 2: 1 D] 36: 121

13. What number should be added to each of the numbers 8, 21, 13 and 31 so that the resulting numbers, in this order form a proportion?
    A] 2 B] 5 C] 3 D] 7

14. An alloy is to contain copper and zinc in the ratio 9 :4. The zinc required (in kg) to be melted with 24 kg of copper, is ?

A] 10.66 B] 9.66 C] 10.33 D] 9

15. What number should be subtracted from both the terms of the ratio 15 : 19 so as to make it as 3 : 4 ?
A] 3 B] 6 C] 5 D] 9

16. Rs.432 is divided amongst three workers A, B and C such that 8 times A's share is equal to 12 times B's share which is equal to 6 times C's share. How much did A get?
A] Rs.192 B] Rs.133 C] Rs.144 D] Rs.128

17. The price of Computer and CD player are in the ratio 6:5. If the computer costs Rs 5000 more than CD player. What is the price of the computer?
A] 25,000 B] 15,000 C] 50,000 D] 30,000

18. If Rs. 582 be divided into three parts, proportional to 1/2:2/3:3/4, then the first part is?
A] 161 B] 151.8 C] 142 D] 153

19. The price of mixer, grinder and washing machine are in the ratio 2:3:6. After one year the price of the items are increased 20%, 15%, 25% respectively. Then what will be ratio after one year?
A] 16:23:50 B] 17:22:23 C] 16:10:22 D] 18:22:24

20. A person has 25p, 10p and 5p in the ration 2:3:4 in his pocket. If the person has Rs. 45 in all, how many 5 paisa coins are there?
A] 110 B] 100 C] 130 D] 180

21. The partners A, B, C invests Rs. 26000, Rs. 34000 & Rs. 10000 respectively in a business. Out of a profit of Rs. 3500, B's share is
A] Rs. 1300 B] Rs. 1700 C] Rs. 500 D] Rs. 1500

22. Pooja invests Rs. 30000 for one year in a shop. How much her partner Neha should invest in order that the profit after one year may be 2:3
A] Rs. 20000 B] Rs. 40000 C] Rs. 45000 D] Rs. 18000

23. Rs. 700 is divided among A,B, and C so that A receives half as much as B and B half as much as C. Then C's share is
A] Rs. 200 B] Rs. 300 C] Rs. 400 D] Rs. 600

24. P and Q started a business investing Rs 85000 and Rs 15000 resp. In what ratio the profit earned after 2 years be divided between P and Q respectively.
A] 17:5 B] 17:3 C] 17:6 D] 17:7

25. In business, A and C invested amounts in the ratio 2:1, whereas the ratio between amounts invested by A and B was 3:2, If Rs 157300 was their profit, how much amount did B receive.
A] Rs 48000 B] Rs 47000 C] Rs 47400 D] Rs 48400

26. If 4 (A's capital) = 6 (B's capital) = 10 (C's capital), then out of a profit of Rs. 4650, C will receive ____
A] Rs.700 B] Rs.800 C] Rs.900 D] Rs.1000

27. A and B invest in a business in the ratio 3 : 2. If 5% of the total profit goes to charity and A's share is Rs. 855, the total profit is:
A] Rs. 1425 B] Rs. 1500 C] Rs. 1537.50 D] Rs. 1576

28. A starts business with Rs. 3500 and after 5 months, B joins with A as his partner. After a year, the profit is divided in the ratio 2 : 3. What is B's contribution in the capital?
A] Rs. 7500 B] Rs. 8000 C] Rs. 8500 D] Rs. 9000

29. In a partnership, A invests (1/6) of the capital for (1/6) of the time, B invests (1/3) of the capital for (1/3) of the time and C, the rest of the capital for the whole time. Out of a profit of Rs. 4600, B's share is
A] Rs. 800 B] Rs. 1000 C] Rs. 650 D] Rs. 960

30. A, B and C enter into a partnership in the ratio $\frac{7}{2} : \frac{4}{3} : \frac{6}{5}$. After 4 months, A increases his share 50%. If the total profit at the end of one year be Rs. 21,600, then B's share in the profit is:
A] Rs. 2100 B] Rs. 2400 C] Rs. 3600 D] Rs. 4000

LEVEL - II

1. A shopkeeper contains apples, oranges and bananas in the ratio 5:7:8. There is a demand to increase their quantity by 50%, 60% and 70% respectively. What will be ratio of the increased quantity?
A] 25:75:100 B] 26:72:112 C] 75:112:136 D] 76:100:201

2. A packet of sweets is distributed among A, B, C, D in the proportion of 6:8:5:4. If B gets 10 sweets more than D then what is A's share?
A] 16 B] 17 C] 15 D] 18

3. If A's 60% of salary is equal to two-third of B's salary. Now find the ratio of A's salary to B's salary.
A] 9:10 B] 10:9 C] 11:12 D] 13:11

4. In a mixture of 45 litres, the ratio of milk and water is 3 : 2. How much water must be added to make the ratio 9 : 11?
A] 10 liters B] 15 liters C] 17 liters D] 20 liters

5. Seats of physics, Chemistry and Mathematics in a school are in the ratio 4: 5: 6. There is a proposal to increase these seats by 75 in each department. What were the total number of seats in the school finally?
A] 600 B] 750 C] 900 D] Data Insufficient

6. 60 kg of an alloy A is mixed with 100 kg of alloy B. If alloy A has lead and tin in the ratio 3 : 2 and Alloy B has tin and copper in the ration 1 : 4, then the amount of tin in the new alloy is
A] 36 kg B] 44 kg C] 53 kg D] 80 kg

7. A diamond falls and breaks into three pieces whose weights are in the ration 1 : 3 : 6. The value of the diamond is proportional to the square of its weight. If the original value is Rs. 30,000. What is the loss in the value due to the breakage?
A] Rs. 13,000 B] Rs. 16,200 C] Rs. 18,600 D] Rs.19,400

8. W varies inversely as the square of t. If W = 12 when t = 2. Find t when W = 27.
A] 27t = 24 B] $27t^2 = 48$ C] 108 = $12t^2$ D] $12t = 54$

9. Find the mean proportion to 36 and 16?

A] 24 B] 36 C] 18 D] 26

10. Find a if, 4 : a :: a : 9

A] ± 7 B] ± 8 C] ± 6 D] ± 9

11. A disinfecting solution is mixed at a ratio of 2 parts of alcohol to 5 parts of distilled water. If the solution has 0.5 liters of water, how many millilitres of alcohol does it contain?

A] 0.2 ml B] 200 ml C] 500 ml D] 100 ml

12. A bag containing 24 mirrors fell down. Which of the following cannot be the ratio of the broken mirrors to unbroken mirrors?

A] 2:1 B] 1:3 C] 4:3 D] 1:1

13. The ratio of marks obtained by vinod and Basu is 6:5. If the combined average of their percentage is 68.75 and their sum of the marks is 275, find the total marks for which exam was conducted.

A] 150 B] 200 C]400 D] None of these.

14. The marks scored by a student in three subjects are in the ratio of 4 : 5 : 6. If the candidate scored an overall aggregate of 60% of the sum of the maximum marks and the maximum marks in all three subjects is the same, in how many subjects did he score more than 60%?

A] 1 B] 2 C] 3 D] None of the subjects

15. The ratio of the cost prices of two articles A and B is 4:5.The articles are sold at a profit with their selling prices being in the ratio 5:6.If the profit on article A is half of its cost price, find the ratio of the profits on the articles A and B?

A] 7:10 B] 9:11 C] 5:9 D] 10:11

16. Manoj got Rs. 6000 as his share out of a total profit of Rs. 9000 which he and Ramesh earned at the end of one year. If Manoj invested Rs. 20000 for 6 months, whereas Ramesh invested his amount for the whole year, what was the amount invested by Ramesh?

A] Rs. 3000 B] Rs. 3000 C] Rs. 1000 D] Rs. 5000

17. A and B enter into partnership. A invests Rs. 16000 for 8 months and B remains in the business for 4 months. Out of a total profit, B claims 2/7 of the profit, B contributed.

A] Rs. 11900 B] Rs. 10500 C] Rs. 13600 D] Rs. 12800

18. Kamal started a business investing Rs 9000. After five months, Sameer joined with a capital of Rs 8000. If at the end of the year, they earn a profit of Rs. 6970, then what will be the share of Sameer in the profit?

A] Rs 2380 B] Rs 2300 C] Rs 2280 D] Rs 2260

19. A, B, C rent a pasture. A puts 10 oxen for 7 months, B puts 12 oxen for 5 months and C puts 15 oxen for 3 months for grazing. If the rent of the pasture is Rs. 175, how much must C pay as his share of rent?

A] Rs. 45 B] Rs. 50 C] Rs. 55 D] Rs. 60

20. A and B enter into partnership with investments of Rs. 54000 and Rs. 81000 respectively. A stayed for the entire year. If at the end of the year the profit was distributed equally, then for how many months less was B's investment there in the business?

A] 2 B] 4 C] 5 D] 6

LEVEL – III

1. A, B and C enter into partnership with capitals in the ratio of 2 : 5 : 3. B joins a few months later than A and C joins 2 months further than B and withdraws from the business some time before the year ended. If the ratio in which profits are distributed is 8 : 10 : 3, how many months later does B join?
A] 5 months B] 4 months C] 6 months D] 7 months

2. The ratio of the amount of money with A & B is 3 : 1. If we add amount of money with C that is Rs.20 to A's amount and subtract amount of money held by D that is Rs.10 from B's amount, we get another ratio which is 1/15 more than the original ratio. What is the sum of money held by A & B?
A] Rs.2441 B] Rs.3045 C] Rs.3040 D] Rs.3042

3. The ratio of marks obtained by Tom and Julia in English are 3 : 4. From the data on marks obtained, it can be inferred that Tom and Julia have got 3 and 6 marks respectively in English per 5 marks obtained in Mathematics. If the marks obtained by Julia in English are 60, then what is the sum total of marks obtained by Tom in both the subjects?
A] 75 B] 120 C] 60 D] 105

4. The monthly incomes of A and B are in the ratio 4 : 3 and the expenses are in the ratio 6 : 5. If their savings are Rs.5000 and Rs.3000 respectively, find their respective monthly incomes.
A] Rs.14000, Rs.10500 B] Rs.24000, Rs.18000
C] Rs.16000, Rs.12000 D] None of these

5. Rohit and Mohit started a business in partnership. They earned a profit of Rs.40000 as a whole at the end of first year. If Rohit took two-fifths of the share of the profit and his investment was Rs.50000, find the investment done by Mohit.
A] Rs.40000 B] Rs.60000 C] Rs.75000 D] Rs.100000

6. Ram, Shyam and Mohan start a business by investing Rs.12000, Rs.16000 and Rs.10000 respectively. Ram is a working partner and gets one-fifth of the total profit for his services while the remaining profit is divided amongst the three in proportion to their investments. If Ram gets Rs.2000 for his services, then what are the shares of profit of Ram, Shyam and Mohan respectively?
A] Rs.4526, Rs.3369, Rs.2105 B] Rs.2526, Rs.3369, Rs.2105
C] Rs.3158, Rs.4210, Rs.2632 D] None of these

7. Rs.9700 has been divided among X, Y and Z such that if their shares are reduced by Rs.30, Rs.20 and Rs.50 the balance is in the ratio of 3 : 4 : 5. What is Y's share?
A] Rs.3180 B] Rs.3220 C] Rs.3253.33 D] Rs.3200

8. On a certain day, the ratio of the passenger in the 1st class and the second class travelling by train is 1:3. The ratio of the fares collected from each first class and second class passengers

is 30:1. If the total amount collected from all the passengers is Rs 1,320. Find the amount in Rs, collected from the second class passengers.

A] 240 B] 360 C] 480 D] 120

9. By mistake, instead of dividing Rs 117 among three persons P, Q and R in the ratio (1/2, 1/3, 1/4), it was divided in the ratio 2:3:4. Who gains the most and how much?

A] P, Rs 28 B] Q, Rs 35 C] R, Rs 25 D] R, Rs 27

10. Three cats are roaming in a zoo in such a way that when cat A takes 5 steps, B takes 6 steps and C takes 7 steps. But the 6 steps of A are equal to the 7 steps of B and 8 steps of C. what is the ratio of their speeds?

A] 140 : 144 : 147 B] 40 : 44 : 47 C] 15 : 21 : 28 D] 252: 245: 240

11. A precious stone weighing 35 grams worth Rs. 12,250 is accidently dropped and gets broken into two pieces having weights in the ratio of 2 : 5. If the price varies as the square of the weight then find the loss incurred.

A] Rs. 5750 B] Rs. 6000 C] Rs. 5500 D] Rs. 5000

12. In a pocket of A, the ratio of Rs.1 coins, 50p coins and 25p coins can be expressed by three consecutive odd prime numbers that are in ascending order. The total value of coins in the bag is Rs 58. If the number of Rs.1, 50p, 25p coins are reversed, find the new total value of coins in the pocket of A?

A] Rs 68 B] Rs 43 C] Rs 75 D] Rs 82

13. A dealer buys dry fruits at Rs. 100, Rs. 80 and Rs. 60 per kilogram. He mixes them in the ratio 3: 4: 5 by weight and sells at a profit of 50%. At what price per kilogram does he sell the dry fruit?

A] Rs. 80 B] Rs. 100 C] Rs. 95 D] None of these

14. A quantity p equals the sum of three other quantities, the first of which is a constant, the second varies directly as x and the third varies directly as x^2. When $x = 1;\ p = 13,$ when $x = 2,\ p = 36$ and when $x = 3,\ p = 79.$ Find the constant quantity

A] 2 B] 5 C] 7 D] 10

15. A varies jointly as x^2 and as $1/\sqrt[3]{y}$. When $x = 2,\ y = 8,\ A = 40.$ Find the percentage change in the value of A when $x = 3$ and $y = 729.$

A] 25% increase B] 25% decrease C] 50% increase D] 50% decrease

16. The distance travelled by a freely falling body is directly proportional to the square of the time taken. If a body falls 144 m in 6 seconds, then find the distance that the body fell in the 7^{th} second.

A] 10m B] 17m C] 52m D] 196m

17. A and B entered into partnership with capitals in the ratio 4 : 5. After 3 months, A withdrew 1/4 of his capital and B withdrew 1/5 of his capital. The gain at the end of 10 months was Rs. 760. A's share in this profit is:

A] Rs. 330 B] Rs. 360 C] Rs. 380 D] Rs. 430

18. A and B started a partnership business investing some amount in the ratio of 3 : 5. C joined then after six months with an amount equal to that of B. In what proportion should the profit at the end of one year be distributed among A, B and C?

A] 3 : 5 : 2 B] 3 : 5 : 5 C] 6 : 10 : 5 D] Data inadequate

19. A and B started a business in partnership investing Rs. 20,000 and Rs. 15,000 respectively. After six months, C joined them with Rs. 20,000. What will be B's share in total profit of Rs. 25,000 earned at the end of 2 years from the starting of the business?

A] Rs. 7500 B] Rs. 9000 C] Rs. 9500 D] Rs. 10,000

20. A, B and C start a venture with investments of Rs. 12000, Rs. 16000 and Rs. 10000 respectively. A left after 2 months; B left after another 2 months at that time A re-joined with only $2/3^{rd}$ of his original investment. A month later B re-joined with one quarter less than his original investment. C remained throughout the year. The profit at the end of the year was Rs. 267000. How much more did B earn than A?

A] Rs. 37500 B] Rs. 42000 C] Rs. 45000 D] Rs. 55000

MIXTURE AND ALLIGATION

Mixtures

Mixing of two or more qualities of things produces a mixture. When two items of different qualities are thus mixed, the quality of the resultant mixture lies in between the qualities of the original constituent items, i.e. it will be higher than the lowest quality and lower than the highest quality of the items being mixed.

Here, the average quality is essentially the weighted average of the two constituent items. If q1 is the quality (or number of items) of one particular item of quality p1 and q2 be the quantity (or number of items) of the second item of quality p2 are mixed together to give a new mixture, then the weighted average value (p) of the quality of the mixture is given by

$$P = \frac{p1q1 + p2q2}{q1 + q2}$$

A mixture can also be a solution – that is, a liquid mixed with another liquid which is normally water. The concentration of the solution is expressed as the proportion (or percentage) of the liquid in the total solution.

For example, if 10 litres of pure alcohol is mixed with 40 litres of water, then in a total solution of 50 litres. There is 10 litres of alcohol. Hence the concentration of this solution is 0.2(=10/50) or 20%.

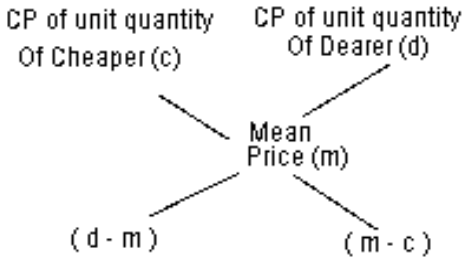
Alligation

It is the rule that enables us to find the ratio in which two or more ingredients at the given price must be mixed to produce a mixture of a desired price.

Mean price: The cost price of a unit quantity of the mixture is called the mean price.

Rule of Alligation: If gradients are mixed in a ratio then we can write

$$\frac{\text{Quantity of cheaper}}{\text{Quantity of dearer}} = \frac{\text{CP of dearer} - \text{Mean Price}}{\text{Mean Price} - \text{CP of cheaper}}$$



∴ (Cheaper Quantity) : (Dearer Quantity) $= (d - m) : (m - c)$.

Concept of Replacement:

Suppose a container contains a solution from which some quantity of solution is taken out and replaced with one of the ingredients. This process is repeated n times then,

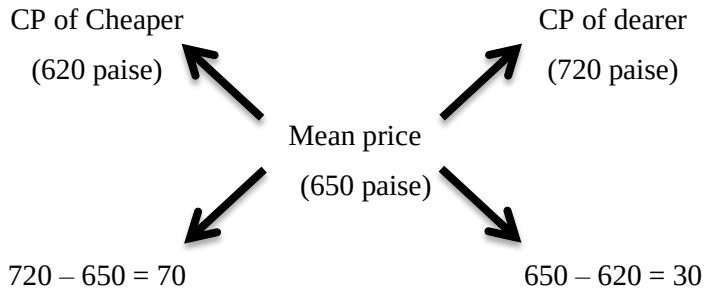
Final Amount of ingredient that is not replaced=

Initial Amount× (Vol. after removal/Vol. after replacing)^n

We can also write it as;
Suppose a container contains x units liquid from which y units are taken out and replaced by water. After n operations, the quantity of pure liquid $= \left[x\left(1-\frac{y}{x}\right)^n\right]$ units.

Example 1: In what proportion must wheat at R 6.20 per kg must be mixed with wheat at R 7.20 per kg so that the mixture is worth R 6.50?

Solution: According to the rule of mixture/alligation,



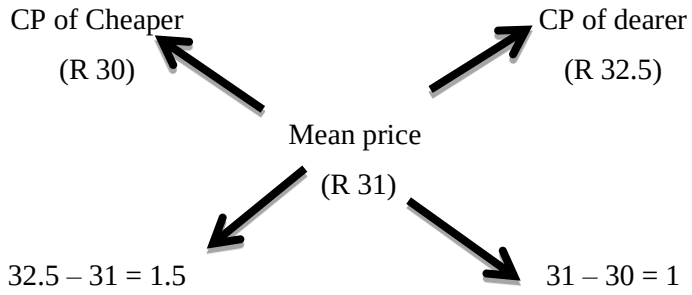
∴ Required ratio = 70 : 30 = 7 : 3

Example 2: In what ratio must a grocer mix rice worth Rs. 30 per kg and Rs. 32.5 per kg so that by selling the mixture at Rs. 34.10 per kg, he may gain 10%?

Solution: SP of 1 kg mixture = R 34.10, gain = 10%

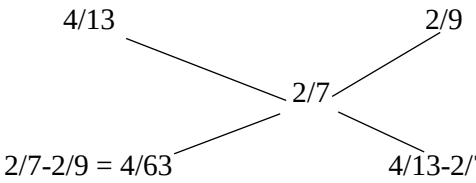
CP of 1 kg of mixture = $\frac{100}{110} \times 34.10$ = R 31

According to the rule of mixture/alligation,



∴ Required ratio = 1.5 : 1 = 3 : 2

Example 3: Two vessels contain mixtures of milk and water in the ratio of 4:9 in the first vessel and in the ratio of 2:7 in the second. In what ration should the contents of these two vessels be mixed such that the resultant mixture has milk and water in the ratio of 2:5?
Solution. Here, we can apply allegation rule taking the concentration of the mixtures, the concentration of the milk in the first vessel os 4/13 and that in second is 2/9.



The ratio in which the 2 mixtures should be mixed is 4/63 : 2/91
= 4/9 : 2/13 = 52: 18 = 26 : 9

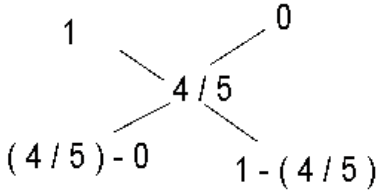
Example 4: A vessel has 300 ml of pure milk. Thirty millilitres of milk is removed and 30 ml of water is poured into the vessel (bringing the volume of mixture in the vessel back to 300 ml). If this operation is repeated another 2 times. What is the percentage of milk in the vessel at the end?
Solution: To solve this problem, we can look at a formula (to be remembered by the students) which will greatly simplify the solution.

In this problem,
P = 300 ml, Q = 30 ml and n = 3
Hence concentrate of milk

$$= \left(\frac{300-30}{300}\right)^3 = \left(\frac{270}{300}\right)^3 = \left(\frac{9}{10}\right)^3 = 0.729$$

∴ Percentage of milk is 72.9% volume.

Example 5: In what proportion must water be mixed with milk to gain 20 % by selling it at cost price?
Solution: Let cost price of milk be Rs 1 per liter, then S.P of mixture is also Rs 1 per liter
Now CP of mixture be = 1 - (20 % of Rs 1) = 1 - (20 * 1 / 100) = 80 / 100 = Rs 4 / 5



Required ratio = 1 : 4

LEVEL – I

1. In what ratio must rice at Rs. 9.30 per kg be mixed with rice at Rs. 10.80 per kg so that the mixture be worth Rs10 per kg?
   A] 8:7 B] 7:9 C] 5:9 D] 7:5

2. How much water must be added to 60 litres of milk at 3/2 litres for Rs. 20 so as to have a mixture worth Rs. 32/3 a litres?
   A] 12 L B] 15 L C] 18 L D] 20 L

3. How many kg of wheat costing R8 must be mixed with 36 kg of rice costing Rs. 5.40 per kg so that 20% gain may be obtained by selling the mixture at Rs. 7.20 per kg?
   A] 10kg B] 12kg C] 9.8kg D] 10.8kg

4. The milk & water in two vessels A & B are in the ratio 4:3 & 2:3 resp. In what ratio, the liquids in both the vessels are mixed to obtain a new mixture in vessel C containing half milk & half water?
   A] 7:5 B] 7:9 C] 5:9 D] 3:7

5. In what ratio must a grocer mix two varieties of pulses costing Rs.15 & Rs. 20 per kg respectively so as to get a mixture worth Rs. 16.50 per kg?
   A] 3:7 B] 5:7 C] 7:3 D]7:5

6. Find the ratio in which rice at Rs. 7.20 a kg be mixed with the rice at Rs. 5.70 a kg to produce a mixture worth Rs. 6.30 a kg
   A] 1:3 B] 3:2 C] 3:4 D] 4:5

7. The cost of A chocolate is Rs. 14 per kg & B chocolate is Rs. 20 per kg. If both A & B are mixed in the ratio 2:3, then the price per kg of the mixed variety of chocolate is:
   A] Rs. 17.6 B] Rs. 18.50 C] Rs. 19 D]Rs. 19.50

8. In what ratio must a grocer mix two varieties of tea worth Rs. 60 a kg & Rs. 65 a kg so that by selling a mixture at Rs. 68.20 a kg, he may gain 10%?
   A] 3:2 B] 3:4 C] 3:5 D] 4:5

9. Two vessels A & B contain spirit & water mixed in the ratio 5:2 & 7:6 respectively. Find the ratio in which these mixture be mixed to obtain a new mixture in vessel C containing spirit & water in the ratio 8:5?
   A] 4:3 B] 3:4 C] 5:6 D] 7:9

10. A container contains 40L of milk. From this container 4L of milk was taken out & replaced by water. This process was repeated further 2 times. How much milk is now contained in the container?
    A] 26.34L B] 27.36L C] 28L D] 29.16L

11. How many kg of brand *A* coffee must be mixed with 126 kg of brand *B* coffee such that the cost of the mixture is Rs. 24 per kg? Per kg prices of *A* and *B* are Rs. 36.60 and Rs. 17.10 respectively.
    A] 42 kg B] 23 kg C] 69 kg D] 63.5 kg

12. 16 litres of draught beer contains 216 calories and 16 litres of Kingfisher contains 174 calories. If an 8 litre mixture of both the beers contains 101 calories, the fraction of Kingfisher beer in the mixture is
A] 2/3 B] 1/2 C] 1/3 D] 1/4

13. A merchant purchased two qualities of pulses at the rate of Rs. 200 per quintal and Rs. 260 per quintal. In 52 quintals of the second quality, how much pulse of the first quality should be mixed so that by selling the resulting mixture at Rs. 300 per quintal, he makes a profit of 25%?
A] 100 quintals B] 104 quintals C] 26 quintals D] None of these

14. Ravi covered a distance of 300 km in 20 hours in 2 parts. He covered the first part by a car which was driven at a speed of 20 km/hr and the second part by an auto rickshaw that was driven at a speed of 12 km/hr. The ratio of the distances covered by Ravi in the two parts is:
A] 1 : 1 B] 2 : 3 C] 5 : 3 D] 3 : 5

15. Two vessels contain a mixture of diesel and kerosene. In the first vessel, the ratio of diesel to kerosene is 8 : 3 and in the second vessel the ratio is 5 : 1. A 35 litre drum is filled from these vessels so as to contain a mixture of diesel and kerosene in the ratio 4 : 1. How many liters are taken from the second vessel?
A] 11 liters B] 35 liters C] 24 liters D] 17.5 liters

16. Alloy 'CuZ' has Cu : Zn ∷ 4 : 1 while alloy 'ZiC' has Cu : Zn ∷ 1 : 3. One melting 10 kg of CuZ with 16 kg of Zinc and some amount of pure Cu, a new alloy 'Cuzec' with Cu : Zn ∷ 3 : 2 is obtained. The weight of Cuzec is
A] 9 kg B] 35 kg C] 30 kg D] None of these

17. How many kgs of Basmati rice costing Rs. 42/kg should a shopkeeper mix with 25 kgs of ordinary rice costing Rs. 24 per kg so that he makes a profit of 25% on selling the mixture at Rs. 40/kg?
A] 20 kgs B] 12.5 kgs C] 16 kgs D] 200 kgs

18. A man buys two horses for RS 1350. He sells one so as to lose 6% and the other so as to gain 7.5%. On the whole he neither gains nor loses. What does each horse cost?
A] 750, 600 B] 550, 800 C] 850, 500 D] 700, 600

19. 18 liters are drawn from a bucket full of pure milk, and it is then completely filled with water. 18 litres of the mixture are again drawn and the bucket is again filled completely with water. The ratio of the volume of water now left in the bucket to that of the milk in it is 9 : 16. What is the total capacity (in litres of the bucket)?
A] 80 B] 45 C] 90 D] 18

20. 729 ml of mixture contains milk and water in the ratio of 7:2. How much more water must be added to get a new mixture containing milk and water in the ratio of 7:3?
A] 600 B] 520 C] 710 D] None of these

LEVEL – II

1. From a cask of milk containing 30 litres, 6 litres are drawn out and the cask is filled up with water. If the same process is repeated a second, then a third time, what will be the number of litres of milk left in the cask?
A] 0.512 liter B] 12 liters C] 14.38 liters D] 15.36 liters

2. There are some shepherds and their sheep in a grazing field. The no. of total heads are 60 and total legs are 168 including both men and sheep. The no. of sheep is
A] 18 B] 26 C] 24 D] 36

3. Gold is 19 times as heavy as water and copper 9 times. In what ratio should these metals be mixed so that the mixture may be 15 times as heavy as water?
A] 1 : 2 B] 3 : 2 C] 2 : 3 D] 4 : 5

4. In a class of 30 students, the average weight of boys is 20 kg and the average weight of the girls is 25 kg. The fraction of boys out of the total students of the class is
A] $\frac{4}{5}$ B] $\frac{5}{6}$ C] $\frac{3}{4}$ D] Data insufficient

5. A jar full of whisky contains 40% alcohol. A part of this whisky is replaced by another containing 19% alcohol and now the percentage of alcohol was found to be 26%. The quantity of whisky replaced is:
A] $\frac{1}{3}$ B] $\frac{2}{3}$ C] $\frac{2}{5}$ D] $\frac{3}{5}$

6. A dishonest grocer professes to sell pure butter at cost price, but he mixes it with adulterated fat and thereby gains 25%. Find the percentage of adulterated fat in the mixture assuming that adulterated fat is freely available.
A] 20% B] 25% C] 33.33% D] 40%s

7. A housewife has 1 litre of solution that contains milk and water in the ratio 3:1. She adds 250 ml of 3:2 solutions of milk and water to it and then uses 250 ml of the combined mixture to make curd. How much of pure milk is she left with?
A] 1,000 ml B] 912.5 ml C] 750 ml D] 720 ml

8. A jar full of milk contains 30% water. A part of this milk is replaced by containing 20% water and now the percentage of water is found to be 26%. The quantity of milk replaced is
A] 2/5 B] 1/5 C] 3/7 D] 4/7

9. The amount of water (in ml) that should be added to reduce9 ml lotion, containing 50% alcohol, to a lotion containing 30% alcohol, is
A] 5 ml B] 4 ml C] 3 ml D] 6 ml

10. Three vessels contain equal mixtures of milk and water in the ration 6:1, 5:2 and 3:1 respectively. If all the solutions are mixed together, the ratio of milk to water in the final mixture will be
A] 64:65 B] 65:64 C] 19:65 D] 65:19

11. Gold in 20 times as heavy as water and copper is 10 times as heavy as water. In what ratio these two metals be mixed so that the alloy is 13 times as heavy as water is
A] 2:7 B] 3:7 C] 1:2 D] 2:3

12. The average age of boys in class is 16.66, while the average age of girls is 18.75. Thus the average age of all the 40 students of the class is 17.5. If the difference between the no. of boys and girls is 8, then the no. of girls in the class is:
A] 12 B] 16 C] 18 D] Data insufficient

13. A vessel contains 125 litres of wine. 25 litres of wine was taken out of the vessel and replaced by water. Then, 25 litres of mixture was withdrawn and again replaced by water. The operation was repeated for third time. How much wine is now left in the vessel?
A] 64 Litres. B] 41 litres C] 52 litres D] 45 litres

14. Three equal glasses are filled with mixture of milk and water. The proportion of milk and water in each glass is as follows: In the first glass as 3 : 1, in the second glass as 5 : 3 and in the third as 9 : 7. The contents of the three glasses are emptied into a single vessel. What is the proportion of milk and water in it?
A] 31 : 17 B] 32 : 21 C] 45 : 11 D] 11 : 25

15. Three glasses of sizes 3 litres, 4 litres and 5 litres contain mixture of milk and water in the ratio 2: 3, 3: 7 and 4: 11, respectively. The contents of all the three glasses are poured into a single vessel. Find the ratio of milk.
A] 14: 31 B] 15: 21 C] 16: 17 D] 18: 19

16. In a mixture of 45 litres, the ratio of milk and water is 3 : 2, How much water must be added to make the ratio 9 : 11?
A] 10 litres B] 15 litres C] 17 litres D] 20 litres

17. A bartender stole champagne from a bottle that contained 50% of spirit and he replaced what he had stolen with champagne having 20% spirit. The bottle then contained only 25% spirit. How much of the bottle did he steal?
A] 80% B] 83.33% C] 85.71% D] 88.88%

18. In three vessels each of 10 litres capacity, mixture of milk and water is filled. The ratios of milk and water are 2 : 1, 3 : 1 and 3 : 2 in the three respective vessels. If all the three vessels are emptied into a single large vessel, find the proportion of milk and water in the mixture.
A] 181 : 49 B] 101 : 49 C] 121 : 59 D] 131 : 69

19. A vendor mixes 12 kg of type I, 10 kg of type II and 14 kg of type III coffee whose costs are Rs.75 per kg, Rs.80 per kg and Rs.90 per kg respectively. He, then, sells the resultant mixture at Rs.85 per kg. Find his profit or loss per kg of coffee.
A] Rs.2.78 profit B] Rs.3.5 profit C] Rs.2.8 loss D] Rs.4.2 profit

20. Two tanks of equal volume contain chemical A & B. The first tank contains half as much A as B. The second tank contains one- fourth as much chemical B as A. The mixtures of the two tanks are mixed in the third tank in the ratio 3 : 5. What is the ratio of A : B finally?
A] 4 : 1 B] 5 : 3 C] 4 : 3 D] 1 : 5

NUMBER, RANKING AND TIME SEQUENCE

In this chapter, we deal with questions which are followed with a sequence consisting numbers, ranking and time. We have to find answers on the basis of given condition. The importance of such types of questions cannot be over-emphasised as their presence in a test of reasoning is almost certain.

Ordering and Ranking

In ordering and ranking arrangement questions, position/rank of a person from left-right/top-bottom of a row/class is to be determined or rank/position is given & total no. of persons is to be calculated. Here, different types of ordering & ranking arrangement questions are explained below.

Left + Right = Total + 1

Type 1

1) Total number of persons = {(sum of positions of same person from both sides i.e. left and right side) – 1}

2) Position of a person from opposite side = {(Total no. of persons – Position of same person from given side) +1}

Example 1: In a row of persons, position of A from left side of the row is 27th and position of A from right side of the row is 34th. Find total no. of persons in the row?

Solution: Total no. of students = (Position of A from left + Position of A from right) -1

⇒Total no. of students = (27 + 34) – 1 = 61 – 1 = 60

Type 2

1) Total no. of persons = No. of persons after or before the given person in a row + Position of same person from the other side

Example 2: In a row of persons, position of A from left side of the row is 27th and there are 5 persons after A in the row. Find total no. of persons in the row?

Solution: No. of persons in the row = Position of A from left + No. of persons after A

⇒ Total no. of persons = 27 + 5 = 32

Type 3

When the positions of two persons are given from opposite ends and we know the total number of persons, then two cases arise when trying to determine the number of persons between these two persons –

When there is no overlapping: i.e. the sum of positions of the two persons from opposite ends < total number of persons

Case I: No. of students between two different persons = Total no. of students – (Sum of positions of two different persons from opposite sides)

When there is overlapping: i.e. the sum of positions of the two persons from opposite ends > total number of persons

Case II: No. of students between two different persons = (Sum of positions of two different persons from opposite sides) – Total no. of students – 2

Example 3: In a row of 54 persons, A is 35th from the left side of the row and B is 22nd from the right side of the row. Find the no. of persons sitting between A and B?
Solution: Here Sum of positions of A & B from opposite ends = 35 + 22 = 57 > Total no. of persons
∴ No. of persons between A & B = (Position of A from left + Position of B from right) – Total no. of students – 2
⇒ No. of persons between A & B = (35+22) – 54 – 2 = 57 – 54 – 2 = 1

Type 4
Positions of two persons is given and their positions are interchanged and after interchanging position of 1st person is given from same side as before interchanging
1) Position of 2nd person from the same side as before interchanging = Position of 2nd person from same side before interchanging + (Position of 1st person after interchanging – position of 1st person before interchanging from same side)
2) To find total no. of students, find the person whose position from both sides can be depicted from the statement. Add both his positions from opposite ends and subtract 1.
3) To find no. of persons between them, Difference in the position of common person whose position from same side before and after interchanging is given then subtract 1

Example 4: A and B are standing in a row of persons. A is 18th from left side of the row and B is 24th from right side of the row. If they interchange their positions A becomes 31st from left. Find No. of persons between A & B
Solution: No. of persons between A & B = (Position of A from left after interchanging– Position of A from left before interchanging) – 1
⇒ No. of persons between A & B = (31 – 18) – 1 = 13 – 1 = 12

Number Test
In these types of questions, a number, a set of numbers, series of digit is given and the student is asked to trace out digit following certain given conditions.

Example 5: How many 5s are there in the following number sequence which are immediately preceded by 7 and immediately followed by 6?
Terms : 7 5 5 9 4 5 7 6 4 5 9 8 7 5 6 7 6 4 3 2 5 6 7 8
Solution: Preceded by 7 and followed by 6 So, there is only one such 5.

Example 6: How many even numbers are there in the following series of numbers, each of which is immediately preceded by an odd number, but not immediately followed by an even number?
Terms : 5 3 4 8 9 7 1 6 5 3 2 9 8 7 3 5
Solution: There are three such even numbers 6, 2, 8 each of which is preceded by an odd number and not followed by an even number. 5 3 4 8 9 7 1 6 3 2 9 8 7 3 5

Example 7: The positions of the first and the sixth digit in the number 5 1 0 9 2 3 8 6 7 4 are interchanged. Similarly, the positions of the second and the seventh digit are interchanged and so on. Which of the following will be the third digit from the right end after the rearrangement?
Solution: Given number = 5109238674

According to the question, after interchanging digits, new number = 3867451092
Hence, third digit from the right end = 0

LEVEL – I

1. In a row of trees, one tree is fifth from either end of the row. How many trees are there in the row?
A. 8 B. 9 C. 10 D. 11

2. Raman ranks sixteenth from the top and forty ninth from the bottom in a class. How many students are there in the class?
A. 64 B. 65 C. 66 D. Cannot be determined

3. Sanjeev ranks seventh from the top and twenty eight from the bottom in a class. How many students are there in the class?
A. 37 B. 36 C. 35 D. 34

4. Some boys are sitting in a row. P is sitting fourteenth from the left and Q is seventh from the right. If there are four boys between P and Q, how many boys are there in the row?
A. 25 B. 23 C. 21 D. 19

5. Aruna ranks twelfth in a class of forty-six. What will be her rank from the last?
A. 33 B. 34 C. 35 D. 37

6. Manoj and Sachin are ranked seventh and eleventh respectively from the top in a class of 31 students. What will be their respective ranks from the bottom in the class?
A. 20th and 24th B. 24th and 20th
C. 25th and 21st D. 26th and 22nd

7. Ravi is 7 ranks ahead of Sumit in a class of 39. If Sumit`s rank is seventeenth from the last, what is Ravi`s rank from the start?
A. 14th B. 15th C. 16th D. 17th

8. How many 3's are there in the following sequence which are neither preceded by 6 nor immediately followed by 9?
9 3 6 6 3 9 5 9 3 7 8 9 1 6 3 9 6 3 9
A. One B. Two C. Three D. Four

9. How many 6's are there in the following series of numbers which are preceded by 7 but not immediately followed by 9?
6 7 9 5 6 9 7 6 8 7 6 7 8 6 9 4 6 7 7 6 9 5 7 6 3
A. One B. Two C. Three D. Four

10. How many 7's are there in the following series which are not immediately followed by 3 but immediately preceded by 8 ?
8 9 8 7 6 2 2 6 3 2 6 9 7 3 2 8 7 2 7 7 8 7 3 7 7 9 4
A. 10 B. 3 C. 2 D. 0

11. In the following list of numerals, how many 2's are followed by 1's but not preceded by 4?
4 2 1 2 1 4 2 1 1 2 4 4 4 1 2 2 1 2 1 4 4 2 1 4 2 1 2 1 2 4 1 4 2 1 2 4 1 4 6

A. Two B. Three C. Four D. Five

12. How many 7's are there in the following sequence which are preceded by 9 and followed by 6 ?
7 8 9 7 6 5 3 4 2 8 9 7 2 4 5 9 2 9 7 6 4 7

A. 2 B. 3 C. 4 D. 5

13. What will be the 13th letter from right side if 1st half of series is reversed?

A. M B. O C. N D. A

14. What will be 16th letter from left side if 2nd half is written in reversed order?

A. W B. X C. V D. U

15. Which alphabet will be mid-way b/w 7th& 11th letter counting from left end of the normal alphabet?

A. G B. I C. H D. M

16. Which letter is 5th to the left of 7th to the right of 12th letter from the right?

A. Z B. Q C. D D. R

17. How many pairs of letters are there in the given words which have as many letter b/w them in the word as in the alphabet-> CREATIVE

A. 1 B. 2 C. 3 D. 4

18. How many such digits are there in the number 7346285 which are as far away from the beginning of the number, as they will be when arranged in ascending order within the number?

A. None B. one C. Two D. Three

19. Nitin was counting down from 32. Sumit was counting upwards the numbers starting from 1 and he was calling out only the odd numbers. What common number will they call out at the same time if they were calling out at the same speed?

A. 19 B. 21
C. 22 D. They will not call out the same number

20. If possible to make a meaningful word from 2nd, 5th, 10th & 12th letters of the word METROPOLITAN, which is 3rd letter of the word? If no such word can be made, X is answer. If more than one word formed, give M as answer.

A. Q B. T C. X D. M

LEVEL - II

1. In a queue, Amrita is 10th from the front while Mukul is 25th from behind and Mamta is just in the middle of the two. If there be 50 persons in the queue. What position does Mamta occupy from the front ?

A. 20th B. 19th C. 18th D. 17th

2. If Atul finds that he is twelfth from the right in a line of boys and fourth from the left, how many boys should be added to the line such that there are 28 boys in the line?

A. 12 B. 13 C. 14 D. 20

3. Manisha ranked sixteenth from the top and twenty ninth from the bottom among those who passed an examination. Six boys did not participate in the competition and five failed in it. How many boys were there in the class?

A. 40 B. 44 C. 50 D. 55

4. Kailash remembers that his brother Deepak`s birthday falls after 20th May but before 28th May, while Geeta remembers that Deepak`s birthday falls before 22nd May but after 12th May. On what date Deepak`s birthday falls?

A. 20th May B. 21st May C. 22nd May D. Cannot be determined

5. Sangeeta remembers that her father`s birthday was certainly after eighth but before thirteenth of December. Her sister Natasha remembers that their father`s birthday was definitely after ninth but before fourteenth of December. On which date of December was their father`s birthday?

A. 10th B. 11th C. 12th D. Data inadequate

6. Standing on a platform, Amit told Sunita that Aligarh was more than ten kilometers but less than fifteen kilometers from there. Sunita knew that it was more than twelve but less then fourteen kilometers from there. If both of them were correct, which of the following could be the distance of Aligarh from the platform?

A. 11 km B. 12 km C. 13 km D. 14 km

7. Ashish leaves his house at 20 minutes to seven in the morning, reaches Kunal`s house in 25 minutes, they finish their breakfast in another 15 minute and leave for their office which takes another 35 minutes, At what time do they leave Kunal`s houses to reach their office ?

A. 7.40 a.m. B. 7.20 a.m. C. 7.45 a.m. D. 8.15 a.m.

8. Ajay left home for the bus stop 15 minutes earlier than usual. It takes 10 minutes to reach the stop. He reached the stop at 8.40 a.m. What time does he usually leave home for the bus stop?

A. 8.30 a.m. B. 8.45 p.m. C. 8.55 a.m. D. None of these

9. Which is the third number to the left of the number which is exactly in the middle of the following sequence of numbers?

1 2 3 4 5 6 7 8 9 2 4 6 8 9 7 5 3 1 9 8 7 6 5 4 3 2 1

A. 3 B. 4 C. 5 D. 6

10. Count each 7 which is not immediately preceded by 5 but is immediately followed by either 2 or 3. How many such 7's are there ?
5 7 2 6 5 7 3 8 3 7 3 2 5 7 2 7 3 4 8 2 6 7 8
A. 2 B. 3 C. 4 D. 5

11. In the following series, how many such odd nummbers are there which are divisible by 3 or 5, then followed by odd numbers and then also followed by even numbers ?
12, 19, 21, 3, 25, 18, 35, 20, 22, 21, 45, 46, 47, 48, 9, 50, 52, 54, 55, 56
A. Nil B. One C. Two D. Three

12. In the following number sequence, how many such even numbers are there which are exactly divisible by its immediate preceding number but not exactly divisible by its immediate following number ?
3 8 4 1 5 7 2 8 3 4 8 9 3 9 4 2 1 5 8 2
A. One B. Two C. Three D. Four

13. Series : 5 1 4 7 3 9 8 5 7 2 6 3 1 5 8 6 3 8 5 2 2 4 3 4 9 6
How many even numbers are there in the sequence which are immediately preceded by an odd number but immediately followed by an even number?
A. 1 B. 2 C. 3 D. 4

14. Make a meaningful word from 2nd, 5th, 8th letter of the word CARETAKER. Which will be the 1st letter of that word? If no such word can be made, give X as answer. If more than one such word formed, give M as an answer
A. E B. T C. X D. M

15. How many digits are there which are either immediately followed by a digit divisible by 3 or immediately preceded by a digit divisible by 5?
7 3 2 7 6 5 4 8 7 6 3 2 3 5 4 3 7 6 3 2
A. Nine B. Eight C. Four D. Two

Directions for questions 16 to 18: Consider the letters of the alphabet written in the order from left to right i.e. from A to Z

16. The letter which is fourth to the left of the letter, which is fifth to the right of F is
A. C B. W C. E D. G

17. The letter which is 6th to the left of the letter which is 8th to the right of P is
A. E B. D C. S D. R

18. The letter which is third to the right of the letter, which is seventh to the left of O is
A. P B. C C. K D. L

19. In the following set of numbers, if 1 is added to the last digit and then the order of digits is reversed, which number will be fourth if arranged in ascending order?
567 284 696 865 738

A. 567 B. 284 C. 865 D. 738

20. How many numbers amongst the numbers 9 to 54 are there which are exactly divisible by 9 but not by 3 ?
A. 5 B. 6 C. 0 D. 9

LEVEL - III

1. If the numbers from 1 to 45 which are exactly divisible by 3 are arranged in ascending order, minimum number being on the top, which would come at the ninth place from the top?
A. 18 B. 21 C. 24 D. 27

2. If the numbers from 5 to 85 which are exactly divisible by 5 are arranged in descending order, which would come at the eleventh place from the bottom?
A. 35 B. 45 C. 50 D. None of these

3. In a class of 60, where girls are twice that of boys, Kamal ranked seventeenth from the top. if there are 9 girls ahead of Kamal, how many boys are after him in rank ?
A. 3 B. 7 C. 12 D. 23

4. In a row of ten boys, when Rohit was shifted by two places towards the left, he became seventh from the left end. What was his earlier position from the right end of the row?
A. First B. Second C. Fourth D. Sixth

5. In a queue, Vijay is fourteenth from the front and Jack is seventeeth from the end, while Mary is in between Vijay and Jack. If Vijay be ahead of Jack and there be 48 persons in the queue, how many persons ar there between Vijay and Marry?
A. 8 B. 7 C. 6 D. 5

6. In a row of girls, Rita and Monika occupy the ninth places from the right end and tenth place from the left end, respectively. If they interchange their places, Rita and Monika occupy seventeenth places from the right and eighteenth place from the left, respectively. How many girls are there in the row?
A. 25 B. 26 C. 27 D. Data inadequate

7. In a row of girls, Shilpa is eighth from the left and Reena is seventeenth from the right. If they interchange their positions, Shilpa becomes fourteenth from the left. How many girls are there in the row?
A. 25 B. 27 C. 29 D. None of these

8. In a row of boys, Kapil is eighth from the right and Nikunj is twelfth from the left. When Kapil and Nikunj interchange positions, Nikunj becomes twenty first from the left. Which of the following will be Kapil's position from the right?
A. 8th B. 17th C. 21st D. Canont be determined

9. If Thursday was the day after the day before yesterday five days ago, what is the least number of days ago when Sunday was three days before the day after tomorrow ?
A. Two B. Three C. Four D. Five

10. If the positions of the first and the third digit within each number are interchanged, which of the following will be the third digit of the second lowest number?
987, 514, 658, 487, 404, 269
A. 8 B. 9 C. 2 D. 4

11. In the number 76534218 each digit is replaced next digit, ie '1' is replaced by '2' , '2' is replaced by '3' and so on and then the digits are arranged in ascending order from left to right, which digit will be fifth from the left end?
A. 6 B. 5 C. 7 D. 4

12. If it is possible to form a number with the second, the fifth and the eighth digits of the number 31549786, which is the perfect square of a two - digit even number, which of the following will be the second digit of that even number?
A. 1 B. 4 C. 6 D. None of these

13. Which of the following is fifth to the right of the twelth digit from the right end of the below arrangement?
1 8 5 9 4 7 1 2 5 8 3 6 5 9 2 7 6 4 5 2 9 2 6 4 1 2 3 5 1 4 2 8 3
A. 3 B. 1 C. 2 D. 7

14. In a row, Kumar is at 7th place from the left and Pawan is at 9th place from the right. When they interchange the positions Kumar becomes 11th from left. How many were seated in the row?
A. 19 B. 20 C. 21 D. 27

15. If the following series is written in the reverse order, which number will be fourth to the right of the seventh number from the left?
7, 3, 9, 7, 0, 3, 8, 4, 6, 2, 1, 0, 5, 11, 13
A. 5 B. 11 C. 9 D. 0

16. In a row of girls, Nithya and Suganya occupy the ninth place from the right end and tenth place from the left end, respectively. If they interchange their places, then Nithya and Suganya occupy seventeenth place from the right and eighteenth place from the left respectively. How many girls are there in Nth row?
A. 22 B. 24 C. 26 D. 28

17. In a row of girls facing North, Reena is 10th to the left of Pallavi, who is 21st from the right end. If Malini, who is 17th from the left end, is fourth to the right of Reena, how many girls are there in the row?
A. 37 B. 41 C. 43 D. 49

18. If it is possible to make a meaningful word with the fourth, the eighth and the tenth letters of the word 'COUNTERACT, which of the following will be the last letter of that word ? If no such word can be made, give X as the answer. If more than one such word can be made, give. M as the answer.
A. A B. N C. X D. M

19. In a row of boys, Haran is eleventh from the left and manoj is seventeenth form the right. When they exchange their places than Haran will be thirteenth from the left. Which of the following will be the new position of Manoj from the right?

A. 11 B. 19 C. 13 D. 17

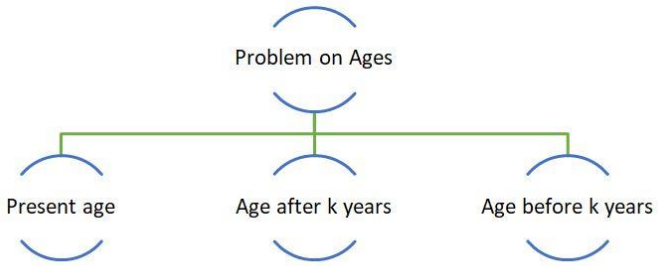
20. Read the arrangement carefully and give the answer of following questions?

K$23DBE8HM4@5JF4%K1+WR#AA*415

How many such symbols are there which is not immediately preceded by a letter but immediately followed by a number?

A. 1 B. 2 C. 3 D. 0

PROBLEM ON AGES AND NUMBERS



Important Formulas on Problems on Ages

- If the present age of 'A' is 'x' years, then
  - 'n' years ago => Age of 'A' was (x-n) years.
  - 'n' years after => Age of 'A' will be (x+n) years.
- In general, at the starting of the solution assume the present age of one person. It is better to assume the present age = 'x' years.
  So it is advised to assume the age of the younger person = 'x' years.
- If the present age 'A' and 'B' are 'x' and 'y' years respectively, then
  - 'n' years ago => Age of 'A' and 'B' were (x-n) and (y-n) years respectively.
  - 'n' years after => Age of 'A' and 'B' will be (x+n) and (y+n) years respectively.
- The age difference between you and your friend is let's supposed 6 years. And after 10 or 15 years this will be same, because clock will run equally for both of you.
- If the current age is x, then n times the age is nx.
- The ages in a ratio a : b will be ax and bx.
- If the current age is x, then 1/n of the age is x/n. .
- If sum of ages of x and y is A and ratio of their ages is p : q respectively, then u can determine age of y by using the formula shown below:
  Age of y = (Ratio of y × sum of ages) / Sum of ratios
  Age of y = (q × A) / (p + q)

Example 1: The age of the father 3 years ago was 7 times the age of his son. At present, the father's age is five times that of his son. What are the present ages of the father and the son?

Solution: Let the present age of son = x yrs
Then, the present age of father = 5xyr
3 years ago,
7(x – 3) = 5x – 3
Or, 7x – 21 =5x – 3
x = 9 yrs
Therefore, son's age = 9 years and Father's age = 45 years.

Example 2: The sum of the ages of a mother and her daughter is 50 yrs. Also 5 yrs ago, the mother's age was 7 times the age of the daughter. What are the present ages of the mother and the daughter?

Solution: Let the age of the daughter be x yrs.
Then, the age of the mother is (50x – x) yrs
5 yrs ago, 7(x – 5) = 50 – x – 5
Or, 8x = 50 – 5 +35 = 80
x =10

Therefore, daughter's age = 10 yrs and mother's age = 40yrs.

Example 3: The age of Rahul and Amit are in the ratio of 8:7. After 10 years the ratio of their ages will be 13:12. What is the difference in years between their ages?

Solution: Let's assume the present age of Rahul and Amit = 8x and 7x
After 10 years,
(8x+10) / (7x+10) = 13/12
We get x=2 years.
So difference in age 8x – 7x = 16 – 14 = 2 years.

Example 4: Sneh's age is 1/6th of her father age. Sneh's father age will be twice of Vimal age after 10 years. If Vimal's 8th birthday was celebrated 2 years ago. Then what is the present age of Sneh?

Solution: Let age of Sneh be x and of his father be y and Vimal's age be z.
Therefore, x = 1/6y.
After 10 years Vimal age would be z+10
Hence, y+10 = 2(z+10).
Thus, present age of Vimal = 8 + 2 = 10 = z.
Substituting z = 10 in 2 equation we can easily get the age of Sneh's father to be 30
The present age of Sneh, x = 5

Problem on Numbers

Basic Formulae:

1. $(a - b)^2 = (a^2 + b^2 - 2ab)$
2. $(a + b)^2 = (a^2 + b^2 + 2ab)$
3. $(a + b)(a – b) = (a^2 – b^2)$
4. $(a^3 + b^3) = (a + b)(a^2 – ab + b^2)$
5. $(a^3 - b^3) = (a - b)(a^2 – ab + b^2)$
6. $(a + b + c)^2 = a^2 + b^2 + c^2 + 2(ab + bc + ca)$
7. $(a^3 + b^3 + c^3 – 3abc) = (a + b + c)(a^2 + b^2 + c^2 – ab – bc – ac)$

Example 5: 5 times a positive number is less than its square by 24. What is the integer?

Solution: Let the unknown number be x.
5 times a positive number = 5x
5 times a positive number is less than its square by 24
$x^2 – 5x = 24$
$x^2 + 3x – 8x – 24$
$x(x + 3) – 8(x + 3)$
$(x - 8)(x + 3)$
x = 8; 8 is the required integer.

Example 6: The sum of numerator and denominator of a fraction is 30. If 2 is added to numerator and 2 is subtracted from denominator, then it becomes 2/3. Find the fraction.

Solution: Let the fraction be a/b

Sum of numerator and denominator = a+b=30 -----(1)

2 is added to numerator and 2 is subtracted from denominator. Hence,

a + 2 / b – 2 = 2/3

3(a+2)=2(b-2)

Solving, we get

3a+6=2b-4

3a-2b=-10-----(2)

Solve equations (1) and (2), we get

a = 10 and b = 20

Therefore, the fraction = 10/20 = 1/2

Example 7: The difference between a two-digit number and the number obtained by interchanging the positions of its digits is 36. What is the difference between the two digits of that number?

Solution: Let the ten's digit be x and unit's digit be y.

Then, (10x + y) - (10y + x) = 36

9(x - y) = 36

x - y = 4.

Example 8: In a two-digit, if it is known that its unit's digit exceeds its ten's digit by 2 and that the product of the given number and the sum of its digits is equal to 144, then the number is?

Solution: Let the ten's digit be x.

Then, unit's digit = x + 2.

Number = 10x + (x + 2) = 11x + 2.

Sum of digits = x + (x + 2) = 2x + 2.

(11x + 2)(2x + 2) = 144

22x2 + 26x - 140 = 0

11x2 + 13x - 70 = 0

(x - 2)(11x + 35) = 0

x = 2.

Hence, required number = 11x + 2 = 24.

LEVEL - I

1. If the sum two numbers is 31 and their product is 240, then find the absolute difference between the numbers.
A. 1 B. 3 C. 4 D. 5

2. The product of fraction A and B is (3/49). Find the value of fraction A, if fraction A is thrice fraction B.
A. 7/9 B. 5/7 C. 3/7 D. 5/9

3. The sum of numerator and denominator of a fraction is 30. If 2 is added to numerator and 2 is subtracted from denominator, then it becomes 2/3. Find the fraction.
A. 1/2 B. 1/3 C. 2/3 D. ¼

4. The denominator of a fraction is 2 more than numerator. If the numerator as well as denominator is increased by 4, the fraction becomes 8/10. Find the original fraction.
A. 2/3 B. 1/3 C. 4 /7 D. 2/5

5. The sum of the two numbers is 50 and their product is 624. Find out the numbers.
A. 23, 27 B. 24, 26 C. 22, 28 D. 18, 32

6. The difference between a positive proper fraction and its reciprocal is 17/72. The fraction is:
A. 9/8 B. 7/8 C. 6/9 D. 7/9

7. The difference between the place value and face value of 9 in the 63894531 is:
A. 89981 B. 89991 C. 88999 D. 89999

8. 3/4th of a number exceeds its 2/3rd by 8. What is the number?
A. 96 B. 36 C. 72 D. 144

9. 6/7 of a certain number is 96. Find quarter of that number.
A. 112 B. 32 C. 56 D. 28

10. The difference between the number and its three fifth is 40, what is the number?
A. 80 B. 100 C. 90 D. 120

11. The average age of a woman and her daughter is 16 years. The ratio of their ages in 7 : 1 respectively. What is the woman’s age?
A. 4 years B. 28 years C. 32 years D. 6 years

12. The ratio between A's and B's ages two years ago was 3: 2 and at present it is 7: 5. Find B's present age?
A. 8 yrs. B. 14 yrs. C. 12 yrs. D. 10 yrs.

13. When you reverse the digits of age of father u will get the age of son. One year ago the age of father was twice that of son's age. What is the current age of father?
A. 27 years B. 63 years C. 73 years D. 36 years

14. Ram is 26 year old then Mohan. After 7 years Ram's age is thrice as Mohan's age. Find Ram's present age?

A. 30 years B. 32 years C. 64 years D. 39 years

15. After 10 years A will be twice the age of B before 10 years and now if the difference is 9 years between them then what is the age of B after 10 years?

A. 24 years B. 39 years C. 29 years D. 49 years

16. The ratio of Adam's age to her mother's age is 3:8.The difference of their ages is 35 years. The ratio of their ages after 4 years will be

A. 7:12 B. 5:12 C. 38:43 D. 42:47

17. What is Aman's present age, if after 20 years his age will be 10 times his age 10 years back?

A. 6.2 years B. 7.7 years C. 13.3 years D. 10 years

18. One year ago, the ratio of Honey and Piyush ages was 2: 3 respectively. After five years from now, this ratio becomes 4: 5. How old is Piyush now?

A. 10 years B. 25 years C. 5 years D. 15 years

19. Saransh is 50 years old and Nazma is 40 years old. How long ago was the ratio of their ages 3:2?

A. 20 years B. 30 years C. 40 years D. 25 years

20. The present ages of A, B and C are in proportions 4:7:9. Eight years ago, the sum of their ages was 56. What are their present ages (in years)?

A. Insufficient data B. 16, 30, 40 C. 16, 28, 40 D. 16, 28, 36

LEVEL – II

1. If the number is decreased by 5 and divided by 7 the result is 7. What would be the result if 4 is subtracted and divided by 10?
A. 4 B. 7 C. 8 D. 5

2. The sum of squares of three numbers is 138 and the sum of their products taken two at a time is 131. Find their sum.
A. 35 B. 42 C. 20 D. 18

3. Find a positive number which when increased by 11 is equal to 60 times the reciprocal of the number
A. 3 B. 4 C. 6 D. 9

4. 1ab8 is 4-digit number divisible by 24. If the number formed from the two digits ab is a multiple of 9. Then a + b = ?
A. 9 B. 8 C. 12 D. 14

5. A positive integer which when added to 100, gives a sum which is greater than when it is multiplied by 100. What is the number?
A. 5 B. 2 C. 3 D. 1

6. 36 is divided in 2 parts such that 8 times the first part added to 3 times the second part makes 203. What is the first part?
A. 15 B. 19 C. 23 D. None of these

7. A number whose one-fourth part is increased by 5 is equal to the third part diminished by 5.
A. 100 B. 80 C. 120 D. 60

8. When 20 is subtracted from a number, it reduces to seven-twelve of the number. What is the sum of the digit of the number?
A. 4 B. 8 C. 10 D. 12

9. When I add 3 times my age 3 years from now to 4 times my age 4 years from now, I get 8 times my current age. How old will I be 3 years from now?
A. 28 years B. 24 years C. 20 years D. 32 years

10. Three years ago , the average age of A, B and C was 27 years and that of B and C, 5 years ago was 20 years. A's present age is?
A. 30 yrs B. 35 yrs C. 40 yrs D. 48 yrs

11. The ratio of the present ages of Sunita and vinita is 4:5. Six years hence the ratio of their ages will be 14:17. What will be the ratio of their ages 12 years hence?
A. 15:19 B. 13:15 C. 16:19 D. 17:19

12. Present ages of Sameer and Anand are in the ratio of 5 : 4 respectively. Three years hence, the ratio of their ages will become 11 : 9 respectively. What is Anand's present age in years?

A. 24 B. 27 C. 40 D. cannot be determined

13. P says to Q "I am thrice as old as you were when i was as old as you are". If the sum of their present age is 100 years, then the present age of Q?

A. 30 B. 60 C. 40 D. cannot be determined

14. Raju's mom age was twice the age of him 2 year ago and his father will age twice of him in next 5 year. Find the sum of the current ages of his mom and dad. If his age 23.

A. 94 B. 97 C. 96 D. 95

15. A women in her conversation said "if u reverse my own age, in figures represent my husband age. he is of course senior to me and difference between our age is one one-eleventh of their sum. What is the woman's and her husband age?

A. 34, 43 B. 45, 54 C. 56, 65 D. 36, 63

16. Eighteen years ago, a father was three times as old as his son. Now the father is only twice as old as his son. Then the sum of the present ages of the son and the father is

A. 54 B. 72 C. 105 D. 108

17. A man's age is 125% of what it was 10 years ago, but 83 (1/3) % of what it will be after 10 years. What is his present age?

A. 70 B. 60 C. 50 D. 40

18. The sum of ages of 5 children born at the intervals of 3 years each is 50 years. Find out the age of the youngest child?

A. 6 years B. 4 years C. 5 years D. 3 years

19. Ayisha's age is $1/6^{th}$ of her father's age. Ayisha's father's age will be twice Shankar's age after 10 years. If Shankar's eight birthdays was celebrated two years before, then what is Ayisha's present age?

A. 10 years B. 12 years C. 8 years D. 5 years

20. My brother is 3 years elder to me. My father was 28 years of age when my sister was born while my mother was 26 years of age when I was born. If my sister was 4 years of age when my brother was born, then what was the age of my father when my brother was born?

A. 32 years B. 34 years C. 33 years D. 35 years

LEVEL – III

1. A number when divided by 9 leaves a remainder 5. When the square of the number is divided by 9, the remainder is:
A. 4 B. 5 C. 6 D. 7

2. In a two digit prime number, if 18 is added, we get another prime number with reversed digits. How many such numbers are possible?
A. 4 B. 3 C. 2 D. 5

3. A 3-digit number 4a5 is added to another 3-digit number 675 to give a 4-digit number 11b0, which is divisible by 3. Then number of possible solution for a + b is?
A. 3 B. 1 C. 4 D. 2

4. A number consists of 3 digits whose sum is 10. The middle digit is equal to the sum of the other two and the number will be increased by 99 if its digits are reversed. The number is:
A. 145 B. 253 C. 370 D. 352

5. The product of two numbers is 9375 and the quotient, when the larger one is divided by the smaller, is 15. The sum of the numbers is:
A. 380 B. 395 C. 400 D. 425

6. The difference between a two-digit number and the number obtained by interchanging the digits is 36. What is the difference between the sum and the difference of the digits of the number if the ratio between the digits of the number is 1 : 2 ?
A. 4 B. 8 C. 16 D. None of these

7. The difference between a two-digit number and the number obtained by interchanging the two digits is 63. Which is the smaller of the two numbers?
A. 12 B. 15 C. 17 D. None of these

8. Lucia is a wonderful grandmother. Her age is b/w 50 to 70.Each of her sons having as many sons as they have brothers. Their combined number gives Lucia's present age. What is her age?
A. 85 B. 55 C. 84 D. 64

9. A person is 80 years old in 490 and only 70 years old in 500 in which year is he born?
A. 400 B. 550 C. 570 D. 440

10. A man spent 1/6th of his life in child hood, 1/12th of his life as youngster and 1/7th of his life as a bachelor. After five years of his marriage a son was born to him. The son died four years before the father died and at the time of his death his age was half the total age of his father. What is the age of the father?
A. 84 B. 48 C. 72 D. 64

11. A Father, son and grandson are walking in the park. A man approaches them and asks for their age. The Father replies, "My son is as many weeks as my grandson is in days, and my grandson is as many months old as I am in years. We are all 100 years together. What is the age of the son?
A. 28 B. 35 C. 15 D. 60

12. A parent has 15 children who were born in an interval of 1.5 years. If the first child's age is 8 times that of the last child then find the age of the first child?
A. 21 B. 42 C. 24 D. 35

13. The captain of pirates came home after spending 6 years in prison and said: When I went to prison I was 5 times more older than my son. Now I am thrice as old as him. When he turns double his age I will be just twice as old as him. What was the pirate's age when his son was born?
A. 20 B. 30 C. 24 D. 42

14. If 6 years are subtracted from the present age of Ajay and the remainder is divided by 18, then the present age of Rahul is obtained. If Rahul is 2 years younger to Denis whose age is 5 years, then what is Ajay's present age?
A. 50 years B. 60 years C. 55 years D. 62 years

15. The ratio of the age of a man and his wife is 4:3. At the time of marriage the ratio was 5:3 and After 4 years this ratio will become 9:7. How many years ago were they married?
A. 8 years B. 10 years C. 11 years D. 12 years

16. Sum of present ages of P and Q is 41. Age of P 2 year hence is equal to age of R, 1 year ago. Age of P, 4 year hence is equal to age of Q 1 year ago and ratio of present age of P and S is 3 : 4. Find the difference of age of R and S.
A. 2 B. 3 C. 4 D. 5

17. Hari Ram’s present age is three times his son’s present age and two fifth of his father’s present age. The average of the present age of all of them is 46 years. What is the difference between Hari Ram’s son’s present age and Hari Ram’s father’s present age?
A. 44 yrs B. 56 yrs C. 67 yrs D. 78 yrs

18. The average age of a couple and their son was 40 years, the son got married and a child was born just two years after their marriage. When child turned to 10 years, then the average age of the family becomes 38 years. What was the age of the daughter in law at the time of marriage?
A. 12 years B. 10 years C. 14 years D. 13 years

19. The average age of seven persons sitting in a row facing east is 26 years. If the average age of the first three persons is 19 years and the average age of the last three persons is 32 years, then find the age of the person sitting in the middle of the row?
A. 32 yrs B. 29 yrs C. 24 yrs D. 27 yrs

20. Ratio of the ages of Mahesh and Nilesh is 5 : x. Mahesh is 18 years younger to Ramesh. After nine years Ramesh will be 47 years old. If the difference between the ages of Mahesh and Nilesh is same as the age of Ramesh, what is the value of x?
A. 11.8 B. 12.9 C. 14.5 D. 13.7

VENN DIAGRAM AND SET THEORY

VENN DIAGRAM

Venn diagram, also known as Euler-Venn diagram is a simple representation of sets by diagrams. The usual depiction makes use of a rectangle as the universal set and circles for the sets under consideration.

Let's take a look at some basic formulas for Venn diagrams of two and three elements.

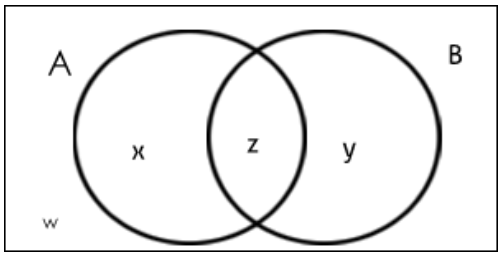
$n (A \cup B) = n(A) + n (B) - n (A \cap B)$

$n (A \cup B \cup C) = n(A) + n (B) + n (C) - n (A \cap B) - n (B \cap C) - n (C \cap A) + n (A \cap B \cap C)$

And so on, where n(A) = number of elements in set A.

Once you understand the concept of Venn diagram with the help of diagrams, you don't have to memorize these formulas.

Venn Diagram in case of two elements



Where;

X = number of elements that belong to set A only

Y = number of elements that belong to set B only

Z = number of elements that belong to set A and B both (A B)

W = number of elements that belong to none of the sets A or B

From the above figure, it is clear that

n(A) = x + z ;

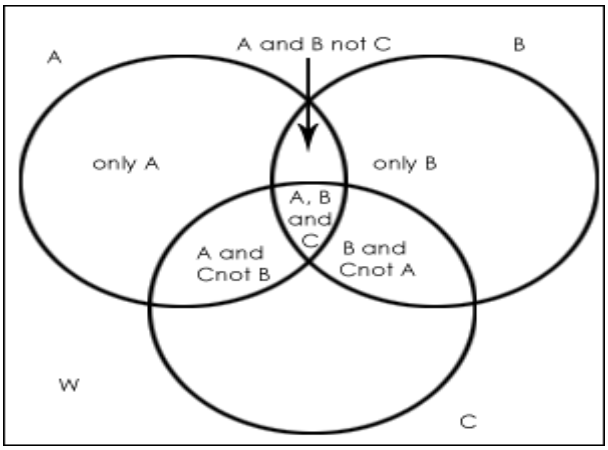
n (B) = y + z ;

$n(A \cap B) = z$;

$n (A \cup B) = x + y + z$.

Total number of elements = x + y + z + w

Venn Diagram in case of three elements



Where, W = number of elements that belong to none of the sets A, B or C

Note: Always start filling values in the Venn diagram from the innermost value

SET THEORY

Set Theory

A Set is defined as a group of objects, known as elements. These objects could be anything conceivable, including numbers, letters, colors, even set themselves. However, none of the objects of the set can be the set itself.

Set Notation

We write sets using braces and denote them with capital letters. The most natural way to describe sets is by listing all its members. For example,

A = {1,2,3,…,10} is the set of the first 10 counting numbers, or naturals,

B = {Red, Blue, Green} is the set of primary colors

Well defined Set

Well-defined means, it must be absolutely clear that which object belongs to the set and which does not. Some common examples of well-defined sets are:

The collection of vowels in English alphabets. This set contains five elements, namely, a, e, i, o, u

N = {1,2,3,…} is the set of counting numbers, or naturals.

Z = {…,−3,−2,−1,0,1,2,3,…} is the set of integers.

Definition of Subset:

If A and B are two sets, and every element of set A is also an element of set B, then A is called a subset of B and we write it as $A \subseteq B$ or $B \supseteq A$.

The symbol $\subset$ stands for 'is a subset of' or 'is contained in'

• Every set is a subset of itself, i.e., $A \subset A$, $B \subset B$.

• Empty set is a subset of every set.

• $A \subseteq B$ means A is a subset of B or A is contained in B.

• $B \subseteq A$ means B contains A.

For example:

Let A = {2, 4, 6} and B = {6, 4, 8, 2}

Here A is a subset of B

Since, all the elements of set A are contained in set B.

But B is not the subset of A

Since, all the elements of set B are not contained in set A.

Number of Subsets of a given Set:

If a set contains 'n' elements, then the number of subsets of the set is 2^n.

Number of Proper Subsets of the Set:

If a set contains 'n' elements, then the number of proper subsets of the set is $2^n - 1$.

If A = {p, q} the proper subsets of A are [{ }, {p}, {q}]

$\Rightarrow$ Number of proper subsets of A are = $2^2 - 1 = 4 - 1$

In general, number of proper subsets of a given set = 2m - 1, where m is the number of elements.

Types of Sets

1. Null set or Empty Set: A set which does not contain any element is called an empty set, or the null set or the void set and it is denoted by ∅

Eg: The set of whole numbers less than 0.

Let A = {x : 2 < x < 3, x is a natural number}

Here A is an empty set because there is no natural number between 2 and 3.

2. Singleton Set: A set which contains only one element is called a singleton set.

Eg: A = {x : x is neither prime nor composite}

It is a singleton set containing one element, i.e., 1.

3. Finite Set: A set which contains a definite number of elements is called a finite set. Empty set is also called a finite set.

Eg: The set of all colors in the rainbow.

N = {x : x ∈ N, x < 7}

4. Infinite Set: The set whose elements cannot be listed, i.e., set containing never-ending elements is called an infinite set.

Eg: Set of all points in a plane

A = {x : x ∈ N, x > 1}

5. Difference of Sets: The difference of sets A and B, written as A-B, is the set of elements belonging to set A and NOT to set B.

Eg: A = {1,2,3,4,5}, B = {2,3,5}

The difference of A and B (i.e. A-B) is {1,4}

NOTE: A-B ≠ B-A

6. Disjoint Sets: If two sets A and B should have no common elements or we can say that the intersection of any two sets A and B is the empty set, then these sets are known as disjoint sets i.e. A ∩ B = ϕ.

Eg: A = {1,2,3}, B = {4,5}

A ∩ B = 0.

Therefore, these sets A and B are disjoint sets.

7. Equality of Two Sets or Equal Sets: Two sets are said to be equal or identical to each other, if they contain the same elements. The sets P and Q is said to be equal, if P ⊆ Q and Q ⊆ P, then we will write as P = Q.

Eg: If A = {1,2,3} and B = {1,2,3}, then A = B.

Let P = {a, e, i, o, u} and B = {a, e, i, o, u, v}, then P ≠Q, since set Q has element v as the extra element.

8. Cardinal Number or Cardinality of a Set: The number of distinct elements in a given set A is called the cardinal number of A. It is denoted by n(A).

Eg: A {x : x ∈ N, x < 5} i.e. A = {1, 2, 3, 4}

Therefore, n(A) = 4

9. Equivalent sets: Two sets which have the same number of elements, i.e. same cardinality are equivalent sets.

Eg: P = {p. q. r, s, t} and Q = {a, e, i, o, u}

Since the two sets P and Q contain the same number of elements 5, therefore they are equivalent sets.

10. Super Set: Whenever a set A is a subset of set B, we say the B is a superset of A and we write, B ⊇ A. Symbol ⊇ is used to denote 'is a super set of'

Eg: A = {a, e, i, o, u} andB = {a, b, c, ..., z}

Here A ⊆ B i.e., A is a subset of B but B ⊇ A i.e., B is a super set of A

11. Proper Subset: If A and B are two sets, then A is called the proper subset of B if A ⊆ B but B ⊇ A i.e., A ≠ B. The symbol '⊂' is used to denote proper subset. Symbolically, we write A ⊂ B.

Eg: A = {1, 2, 3, 4} , Here n(A) = 4

B = {1, 2, 3, 4, 5} , Here n(B) = 5

We observe that, all the elements of A are present in B but the element '5' of B is not present in A.

So, we say that A is a proper subset of B i.e. A ⊂ B

Note:

1. No set is a proper subset of itself.

2. Null set or ∅ is a proper subset of every set.

12. Power Set: The collection of all subsets of set A is called the power set of A. It is denoted by P(A). In P(A), every element is a set.

Eg: If A = {p, q} then all the subsets of A will be

P(A) = {∅, {p}, {q}, {p, q}}

Number of elements of P(A) = n[P(A)] = 4 = 2^2

In general, Power Set =n[P(A)] = 2m where m is the number of elements in set A.

13. Universal Set: A set which contains all the elements of other given sets is called a universal set. The symbol for denoting a universal set is ∪ or ξ.

Eg: If A = {1, 2, 3} B = {2, 3, 4} C = {3, 5, 7}

then U = {1, 2, 3, 4, 5, 7}

Operations on Sets

When two or more sets combine together to form one set under the given conditions, then operations on sets are carried out.

1. Union of Sets: The union of sets A and B, written as A∪B, is the set of elements that appear in either A OR B.

Eg: A = {1,2,3,4,5}, B = {2,4,6,8,10}

The union of A and B (i.e. A∪B) is {1, 2, 3, 4, 5, 6, 8, 10}

2. Intersection of Sets: The intersection of sets A and B, denoted as A ∩ B, is the set of elements common to both A AND B.

Eg: A = {1,2,3,4,5}, B = {2,4,6,8,10}

The intersection of A and B (i.e. A∩B) is simply {2, 4}

3. Cartesian Product of Sets: The Cartesian product of sets A and B, written A x B, is expressed as:

A x B = {(a,b) | a is every element in A, b is every element in B}

Eg: A = {1,2}, B = {4,5,6}

The Cartesian product of A and B (i.e. A x B) is {(1,4), (1,5), (1,6), (2,4), (2,5), (2,6)}

4. Complement of a Set: In complement of a set if U be the universal set and A a subset ofU, then the complement of A is the set of all elements of U which are not the elements of A. We denote the complement of A as A'.

Eg: If U = {1, 2, 3, 4, 5, 6, 7}

A = {1, 3, 7}

We observe that 2, 4, 5, 6 are the only elements of U which do not belong to A.

Therefore, A' = {2, 4, 5, 6}

Note:

The complement of a universal set is an empty set.

The complement of an empty set is a universal set.
The set and its complement are disjoint sets.

Some properties of complement sets

(i) A ∪ A' = A' ∪ A = ∪ (Complement law)

(ii) (A ∩ B') = ϕ (Complement law)

(iii) (A ∪ B) = A' ∩ B' (De Morgan's law)

(iv) (A ∩ B)' = A' ∪ B' (De Morgan's law)

(v) (A')' = A (Law of complementation)

(vi) ϕ' = ∪ (Law of empty set

(vii) ∪' = ϕ and universal set)

Laws of Sets

1. Commutative Laws: For any two finite sets A and B;

(i) A U B = B U A

(ii) A ∩ B = B ∩ A

2. Associative Laws: For any three finite sets A, B and C;

(i) (A U B) U C = A U (B U C)

(ii) (A ∩ B) ∩ C = A ∩ (B ∩ C)

Thus, union and intersection are associative.

3. Idempotent Laws: For any finite set A;

(i) A U A = A

(ii) A ∩ A = A

4. Distributive Laws: For any three finite sets A, B and C;

(i) A U (B ∩ C) = (A U B) ∩ (A U C)

(ii) A ∩ (B U C) = (A ∩ B) U (A ∩ C)

Thus, union and intersection are distributive over intersection and union respectively.

5. De Morgan's Laws: For any two finite sets A and B;

(i) A – (B U C) = (A – B) ∩ (A – C)

(ii) A - (B ∩ C) = (A – B) U (A – C)

De Morgan's Laws can also we written as:

(i) (A U B)' = A' ∩ B'

(ii) (A ∩ B)' = A' U B'

More laws of sets:

(i) A – B = A ∩ B'

(ii) B – A = B ∩ A'

(iii) A – B = A ⇔ A ∩ B = ∅

(iv) (A – B) U B = A U B

(v) (A – B) ∩ B = ∅

(vi) A ⊆ B ⇔ B' ⊆ A'

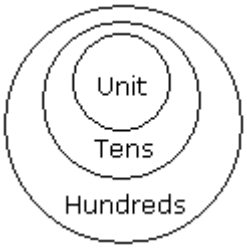
(vii) (A – B) U (B – A) = (A U B) – (A ∩ B)

Also If A and B are two sets then

n(AUB) = n(A) + n(B) – n(A∩B)

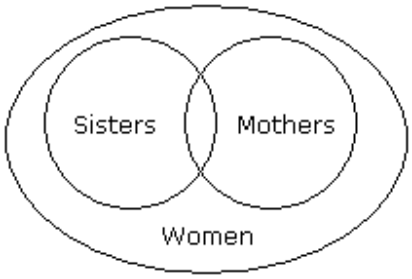
n(AUBUC) = n(A) + n(B) +n(C) – n(A∩C) – n(A∩B) – (B∩C) + n(A∩B∩C)

Example 1: If the first word is related to second word and second word is related to third word. Then they will be shown by diagram as given below.
Unit, Tens, Hundreds



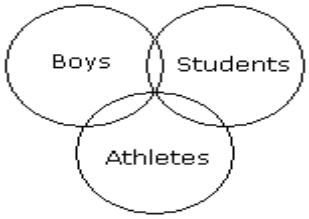
Ten units together make one Tens or in one tens, whole unit is available and ten tens together make one hundreds.

Example 2: If there is some relation between two items and these two items are completely related to a third item they will be shown as given below.
Women, Sisters, Mothers



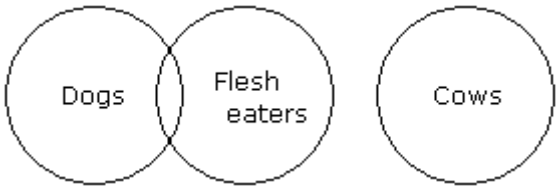
Some sisters may be mothers and vice-versa. Similarly some mothers may not be sisters and vice-versa. But all the sisters and all the mothers belong to women group.

Example 3: All the three items are related to one another but to some extent not completely.
Boys, Students, Athletes



Some boys may be students and vice-versa. Similarly some boys may be athletes and vice-versa. Some students may be athletes and vice-versa.

Example 4: First item is partially related to second but third is entirely different from the first two.
Dogs, Flesh-eaters, Cows



Some dogs are flesh-eaters but not all while any dog or any flesh-eater cannot be cow.

Example 5: If a set A = {3, 6, 9, 10, 13, 18}. State whether the following statements are 'true' or 'false':

(i) $7 \in A$

(ii) $12 \notin A$

(iii) $13 \in A$

(iv) $9, 12 \in A$

(v) $12, 14, 15 \in A$

Solution: (i) $7 \in A$

False, since the element 7 does not belongs to the given set A.

(ii) $10 \notin A$

False, since the element 10 belongs to the given set A.

(iii) $13 \in A$

True, since the element 13 belongs to the given set A.

(iv) $9, 10 \in A$

True, since the elements 9 and 12 both belong to the given set A.

(v) $10, 13, 14 \in A$
False, since the element 14 does not belongs to the given set A.

Example 6: If A {1, 3, 5}, then write all the possible subsets of A. Find their numbers.

Solution: The subset of A containing no elements - { }

The subset of A containing one element each - {1} {3} {5}

The subset of A containing two elements each - {1, 3} {1, 5} {3, 5}

The subset of A containing three elements - {1, 3, 5)

All possible subsets of A are { }, {1}, {3}, {5}, {1, 3}, {3, 5}, {1,5},{1,3,5}

Therefore, number of all possible subsets of A is 8 which is equal 23.

Proper subsets are = {1}, {3}, {5}, {1, 3}, {3, 5}, {1,5}, {1, 3, 5}

Number of proper subsets are 7 = 8 - 1 = 23 – 1

Example 7: Let A and B be two finite sets such that n(A) = 20, n(B) = 28 and $n(A \cup B) = 36$, find $n(A \cap B)$.

Solution: Using the formula $n(A \cup B) = n(A) + n(B) - n(A \cap B)$.

then $n(A \cap B) = n(A) + n(B) - n(A \cup B)$

$= 20 + 28 - 36 = 48 - 36 = 12$

Example 8: In a group of 60 people, 27 like cold drinks and 42 like hot drinks and each person likes at least one of the two drinks. How many like both coffee and tea?

Solution: Let A = Set of people who like cold drinks B = Set of people who like hot drinks Given, $(A \cup B) = 60$ $n(A) = 27$ $n(B) = 42$ then;

$n(A \cap B) = n(A) + n(B) - n(A \cup B)$

$= 27 + 42 - 60$

$= 69 - 60 = 9$

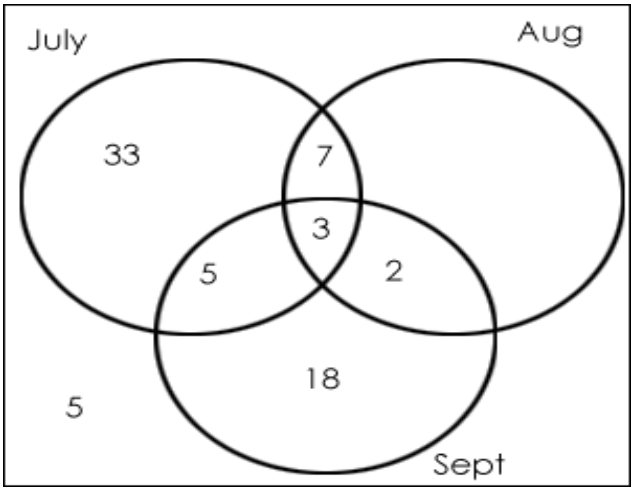
Therefore, 9 people like both tea and coffee.

Example 9: A survey was conducted of 100 people to find out whether they had read recent issues of Golmal, a monthly magazine. The summarized information regarding readership in 3 months is given below:
Only September: 18; September: 28; None of the three months: 24.
September but not August: 23; July: 48; September and July: 8; July and August: 10

What is the number of surveyed people who have read exactly two consecutive issues (out of the three)?

A. 7 B. 9 C. 12 D. 14 E. 17

Solution:



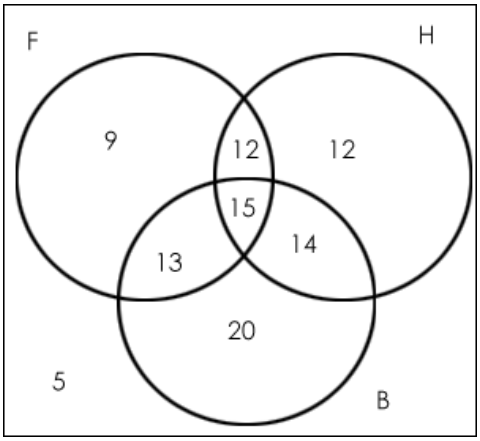
So, exactly two consecutive issues will be in July-August and August-September.
So, the answer is 7+2=9 i.e. option B.

Example 10: In a survey of 500 students of a college, it was found that 49% liked watching football, 53% liked watching hockey and 62% liked watching basketball. Also, 27% liked watching football and hockey both, 29% liked watching basketball and hockey both and 28% liked watching football and basketball both. 5% liked watching none of these games.

How many students like watching all the three games?
Find the ratio of number of students who like watching only football to those who like watching only hockey.
Find the number of students who like watching only one of the three given games.
Find the number of students who like watching at least two of the given games.

Solution: n(F) = percentage of students who like watching football = 49%
n(H) = percentage of students who like watching hockey = 53%
n(B)= percentage of students who like watching basketball = 62%
$n(F \cap H) = 27\%$; $n(B \cap H) = 29\%$; $n(F \cap B) = 28\%$
Since 5% like watching none of the given games so, $n(F \cup H \cup B) = 95\%$.
Now applying the basic formula,
$95\% = 49\% + 53\% + 62\% - 27\% - 29\% - 28\% + n(F \cap H \cap B)$
Solving, you get $n(F \cap H \cap B) = 15\%$.

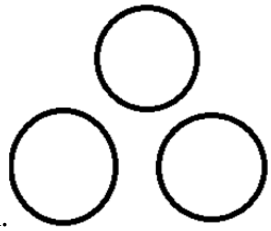
Now, make the Venn diagram as per the information given.
Note: All values in the Venn diagram are in percentage.



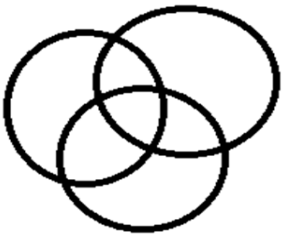
1. Number of students who like watching all the three games = 15 % of 500 = 75.
2. Ratio of the number of students who like only football to those who like only hockey = (9% of 500)/(12% of 500) = 9/12 = 3:4.
3. The number of students who like watching only one of the three given games = (9% + 12% + 20%) of 500 = 205
4. The number of students who like watching at least two of the given games=(number of students who like watching only two of the games) +(number of students who like watching all the three games)= (12 + 13 + 14 + 15)% i.e. 54% of 500 = 270.

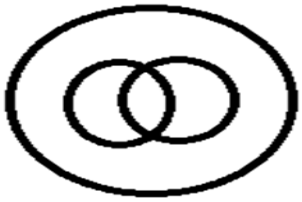
LEVEL - I

Directions(1-10): Which of the following venn diagrams correctly represents relations for the following:

A. 

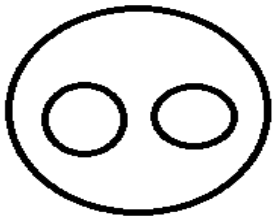
B. 

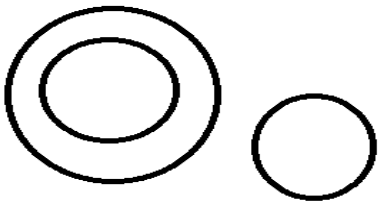
C. 

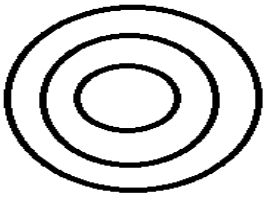
D. 

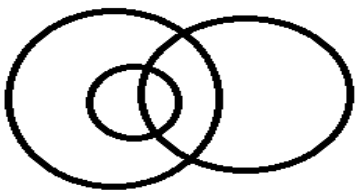
1. Yak, Zebra, Bear
2. Citizens, Educated, Men
3. Dog, Animal, Pet
4. Men, Authors, Teachers
5. Boys, Students, Athletes
6. Whales, Fishes, Crocodiles
7. Tennis fans, Cricket Players, Students
8. Mountains, Forests, Earth
9. Flowers, Cloths, White
10. Examination, Questions and Practice

Directions(11-20): Choose the correct diagram from the below mentioned venn diagrams for the following relations:

A. 

B. 

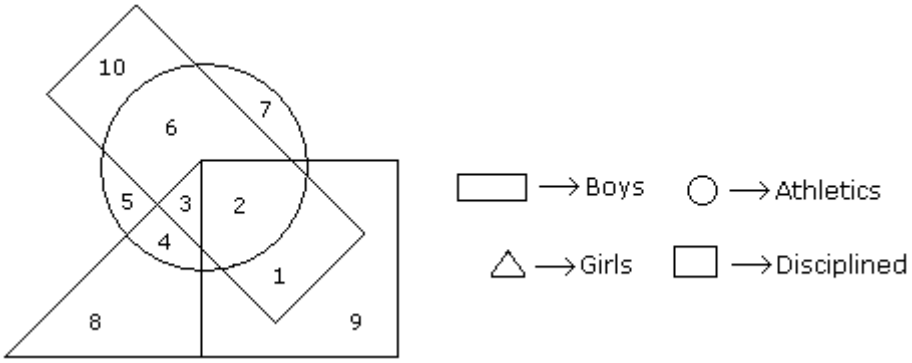
C. 

D. 

11. Diseases, T.B., Scurvy
12. Sun, Moon, Stars
13. Animals, Men, Plants
14. Factory, Product and Machinery
15. Doctors, Lawyers, Professionals
16. Triangles, Four-sided figure, Square
17. Human, girls and boys
18. Musicians, Instrumentalist, Violinists
19. Sparrows, Birds, Mice
20. Elected house, M.P., M.L.A.

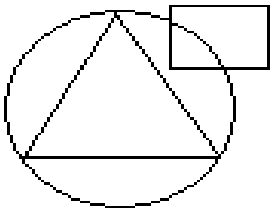
LEVEL - II

1. In the following diagram the boys who are athletic and are disciplined are indicated by which number?



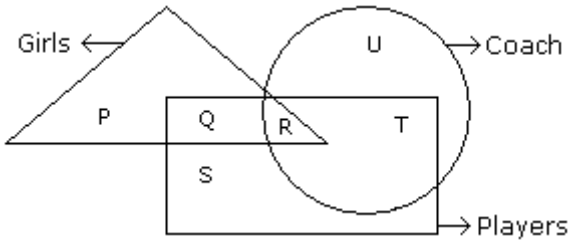
A. 1 B. 2 C. 10 D. 6

2. In an organization of pollution control board, engineers are represented by a circle, legal experts by a square and environmentalist by a triangle. Who is most represented in the board as shown in the following figure ?



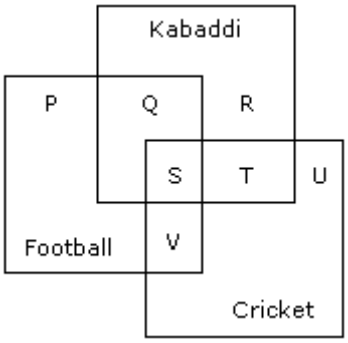
A. Environmentalists
B. Legal Experts
C. Engineers with legal background
D. Environmentalists with Engineering background

3. In the following figure triangle represents ‘girls’, square players and circle-coach. Which part of the diagram represents the girls who are player but not coach?



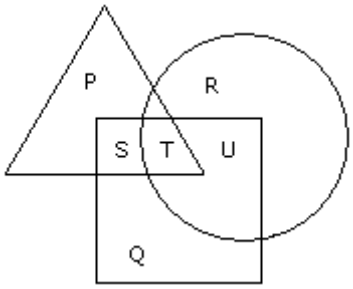
A. P B. Q C. R D. S

4. The diagram given below represents those students who play Cricket, Football and Kabaddi. Study the diagram and identify the students who play all the three games.



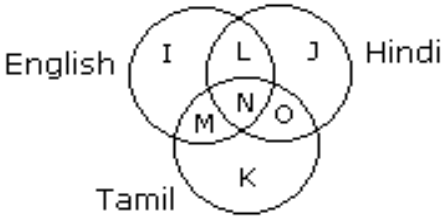
A. P + Q + R B. V + T C. S + T + V D. S

5. In the figure given below, square represents doctors, triangle represents ladies and circle represents surgeon. By which letter the ladies who doctor and surgeon both are represented ?



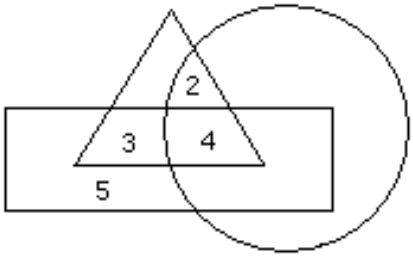
A. U B. T C. S D. P

6. Study the diagram and identify the people who can speak only one language.



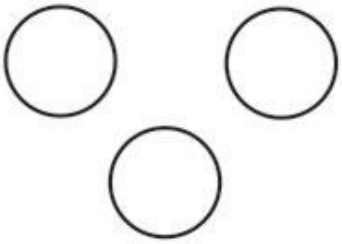
A. L + M + O B. K + J + I C. K D. I

7. In the given figure if Triangle represents healthy people, Square represents old persons and Circle represents men then What is the number of those men who are healthy but not old ?



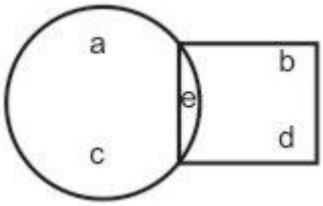
A. 3 B. 4 C. 6 D. 2

8. Which of the following groups of elements given in the alternatives is best represented by the diagram, given below:



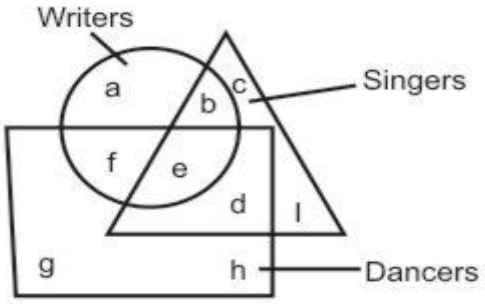
A. Barley, Mustard, Potato
B. Shoes, Garments, Clothes
C. Hand, Body, Feet
D. Bridge, Brick, Building

9. In the diagram given below, the circle represents the students qualified in General Awareness (GA) and the square represents the students qualified in Quantitative Aptitude (QA) test paper. Which of the following represents the students who passed in both the papers?



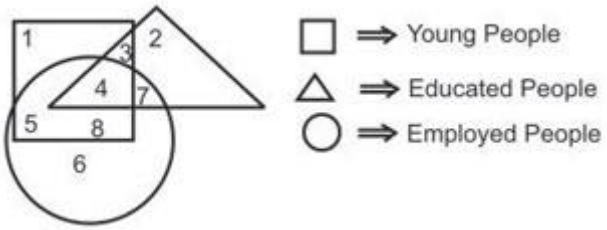
A. a and c B. b and d C. a, b, c, d and e all D. e only

10. In the following Venn-Diagram, find out the letters/ alphabet that represents the writer who can sing as well as dance. Rectangle represents dancers, triangle represents singers and the circle represents the writers.



A. f B. b C. e D. i

11. If square represents young people, triangle represents educated people and circle represents employed people then, which of the following numbers might represent those areas that represent young, uneducated but employed people?



A. 4 B. 5 C. 8 D. 5 and 8

12. In a town of 500 people, 285 read Hindu and 212 read Indian Express and 127 read Times of India, 20 read only Hindu and Times of India and 29 read only Hindu and Indian Express and 35 read only Times of India and Indian express. 50 read no newspaper. Then how many read only one paper?
A. 123 B. 231 C. 312 D. 321

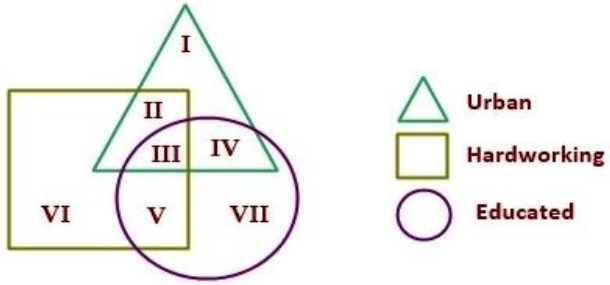
13. Out of 120 students in a school, 5% can play all the three games Cricket, Chess and Carrom. If so happens that the number of players who can play any and only two games is 30. The number of students who can play the Cricket alone is 40. What is the total number of those who can play Chess alone or Carrom alone?
A. 45 B. 44 C. 46 D. 24

Directions(14-15): A college has 63 students studying Political Science, Chemistry and Botany. 33 students study Political Science, 25 Chemistry and 26 Botany. 10 study Political Science and Chemistry, 9 study Botany and Chemistry while 8 study both Political Science and Botany. Same numbers of students study all three subjects as those who learn none of the three.
14. How many students study all the three subjects?
A. 2 B. 3 C. 5 D. 7

15. How many students study only one of the three subjects?
A. 21 B. 30 C. 39 D. 42

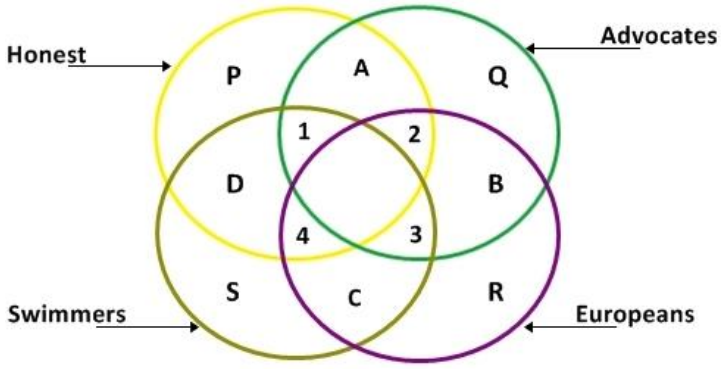
16. In a class,7 students like to play Basketball and 8 like to play Cricket. 3 students like to play on both Basketball and Cricket. How many students like to play Basketball or Cricket or both?
A. 12 B. 13 C. 15 D. 17

17. Which one of the area marked I – VII represents the urban educated who are not hardworking?



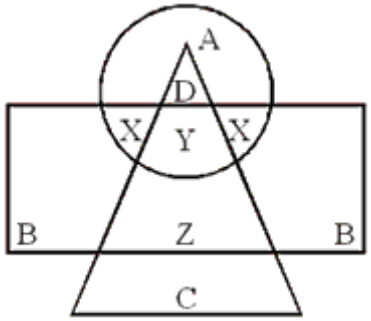
A. IV B. III C. II D. I

18. What does the area marked 1 in the figure given below represent?



A. All honest European swimmers
B. All honest advocates who are swimmers
C. All no-European advocates who are honest swimmers
D. All non-Europeans who are honest swimmers

Directions to Solve (19-20): In the following diagram, the circle represents College Professors, the triangle stands for Surgical Specialists, and Medical Specialists are represented by the rectangle.

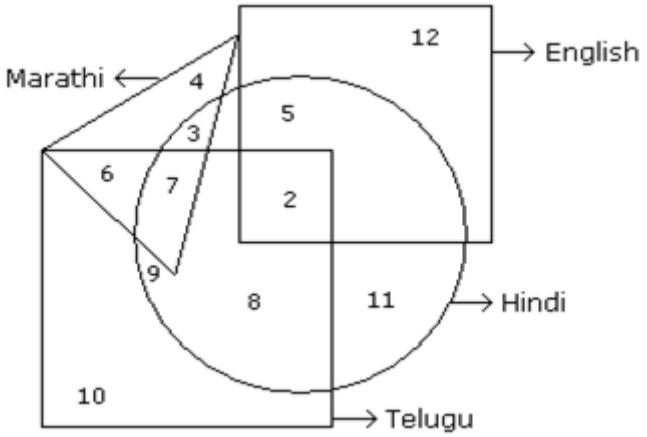


19. College Professors who are also Surgical Specialists are represented by?
A. A B. B C. C D. D

20. B represents?
A. Professors who are neither Medical nor Surgical Specialists
B. Professors who are not Surgical Specialists
C. Medical Specialists who are neither Professors nor Surgical Specialists
D. Professors who are not Medical Specialists

LEVEL - III

Directions to Solve (1-5):
In the following figure small square represents the persons who know English, triangle to those who know Marathi, big square to those who know Telugu and circle to those who know Hindi. In the different regions of the figures from 1 to 12 are given.



1. How many persons can speak English and Hindi both the languages only?
A. 5 B. 8 C. 7 D. 18

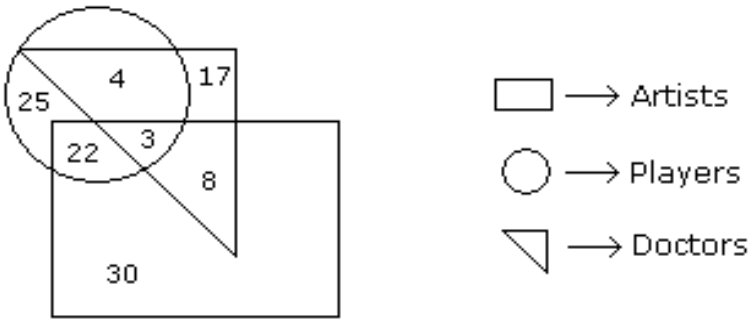
2. How many persons can speak Marathi and Telugu both?
A. 10 B. 11 C. 13 D. None of these

3. How many persons can speak only English ?
A. 9 B. 12 C. 7 D. 19

4. How many persons can speak English, Hindi and Telugu?
A. 8 B. 2 C. 7 D. None of these

5. How many persons can speak all the languages?
A. 1 B. 8 C. 2 D. None

Directions to Solve (6-10): Study the following figure and answer the questions given below.



6. How many doctors are neither artists nor players ?
A. 17 B. 5 C. 10 D. 30

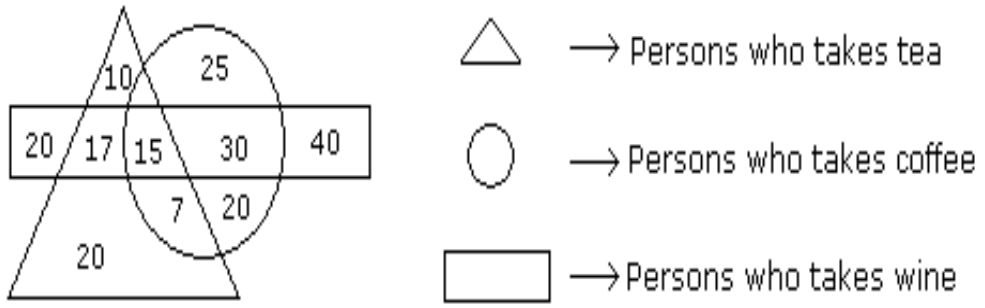
7. How many doctors are both players and artists ?
A. 22 B. 8 C. 3 D. 30

8. How many artists are players ?
A. 5 B. 8 C. 25 D. 16

9. How many players are neither artists nor doctors ?
A. 25 B. 17 C. 5 D. 10

10. How many artists are neither players nor doctors ?
A. 10 B. 17 C. 30 D. 15

Directions to Solve (11-15): Study the diagram given below and answer each of the following questions.



11. How many persons who take tea and wine but not coffee?
A. 20 B. 17 C. 25 D. 15

12. How many persons are there who take both tea and coffee but not wine?
A. 22 B. 17 C. 7 D. 20

13. How many persons take wine ?
A. 100 B. 82 C. 92 D. 122

14. How many persons are there who takes only coffee ?
A. 90 B. 45 C. 25 D. 20

15. How many persons take all the three?
A. 20 B. 17 C. 25 D. 15

Directions to Solve (16-20): In a college, 200 students are randomly selected. 140 like tea, 120 like coffee and 80 like both tea and coffee.

16. How many students like only tea?

A. 20 B. 40 C. 50 D. 60

17. How many students like only coffee?

A. 20 B. 40 C. 50 D. 60

18. How many students like neither tea nor coffee?

A. 20 B. 40 C. 50 D. 60

19. How many students like only one of tea or coffee?

A. 50 B. 70 C. 90 D. 100

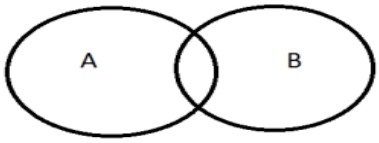
20. How many students like at least one of the beverages?

A. 120 B. 170 C. 180 D. 150

SYLLOGISM

The word 'Syllogism' is also referred to 'Logic'. Syllogism is an important section of logical reasoning and hence, a working knowledge of its rules is required to solve the problems. Two or more statements are given and one is supposed to find out all the possible conclusions from the given statements.
The first step is to make a Venn diagram. Second step is deriving the conclusion. Let's go to all possible concepts. (Concepts = Statements)

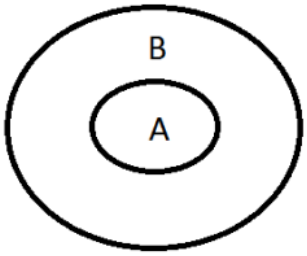
Rule1:
Statement: Some A is B.



Definite Conclusions :
1. Some A is B
2. Some B is A

Possibility Conclusions :
1. All A's are B is a Possibility
2. All B's are A is a Possibility
3. Some A are not B is a possibility
4. Some B are not A is a possibility

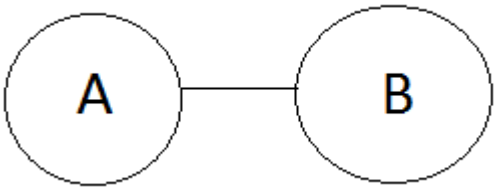
Rule 2:
All A is B



Definite Conclusions :
1. All A is B
2. Some A is B
3. Some B is A

Possibility Conclusions :
1. All B's are A is Possibility
2. Some B's are not A is a Possibility

Rule 3:
No A is B

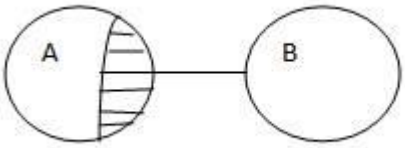


Definite Conclusion :
1. No A is B
2. No B is A

Possibility Conclusions:
No Possibility Conclusion

3. Some A is not B
4. Some B is not A

Rule 4:
Some A's are Not B



Definite Conclusion :
1. Some A's are not B

Possibility Conclusions:
1. Except All A's are B is possibility.
All other possibilities conclusion follows

Shortcut:
All+All=All
All+No=No
All+Some=No Conclusion

Some+All=Some
Some+No= Some Not
Some+Some= No Conclusion

No +All = Some Not (Reversed)
No+Some=Some Not (Reversed)
No+No=No Conclusion
Some Not /Some Not Reversed +Anything = No Conclusion

Points to remember:

- First draw venn diagrams according to the statement
- If the definite conclusion doesn't satisfy the basic diagram then no need to check the possibility diagram
- If the definite conclusion satisfies the basic diagram then it must satisfy all possibility diagrams.
- Possibility conclusion can satisfy any one of the possibility Diagram

Conditions of Either Or (Complementary Pair):
(1) Subject Predicate should be same in both statements
(2) Complimentary pairs i.e. one should be positive and one should be negative
(3) Maximum possibility i.e. maximum diagrams possibility should be covered
(4) Individually both false
(5) relation between subject and predicate should not be clear.
(6) Either or condition not applicable between All and no type sentences.

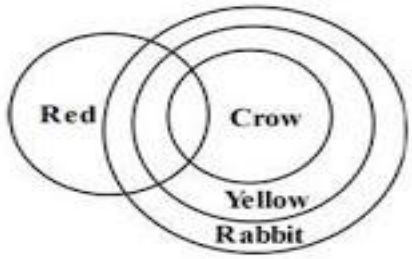
Condition 1: Some + Some Not
Eg: Some A are B + Some A are not B
OR
Some B are A + Some A are not B

Condition 2: Some + No
Eg: Some A is B + No A is B
OR
Some B is A + No A is B

Condition 3: All + Some Not
Eg: All A is B + Some A are not B
Note: All A is B + Some B are not A (is not complementary pair)

Example1:
Statements
Some reds are crows.
All crows are yellows.
All yellows are rabbits.
Conclusions
I. All crows are rabbits.
II. Some yellows are reds.
III. Some reds are rabbits.

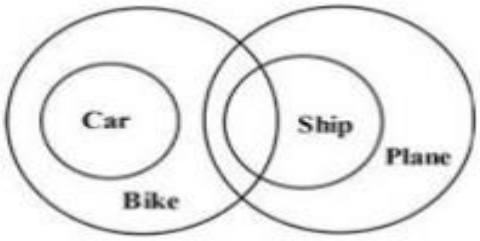
This is the standard representation of all the statements taken together. Now we shall check the conclusions based on this representation.



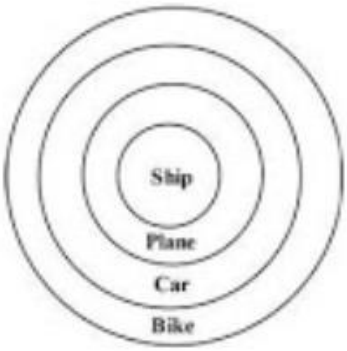
From the diagram, we can see that the circle ‘rabbit’ engulfs the circle ‘crow’. So conclusion I follow. Also, the circles ‘yellow’ and ‘red’ intersect each other. So conclusion II also follows. We can see that the circles ‘rabbit’ and ‘red’ intersect each other. So conclusion III also follows.
Hence all of the given conclusions follow.

Example 2:
Statements
All cars are bikes
Some bikes are ships
All ships are planes
Conclusions
I. At least some planes are bikes.
II. Some bikes are cars.
III. All planes are cars is a possibility.

From the given statements, the standard diagram can be drawn as:



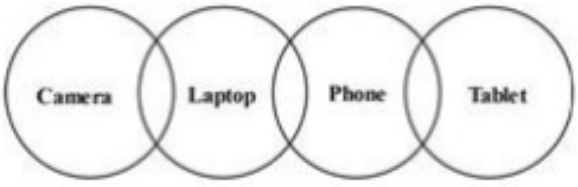
From this, we can say that conclusions I and II follow, but III does not. Conclusion III says all planes are cars is a possibility, it does not mean that it has to be definitely true. So, we can have another representation of the given statements as below:



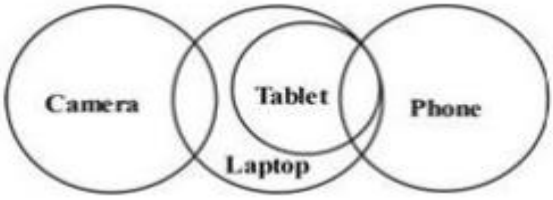
So, even if we have a single case where all planes are car, the conclusion follows. Hence all the conclusions follow.

Example 3:
Statements
Some cameras are laptops.
Some laptops are phones.
Some phones are tablets.
Conclusions
I. At least some tablets are cameras
II. There is a possibility that all tablets are laptops
III. No tablet is a laptop

From the given statements, the standard diagram can be drawn as:



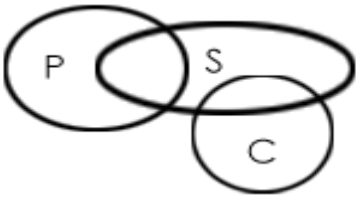
According to this diagram, conclusion III follows.
But there's a conclusion with the word 'possibility'. So we'll check if any such case is possible.
In that case, the diagram would look like:



But in this case, conclusion III does not follow.
Thus either conclusion II or conclusion III follows.

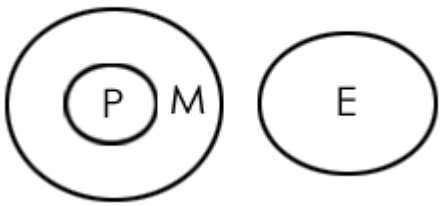
Example 4:
Statements
Some parrots are scissors.
Some scissors are not combs.
Conclusions
Some scissors are parrots.
Some combs are parrots.

Now, in this case, the possible conclusion is: Some scissors are parrots (I to I), but with two particular statements only I is possible.



Therefore, only 1 conclusion is possible. Nothing else is possible.

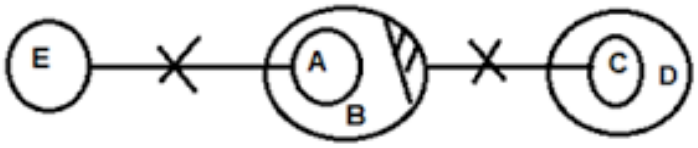
Example 5:
Statements
All prisoners are men.
No man is educated.
Conclusions
All prisoners are uneducated.
Some men are prisoners.



Conclusion I follows from the venn diagram, so conclusion I is true. Conclusion II also follows from the venn diagram, so conclusion II is also true. Therefore, both conclusions are true.

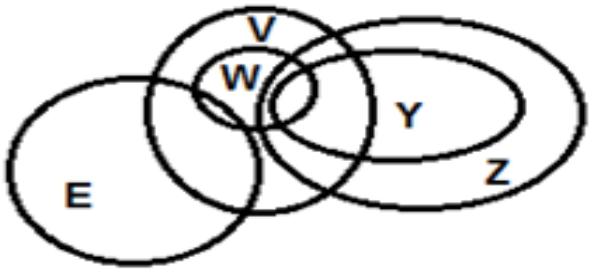
In each question below statements followed by two conclusions which is numbered as I, and II. You have to take the given statements to be true even if they seem to be at variance with commonly known facts. Read all the conclusions and then decide which of the given conclusions logically follows from the given statements, disregarding commonly known facts.
Mark your answer as –
(a) If only conclusion I follows.
(b) If only conclusion II follows.
(c) If either conclusion I or conclusion II follows.
(d) If neither conclusion I nor conclusion II follows.
(e) If both conclusion I and conclusion II follow.

Example 6:
Statements: All A is B. Some B is not C. All C is D. No A is E
Conclusions:
I. All C can be B is a possibility.
II. Some B can be D is a possibility.



From the above venn diagram we can conclude that, in case of possibilities we can say both the conclusions are true.

Example 7:
Statements: All W is V. Some W is Y. All Y is Z. Some W is E
Conclusions:
I. Some E is V
II. Some E is Y



From the above venn diagram we can conclude that, it follows only conclusion I and does not follows second conclusion.

LEVEL - I

Directions for 1 to 20: Given two statements, verify the conclusions and mark the answer as given below.
Mark (a) - If only conclusion I follow
Mark (b) - If only conclusion II follows
Mark (c) - If either conclusion I or II follows
Mark (d) - If neither of the two conclusions follows
Mark (e) - If both conclusions follow

1. Statements:
I. Some cars are trucks II. Some trucks are buses
Conclusions:
I. Some cars are trucks II. Some cars are not trucks

2. Statements:
I. All locks are keys II. No key is a spoon
Conclusions:
I. No lock is spoon. II. No spoon is a lock

3. Statements:
I. All grasses are trees II. No tree is a shrub
Conclusions:
I. No grasses are shrubs II. Some shrubs are grasses

4. Statements:
I. Some boys are thieves II. All thieves are dacoits
Conclusions:
I. Some boys are dacoits II. All dacoits are thieves

5. Statements:
I. Some bottles are pencils II. Some pencils are glasses
Conclusions:
I. No glass is bottle II. Some bottles are glasses

6. Statements:
I. All fans are chairs II. No tables are fans
Conclusions:
I. No tables are chairs II. Some tables are chairs

7. Statements:
I. All women are mothers II. All mothers are sisters
Conclusions:
I. All womens are sisters II. Some women are not sisters

8. Statements:
I. All plays are stories II. Some poems are plays
Conclusions:
I. Some poems are stories II. All stories are poems

9. Statements:
I. All hunters are punters II. Some punters are tigers
Conclusions:
I. Some hunters are tigers II. Some punters are hunters

10. Statements:
I. All boxes are pens II. All pens are dogs
Conclusions:
I. All boxes are dogs II. Some dogs are pens

11. Statements:
I. Some boys are girls II. All girls are cute
Conclusions:
I. Some boys are cute II. All boys are cute

12. Statements:
I. All books are pens II. All pens are pencils
Conclusions:
I. All books are pencils II. Some pens are pencils

13. Statements:
I. Some singers are rockers II. All rockers are dancers
Conclusions:
I. Some rockers are dancers II. No singers are dancers

14. Statements:
I. No bars are coins II. All coins are books
Conclusions:
I. All coins are books II. Some books are not bars

15. Statements:
I. Some copies are desks II. No desks are pen
Conclusions:
I. Some copies are pen II. Some copies are not pen

16. Statements:
I. All boxes are pens II. No dogs are pens
Conclusions:
I. No boxes are dogs II. Some pens are boxes

17. Statements:
I. All apples are oranges II. Some oranges are papayas
Conclusions:
I. Some apples are papayas II. Some papayas are apples

18. Statements:
I. Some dogs are bulls II. No tigers are dogs
Conclusions:
I. No dogs are tiger II. Some bulls are tiger

19. Statements:
I. Some bottles are pencils II. Some pencils are glasses
Conclusions:
I. No glass is bottle II. Some bottles are glasses

20. Statements:
I. All fans are chairs II. No tables are fans
Conclusions:
I. No tables are chairs II. Some tables are chairs

LEVEL - II

Directions (1-5): In each question below are given four statements followed by two conclusions which is numbered as I, and II. You have to take the given statements to be true even if they seem to be at variance with commonly known facts. Read all the conclusions and then decide which of the given conclusions logically follows from the given statements, disregarding commonly known facts.
Mark your answer as –
(A) If only conclusion I follows.
(B) If only conclusion II follows.
(C) If either conclusion I or conclusion II follows.
(D) If neither conclusion I nor conclusion II follows.
(E) If both conclusion I and conclusion II follow.

1. Statements: All A is B. Some B is not C. All C is D. No A is E
Conclusions:
I. All C can be B II. Some B can be D

2. Statements: Some M is N. Some N is P. All P is Z. No Z is X
Conclusions:
I. Some N is Z II. Some N is X

3. Statements: No J is K. Some K is D. Some D is E. No E is F
Conclusions:
I. Some E is K II. Some D is F

4. Statements: All W is V. Some W is Y. All Y is Z. Some W is E
Conclusions:
I. Some E is V II. Some E is Y

5. Statements: Only D is E. No E is F. All F is G. Some G is H
Conclusions:
I. Some G is F II. Some G is not E

Directions (6-10): Question consists of five statements followed by five conclusions. Consider the given statements to be true even if they seem to be at variance with commonly known facts. Read all the conclusions and then decide which of the given conclusions does not logically follow from the given statements using all statements together.

6. Statements: All M are N. All N are C. No D is N. All K are F. Some K are D
Conclusions:
(a) Some K are not N.
(b) Some C can be K.
(c) Some F is C.
(d) No M are D
(e) All N can be K.

7. Statements: All D is E. Some D is P. No P is K. All K are L. Some L are T
Conclusions:
(a) All P can be T
(b) All L can be P
(c) All D can be P
(d) Some E is P
(e) Some T can be K.

8. Statements: Some A is B. Some B is K. All K are T. No M is K. Some M is N
Conclusions:
(a) Some T can be M
(b) All M being T is a possibility
(c) Some K can be M
(d) All M can be B
(e) Some B is A

9. Statements: Some W is X. All X is Y. No Y is T. No T is K. Some K is L.
Conclusions:
(a) All X can be T
(b) All L can be Y
(c) All X can be K
(d) Some Y is W
(e) No K is T.

10. Statements: No P is Q. Some Q is R. Some R is not S. Some S is T. All T is V
Conclusions:
(a) All S can be R
(b) All S can be V
(c) Some S is V
(d) Some R is T
(e) All Q can be V.

Directions (11-20): In each of the questions/set of questions below are given two statements followed by two conclusions numbered I and II. You have to assume everything in the statements to be true even i f they seem to be at variance from commonly known facts and then decide which of the two given conclusions logically follows from the information given in the statement. Give answer
A) if only conclusion I follows.
B) if only conclusion II follows.
C) if either conclusion I or conclusion II follows.
D) if neither conelusion I nor conclusion II follows.
E) if both conclusions I and II follow.

11. Statements:
All rings are circles.
All squares are rings.
No ellipse is a circle.

Conclusions:
I. Some rings being ellipses is a possibility.
II. At least some circles are squares.

12. Statements:
No house is an apartment.
Some bungalows are apartments.
Conclusions:
I. No house is a bungalow.
II. All bungalows are houses.

13. Statements:
Some gases are liquids.
All liquids are water.
Conclusions:
I. All gases being water is a possibility.
II. All such gases which are not water can never be liquids.

14. Statements:
All minutes are seconds.
All seconds are hours.
No second is a day.
Conclusions:
I. No day is an hour.
II. At least some hours are minutes.

15. Statements:
Some teachers are professors.
Some lecturers are teachers.
Conclusions:
I. All teachers as well as professors being lecturers is a possibility.
II. All those teachers who are lecturers are also professors.

16. Statements:
Some teachers are professors.
Some lecturers are teachers.
Conclusions:
I. No professor is a lecturer.
II. All lecturers being professors is a possibility.

17. Statements:
Some squares are circles.
Some circles are rectangles.
Conclusions:
I. At least some rectangles are squares.
II. No rectangle is a square.

18. Statements:
No office is a palace.
All colleges are palaces.
Conclusions:
I. All palaces are colleges.
II. No college is an office.

19. Statements:
All mountains are rivers.
All rivers are lakes.
Conclusions:
I. All mountains are lakes.
II. At least some lakes are rivers.

20. Statements:
Some wins are losses.
All trophies are losses.
Conclusions:
I. All trophies are wins.
II. All losses are trophies.

LEVEL - III

Directions (1-5): Question consists of Six statements followed by five conclusions. Consider the given statements to be true even if they seem to be at variance with commonly known facts. Read all the conclusions and then decide which of the given conclusions does not logically follow from the given statements using all statements together.

1. Statements: Some file is copy. All copy is kite. Some kite is joy. All joy is orange. All orange is toy. All file is black.
Conclusions:
(a)Some kite is black
(b)Some kite is orange
(c)Some kite is toy
(d) Some copy is black
(e) Some toy is copy

2. Statements: Some mango is banana. No banana is apple. All grapes are apple. Some grapes are tree. No tree is green. All green is good.
Conclusions:
(a)No grapes is banana.
(b)Some mango is not apple.
(c)All tree being good is a possibility
(d)Some apple is tree
(e)Some good are tree.

3. Statements: Some court is justice. No justice is faith. All faith is quick. No quick is decision. Some decision are jury. All jury is delay.
Conclusions:
(a)Some court is not faith
(b)All justice being quick is possibility.
(c)No faith is delay.
(d)No faith is decision
(e)Some delay is decision

4. Statements: All heart is green. Some green is fire. All fire is tree. No fire is Lion. All mobile is lion. Some mobile is network.
Conclusions:
(a)Some tree is green
(b)Some network is lion
(c)Some tree is not lion
(d)Some green is not lion
(e)Some Heart is fire

5. Statements: All time is unit. Some time is rock. All rock is stone. No stone is door. All door is car. No car is bus.
Conclusions:
(a)Some time is stone.

(b)Some unit is stone.
(c)No rock is door.
(d)No stone is car.
(e)Some car is not bus.

Directions (6-10): In each of the questions below are given four statements followed by four conclusions numbered I, II, III & IV. You have to take the given statements to be true even if they seem to be at variance with commonly known facts. Read all the conclusions and then decide which of the given conclusions logically follows from the given statements disregarding commonly known facts.

6. Statements:
Some trains are cars.
All cars are branches.
All branches are nets.
Some nets are dresses.
Conclusions:
I. Some dresses are cars.
II. Some nets are trains.
III. Some branches are trains.
IV. Some dresses are trains.
(a) Only I and III follow
(b) Only II and III follow
(c) Only I and IV follow
(d) Only II, III and IV follow
(e) None of these

7. Statements:
Some pencils are kites.
Some kites are desks.
All desks are jungles.
All jungles are mountains.
Conclusions:
I. Some mountains are pencils.
II. Some jungles are pencils.
III. Some mountains are desks.
IV. Some jungles are kites.
(a) Only I and III follow
(b) Only I, II and III follow
(c) Only III and IV follow
(d) Only II, III and IV follow
(e) None of these

8. Statements:
All papers are clips.
Some clips are boards.
Some boards are lanes.
All lanes are roads.
Conclusions:
I. Some roads are boards.
II. Some lanes are clips.
III. Some boards are papers.

IV. Some roads are clips.
(a) Only I and II follow
(b) Only I and III follow
(c) Only I, II and III follow
(d) Only II, III and IV follow
(e) None of these

9. Statements:
All pens are clocks.
Some clocks are tyres.
Some tyres are wheels.
Some wheels are buses.
Conclusions:
I. Some buses are tyres.
II. Some wheels are clocks.
III. Some wheels are pens.
IV. Some buses are clocks.
(a) None follows
(b) Only I follows
(c) Only II follows
(d) Only III follows
(e) Only IV follows

10. Statements:
All stones are hammers.
No hammer is a ring.
Some rings are doors.
All doors are windows.
Conclusions:
I. Some windows are stones.
II. Some windows are rings.
III. No window is a stone.
IV. Some rings are stones.
(a) Only I follows
(b) Only II follows
(c) Only III follows
(d) Only either I or III follows
(e) Only either I or III and II follow

Directions (11-15): Read all the conclusions and then decide which of the given conclusions logically follows from the given statements disregarding commonly known facts.

11. Statements: Some red are blue. Some blue are grey.
All grey are white. No white is black.
Conclusions: I. No black is grey.
II. Some blue are white.
III. Some black are red.
IV. No black is red.
(a) Only I and II follow
(b) Only either III or IV follows
(c) Only I and either III or IV follow
(d) Only I, II and either III or IV follow
(e) None of these

12. Statements: All red are white. Some white are pink.
Some pink are yellow. No yellow is blue.
Conclusions: I. No blue is pink.
II. Some pink are red.
III. Some blue are red.
IV. Some blue are pink.
(a) None follows
(b) Only either I or IV follows
(c) Only I follows
(d) Only III & IV follow
(e) All follow

13. Statements: Some blue are black. Some black are grey.
All grey are red. All red are pink.
Conclusions: I. Some red are black.
II. Some pink are black.
III. Some pink are grey.
IV. Some red are blue.
(a) Only I & II follow
(b) Only II & III follow
(c) Only I, II and III follow
(d) All follow
(e) None of these

14. Statements: All green are pink. Some pink are black.
Some black are blue. All blue are white.
Conclusions: I. Some black are white.
II. Some blue are pink.
III. Some pink are green.
IV. No green is white.
(a) None follows
(b) Only I and III follows
(c) Only III follows
(d) Only either I or II follows
(e) None of these

15. Statements: Some blue are white. All white are red.
All red are pink. Some pink are yellow.
Conclusions: I. Some yellow are red.
II. Some yellow are white.
III. All red are white.
IV. Some yellow are blue.
(a) None follows
(b) Only I follows
(c) Only II follows
(d) Only II & III follow
(e) None of these

Directions (16-18): In each of the questions below are given three statements followed by two conclusions numbered I and II. You have to take the given statements to be true even if they seem to be at variance with commonly known facts. Read all conclusions and then decide which of the given conclusions logically follows from the given statements, disregarding commonly known facts. Give answer-
(a) If only conclusion I follows
(b) If only conclusion II follows
(c) If only conclusion I or II follows

(d) If neither conclusion I nor II follows
(e) If both conclusions I and II follows

16. Statements: Some poor are rich. All rich are doctors. Some intelligent are doctors.
Conclusions: I. At least some poor are intelligent.
II. All intelligent being rich is a possibility.

17. Statements: Some poor are rich. All rich are doctors. Some intelligent are doctors.
Conclusions: I. All intelligent being doctors is a possibility.
II. Some poor are doctors.

18. Statements: All fans are bulbs. All wires are holders. Some wires are bulbs.
Conclusions: I. At least some fans are wires.
II. All holders being fans is a possibility.

Directions (19-20) : In each of the questions below are given three statements followed by two conclusions numbered I and II. You have to take the given statements to be true even if they seem to be at variance with commonly known facts. Read all the conclusions and then decide which of the given conclusions logically follows from the given statements, disregarding commonly known facts.
Give answer-
a) If only conclusion I follow.
b) If only conclusion II follows.
c) If either conclusion I or conclusion II follows.
d) If neither conclusion I nor conclusion II follows.
e) If both conclusions I and II follow.

19. Statements:
No fan is a light. All boards are fans. All fans are wires.
Conclusions:
I. All boards being wires is a possibility.
II. No boards is a light.

20. Statements:
No oil is a bread. No pot is a tap. All breads are pots.
Conclusions:
I. Some oils are not pots.
II. All taps being breads is a possibility.

PERMUTATION AND COMBINATION

These two words permutation and combination, at the initial level are very confusing and are generally used interchangeably. So let's take them one by one and understand them.

Combination

Combination means from the given certain objects (may be alike or different) selecting one or more objects. Combination can also be replaced by the words – selection, collection or committee.

For Example: Combination of top 5 cricket players from the team of 11 players is the selection of 5 players (in any order).

The sequence in which they have to be selected is not important here. Also we can say that the order of selection is not the concern in the case of combination

Permutation

Permutation means arrangement of the alike or different objects taken some or all at a time. So we can observe the word 'arrangement' used in the definition of permutation. Here the arrangement means selection as well as ordering. That means the order in which the objects are selected have also been taken care of in this case.

For Example: The number of 5 digit numbers which can be formed using the digits 0, 1, 2, 3, 4 and 5. In this example, we just not have to select the 5 digits out of given 6 digits but also have to see the number of possible cases for the different arrangement. So the numbers 34251, 21034, 42351 are all different cases.

Factorial

In Mathematics, the factorial is represented by the symbol '!' i.e. if we have to write 5 factorial, so it will be written as 5! So in general factorial of any positive number n will be represented by n! Mathematically,

$$n! = \begin{cases} 1 & if\ n = 0 \\ (n-1)!\ n & if\ n > 0 \end{cases}$$ where n is any positive integer.

Similarly we can say for any positive integer 'n'

n! = n x (n – 1) x (n – 2) x …….. x 3 x 2 x 1.

i.e. the product of all the positive integers less than or equal to n.

Just see below for the factorial of few frequently used numbers.

0! = 1

1! = 1

2! = 2 x 1 = 2

3! = 3 x 2 x 1 = 6

4! = 4 x 3 x 2 x 1 = 24

5! = 5 x 4 x 3 x 2 x 1 = 120 and so on.

Difference between Permutation and Combination

1. The very basic difference in permutation and combination is the order of the objects considered. In combination, the order is not considered at all while for permutation it is must. So the permutation is the ordered arrangement while the combination is the unordered selection.

From the three alphabets A, B and C, the permutation of these 3 letters will be ABC, ACB, BAC, BCA, CBA and CAB. While the combination of 3 letters will be just (A, B, C).

2. Permutation gives the answer to the number of arrangements while the combination explains the possible number of selections.

3. Permutation of a single combination can be multiple but the combination of a single permutation is unique (considering all at a time).

Fundamental Principles of Counting

Multiplication Theorem

If an operation can be performed in m different ways and following which a second operation can be performed in n different ways, then the two operations in succession can be performed in m*n different ways.

Example 1: In a class of 5 girls and 4 boys, the teacher has to select 1 girl AND 1 boy. In how many ways can she make her selection?

Solution: Here the teacher has to choose the pair of a girl AND a boy
For selecting a boy she has 8 options/ways AND that for a girl 10 options/ways
For 1st boy ------- any one of the 5 girls ---------- 5 ways
For 2nd boy ------- any one of the 5 girls ---------- 5 ways….
For 4th boy ------- any one of the 5 girls ---------- 5 ways
Total number of ways 5 + 5 + 5 + 5 = 20 ways OR 5*4 = 20 ways.

Addition Theorem

If an operation can be performed in m different ways and a second independent operation can be performed in n different ways, either of the two operations can be performed in (m + n) ways.

Example 2: In a class of 5 girls and 4 boys, the teacher has to select either a girl OR a boy. In how many ways can he make his selection?

Solution: Here the teacher has to choose either a girl OR a boy (Only 1 student)
For selecting a boy he has 4 options/ways OR that for a girl 5 options/ways.
The first of these can be performed in 4 ways and the second in 5 ways.
Therefore, by fundamental principle of addition either of the two jobs can be performed in (4 + 5) ways.
Hence, the teacher can make the selection of a student in 9 ways.

Permutations (Arrangement)

The different arrangements which can be made by taking some or all of the given things or objects at a time is called Permutation. In permutations the order of arrangement is taken into account; When the order is changed, a different permutation is obtained.

Eg. A number of permutations of three elements a, b, c by taking three at a time will be abc, acb, bac, bca, cab, cba.

The formula of calculating number of permutations is ${}^{n}P_{r}$ i.e. number of all permutations all n distinct things taken r at a time ($0 \leq r \leq n$) = ${}^{n}P_{r} = n! / (n-r)!$

A permutation of n taken r at a time is defined as an ordered selection of r out of the n items. The total number of all the possible permutations is denoted as:

nPr = n! (n−1)(n-2) ….. (n-r+1)! Where $n \geq r$

Note: This is valid only when repetition is not allowed.

Example 3: In how many different ways would you arrange 5 persons on 3 chairs?

Solution: Here n= 5 and r= 3

Arranging 5 persons on 3 chairs is same as filling 3 places when we have 5 different things at our disposal. The first place can be filled in 5 ways (by Fundamental Principal of Multiplication).

After filling it, there are 4 things left and anyone of these 4 things can be used to fill second place. So the second place can be filled in 4 ways.

Hence by fundamental principal of multiplication, the first two places can be filled in 5 * 4 ways.

Now, there are 3 things left, so that the third place be filled in 3 ways
So the total number of arrangements will be 5 * 4 * 3.

As per the formula of permutation it will be 5P3 = 5! / (5−3)! = 5! / 2! = 5 X 4 X 3

Rule 1: Continuing in this manner we can say that number of permutations (or arrangements) of n things taken all at a time will be n!
e.g. In how many ways can 6 persons stand in a queue? Here n= r=6 so total number of permutations will be 6! = 720

Example 4: How many four digit numbers are there with distinct digits n = 10 i.e. 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 and r = 4
Solution: Total Number of arrangements = 10! / (10−4)!
But these arrangements also include those numbers which have zero (0) at thousand's place.
Such numbers are not four digit numbers and hence need to be excluded.
When 0 is fixed at thousand's place, we have to arrange remaining 9 digits by taking 3 at a time in a way 9! / (9−3)!
Hence total number of four digit numbers = 10! / (10−4)! – 9! / (9−3)! = 5040 – 504 = 4536

Example 5: There are 6 periods in each working day of a school. In how many ways can one arrange 5 subjects such that each subject is allowed at least one period?
Solution: 5 periods can be arranged in 6 periods in ${}^{6}P_{5}$ ways.
Now one period is left and it can be allotted to any one of the 5 subjects. So number of ways in which remaining one period can be arranged is 5.
Total Number of arrangements = ${}^{6}P_{5}$ X 5 = 3600

Permutations under Certain Conditions
1. Permutations of n different objects taken r at a time, when a particular object is to be always included in each arrangement is r. ${}^{(n-1)}P_{(r-1)}$
2. Permutations of n different objects taken r at a time, when a particular object is never taken in each arrangement is ${}^{(n-1)}P_{r}$

Example 6: Make all arrangement of letters of the word PENCIL so that
i) N is always next to E
ii) N and E are always together.
Solution: i) Let's keep EN together and consider it one letter.
Now we have 5 letters which can be arranged in a row in ${}^{5}P_{5}$ = 5! = 120 ways.

ii) Solve as above. Just keep in mind that now E and N can interchange their places in 2! ways. So total arrangements = 5! X 2! = 240

Rule 2: Permutation of n different things taken r at a time when repetition is allowed
n x n x n x…. r times = n^{r} ways

Rule 3: The number of mutually distinguishable permutations of n things, taken all at a time, of which p are alike of one kind, q are alike of second such that p + q = n, is n! / (p! x q!)

Rule 4: The total number of permutations of n things, of which p are alike of one kind, q are alike of second kind and remaining all are distinct, is n! / (p! x q!)

Example 7: How many words would you form with the letters of the word MISSISSIPPI ?
Solution: Total letters =11, S = 4 times, I = 4 times, P = 2 times
So, total number of permutations = 11! / (4! X 4! X 2!) = 34650

Rule 5: Sum of all the numbers which can be formed by using the n digits without repetition is: (n-1)! * (sum of the digits) * (111…..n times).
Rule 6: Sum of all the numbers which can be formed by using the n digits (repetition being allowed) is: n^{n-1}*(sum of the digits)*(111…..n times).

Example 8: Find the sum of all the numbers that can be formed with the digits 2, 3, 4, and 5 taken all at a time.
(i) If repetition is not allowed
(ii) If repetition is allowed
Solution: i) (sum of digits) (n-1)! (11111….. n times)
= (2 + 3 + 4 + 5) (4-1)! (1111) = 93324
ii) n^{n-1}*(sum of the digits)*(111…..n times)
= 64 * (2 + 3 + 4 + 5) * 1111 = 896 * 1111 = 995456

Circular permutations
If the objects are arranged in a circular manner this distinguished ordering no longer exists, that is, there is no "first element" in the arrangement, any element can be considered as the start of the arrangement. The arrangements of objects in a circular manner are called circular permutations.
The number of circular permutations of a set S with n elements is (n - 1)!
The basic difference between linear permutations and circulations is that every linear arrangement has a beginning and an end, but there is nothing like beginning or end in a circular permutation. Thus, in circular permutations, we consider one object as fixed and the remaining objects are arranged as in case of linear arrangement.

Rule 7: There are certain arrangements in which clockwise and anticlockwise arrangements are not distinct. e.g. arrangements of beads in a necklace, arrangement of flowers in a garland etc.
In such cases number of circular permutations of n distinct objects is 1/2 * [(n-1)!]

Example 9: i) Arrange 6 persons around a circular table.
ii) In how many of these arrangements will two particular persons be next to each other?
Solution: i. (6-1)! = 5! = 120
ii. Consider two particular persons as one person. We have 5 persons in all.
These 5 persons can be seated around a circular table in (5-1)! = 4! Ways.
But two Particular persons can be arranged between themselves in 2! Ways
So Total number or arrangements = 4! X 2! = 48

Combinations (Selection)

Each of the different selections or groups which are made by taking some or all of a number of things or objects at a time is called combination. ${}^{n}c_{r} = n! / \{r! (n-r)!\}$

Suppose there are three objects namely x, y, and z. Now we are asked to calculate the combinations (selections) of these objects taking 2 at a time.

x y, y z, x z = Total 3 Combinations.

Note the important difference here. In later case we did not differ between x y and y x, as we did in the first case. This is the only difference between Permutations and Combinations.

In Combinations we find different ways of choosing r objects from n given objects while in Permutations we find different ways of choosing r objects from n given objects and ways of arranging these r objects.

The formula of permutations (${}^{n}P_{r}$) itself says first selection (${}^{n}c_{r}$) and then arrangement (r!) i.e.

$${}^{n}P_{r} = {}^{n}c_{r} * r!$$

Other Important Rules:

i. If ${}^{n}c_{x} = {}^{n}c_{y}$, then either x = y or x + y = n

ii. ${}^{n}c_{r} = {}^{n}c_{(n-r)}$

iii. ${}^{n}c_{n} = 1$

iv. ${}^{n}c_{0} = 1$

v. Selection of any number of things out of n distinct things. $= 2^{n}$

vi. Selection of any number of things out of n identical things = n+1

Zero ball selected = 1 way

One ball selected = 1 way

Two balls selected =1 way

Total ways = (2 +1) = 3 ways.

vii. Number of diagonals of n sided polygon = ${}^{n}c_{2} - n = n(n-3) / 2$

viii. Number of straight lines formed by n points of which r are collinear = ${}^{n}c_{2} - {}^{r}c_{2} + 1$

ix. Number of triangles formed by n points of which r are collinear = ${}^{n}c_{3} - {}^{r}c_{3}$

x. With m parallel lines intersected by n parallel lines number of parallelograms can be formed = ${}^{m}c_{2} * {}^{n}c_{2} = m\ n(m-1)(n-1) / 4$

Example 10: Find the number of ways in which Asha can eat sweets out of 5 distinct sweets at a party?

Solution: Number of ways Asha can or cannot eat sweets at a party out of 5 distinct sweets available at party = $2^{5} = 32$

Corollary: When zero selections are not allowed i.e. If Asha has asked to select at least one sweet = $2^{n} - 1 = 2^{5} - 1 = 31$

Example 11: 3 men and 3 women are candidates for 2 vacancies. A voter has to vote for 2 candidates. In how many ways can one cast her/his vote?

Solution: In all there are 6 candidates and a voter has to vote for any 2 of them.

So he can select 2 candidates from 6 candidates in ${}^{6}C_{2}$ ways

= 6! / 4! X 2! = (6X5) / 2 = 5 X 3 = 15

Example 12: In how many ways can a cricket eleven be chosen out of a batch of 15 players if

Solution: i) There is no restriction on the selection = ${}^{15}C_{11}$

ii) A Particular Player is always chosen = ${}^{14}C_{10}$

iii) A Particular Player is never chosen = ${}^{14}C_{11}$

Division and Distribution

A. Distinct Objects

Case 1: Number of ways in which n distinct things can be divided into r unequal groups containing a_1, a_2, a_3, ..., a_r things (different number of things in each group and the groups are unmarked, i.e., not distinct)

$= {}^{n}C_{a1} \times {}^{(n-a_1)}C_{a2} \times \ldots \times {}^{(n-a_1-a_2-\ldots-a_{r-1})}C_{ar}$

$= n!/(a_1!\, a_2!\, a_3! \ldots a_r!)$

(Here $a_1 + a_2 + \ldots + a_r = n$)

Case 2: Number of ways in which n distinct things can be distributed among r persons such that some person get a_1 things, another person get a_2 things . . . . and similarly someone gets a_r things (each person gets different number of things)

= Number of ways in which n distinct things can be divided into r unequal groups containing a_1, a_2, a_3, ..., a_r things (different number of objects in each group and the groups are numbered, i.e., distinct)

$= n!\, r!/(a_1!\, a_2!\, a_3! \ldots a_r!)$

(Here $a_1 + a_2 + a_3 + \ldots + a_r = n$)

Case 3: Number of ways of grouping dissimilar things

In how many ways can you divide 4 different things (say a, b, c and d) into two groups having two things each? Your answer would be to select two things out of the four and two would be left behind for selecting next 2, i.e. ${}^{4}C_2 \times {}^{2}C_2 = 6$. But are there really 6 ways?

Actually, there are only 3 ways of dividing the four things into two groups of two. When you selected two things out of the four, the things selected were ab, ac, ad, bc, bd, and cd. But the last three groups are already formed when you select the first three groups, i.e. when you select ab, you automatically get cd. When you select ac, you automatically get bd, and so on.

If 'n x a' different things are divided into n groups of 'a' things each, the number of ways of grouping $= {}^{na}C_a \times {}^{(na-a)}C_a \times {}^{(na-2a)}C_a \times \ldots\ldots\ldots \times {}^{2a}C_a = na!/\{n!\,(a!)^n\}$

Case 4: Number of ways in which m × n distinct things can be distributed equally among n persons (each person gets a number of things)

= Number of ways in which m × n distinct things can be divided equally into n groups (each group will have m things and the groups are numbered, i.e., distinct) $= (n \times a)!\,/\,(a!)^n$

B. Identical Objects

Case 1: Number of ways of Non negative integral distribution of n identical items among r persons i.e. each one of whom can receive 0,1,2 or more items (≤n) $= {}^{(n+r-1)}C_{(r-1)}$

Case 2: Number of ways in which n identical things can be distributed among r persons, each one of whom can receive at least 1 item (≤n) i.e. positive integral distribution $= {}^{(n-1)}C_{(r-1)}$

LEVEL – I

1. In how many ways can the letters of the word SPECIAL be arranged using all the letters?
A. 5010 B. 5020 C. 5040 D. 5080

2. In how many ways can the letters of the word SPECIAL be arranged using only 4 letters at a time?
A. 810 B. 850 C. 830 D. 840

3. How many distinguishable permutations of the letters in the word BANANA are there?
A. 720 B. 120 C. 60 D. 360

4. How many ways a 6 member team can be formed having 3 men and 3 ladies from a group of 6 men and 7 ladies?
A. 700 B. 720 C. 120 D. 500

5. The value of ${}^{75}C_2$ is:
A. 2775 B. 2315 C. 1215 D. 1675

6. What is the number of possible words that can be made using the word "EASYQUIZ" such that the vowels always come together?
A. 120 B. 720 C. 2880 D. 4320

7. What is the number of possible words that can be made using the word "QUIZ" such that the vowels never come together?
A. 8 B. 12 C. 16 D. 24

8. How many words can be made from the word "APPLE" using all the alphabets with repetition and without repetition respectively?
A. 1024, 60 B. 60, 1024 C. 1024, 1024 D. 240, 1024

9. In how many different ways can the alphabets of the word 'SCORING' be arranged so that the vowels always come together?
A. 120 B. 720 C. 240 D. 1440

10. In how many ways can the alphabets of the word 'DERAIL' be arranged so that the vowels come at the odd positions only?
A. 12 B. 18 C. 24 D. 36

11. In how many ways can an interview panel of 3 members be formed from 3 engineers, 2 psychologists and 3 managers if at least 1 engineer must be included?
A. 30 B. 15 C. 46 D. 45

12. Out of 7 boys and 4 girls, how many queues of 3 boys and 2 girls can be formed?
A. 120 B. 25200 C. 24800 D. 1440

13. A box contains 2 red coins, 3 green coins and 4 blue coins. In how many ways can 3 coins be chosen such that at least one coin is green?

A. 16 B. 32 C. 64 D. 128

14. Out of 6 engineers and 4 doctors, how many groups of 4 professionals can be formed such that at least 1 engineer is always there?

A. 129 B. 109 C. 229 D. 209

15. From a group of 9 different books, 4 books are to be selected and arranged on a shelf. How many arrangements are possible?

A. 3023 B. 3024 C. 3025 D. 3026

16. How many different combinations are possible if 10 numbers are grouped five at a time?

A. 252 B. 242 C. 232 D. 282

17. There are 3 questions in a question paper. If the questions have 4, 3 and 2 solutions respectively, find the total number of solutions.

A. 22 B. 23 C. 24 D. 28

18. In how many ways can a party of 4 men and 4 women be seated at a circular table so that no two women are adjacent?

A. 576 B. 144 C. 36 D. 16

19. There are 5 boys and 5 girls. In how any ways they can be seated in a row so that all the girls do not sit together?

A. 5! X 5! B. 10! - 5! X 5! C. 6! X 5! D. 10! - 6! X 5!

20. In a party, every guest shakes hand with every other guest. If there were total of 66 handshakes in the party, find the number of persons present in the party?

A. 12 B. 33 C. 4376 D. 66

LEVEL – II

1. How many 4-digit numbers can be formed from the digits 1, 2, 3, 4, 5, 6 and 7 which are divisible by 5 when none of the digits are repeated?

A. 120 B. 35 C. 24 D. 720

2. In how many ways can 20 boys and 18 girls make a queue such that no two girls are together?

A. $20!* {}^{20}C_{18}$ B. $20!* {}^{20}P_{18}$ C. $20!* {}^{21}C_{18}$ D. $20!* {}^{21}P_{18}$

3. In how many ways can 3 prizes be distributed among 4 boys,

i) When no boy gets more than one prize?

A. 12 B. 64 C. 24 D. 56

ii) When a boy may get any number of prizes?

A. 12 B. 64 C. 24 D. 56

iii) When no boy gets all the prizes?

A. 64 B. 63 C. 12 D. 60

4. i. How many different arrangements can be made by using all the letters in the word MATHEMATICS?

A. $11! / (2!)^3$ B. $11! / (2!)^2$ C. 11! D. $11! / (2!)^3 \times 5!$

ii. How many of the words begin with I from the word MATHEMATICS?

A. $11! / (2!)^2$ B. $10! / (2!)^3$ C. 10! D. $10! / (2!)^3 \times 4!$

5. In how many ways can 6 similar toffees be distributed to 4 boys, such that every boy receives at least one toffee?

A. 10 B. 18 C. 5 D. 13

6. How many 3 digit numbers can be formed whose unit digit is a prime number? (Repetition is allowed).

A. 500 B. 450 C. 400 D. 360

7. If there are 4 roads from A to B, 5 roads from B to C and 3 roads from C to D, then how many combinations of roads are there from A to D via B and C?

A. 48 B. 60 C. 72 D. 24

8. There are 10 steamers plying between Kerala and Mumbai. In how many ways can a person go from Kerala to Mumbai and return by a different steamer?

A. 100 B. 90 C. 19 D. 99

9. In how many different ways a person can choose his dress among 3 shirts, 4 jeans and 5 trousers? A dress is formed by either a shirt and a jean or a shirt and a trouser.

A. 17 B. 60 C. 27 D. 12

10. Find the number of ways in which a six-lettered code can be formed using the English alphabets

and the digits from 0 to 9 such that the first three places and the last three places are to be filled with the numerals and alphabets respectively.
A. $9(10)^2(26)^3$ B. $(234)^3$ C. $(260)^3$ D. $(36)^6$

11. The letter of the word LABOUR are permuted in all possible ways and the words thus formed are arranged as in a dictionary. What is the rank of the word LABOUR?
A. 275 B. 251 C. 240 D. 242

12. A standard deck of cards consists of 4 suits (spades, hearts, diamonds, and clubs) of 13 cards each. In how many ways can 5-card hands be dealt that include 3 diamonds and 2 cards from other suits?
A. 211906 B. 211916 C. 211926 D. 211936

13. The Indian Cricket team consists of 16 players. It includes 2 wicket keepers and 5 bowlers. In how many ways can a cricket eleven be selected if we have to select 1 wicket keeper and at least 4 bowlers?
A. 1011 B. 1092 C. 2092 D. 3092

14. A class photograph has to be taken. The front row consists of 6 girls who are sitting. 20 boys are standing behind. The two corner positions are reserved for the 2 tallest boys. In how many ways can the students be arranged?
A. 9!x1440 B. 10!x1440 C. 11!x1440 D. 18!x1440

15. How many words can be formed from the letters of the word "ENGINEERING", so that vowels always come together?
A. 4200 B. 420 C. 7! X 5! D. 7! X 5! / (2! X 3!)

16. Ram goes to a fruit-seller who is left with 4 apples, 5 bananas and 6 guavas only. In how many ways can Ram make a purchase from the shop?
A. 120 B. 209 C. 119 D. 210

17. How many three-digit numbers divisible by 3 may be formed out of the digits 2, 3, 4 and 6 if the digits are not to be repeated?
A. 24 B. 6 C. 12 D. 36

18. In how many ways 6 girls out of 12 girls in a class may be selected for a team so that 2 particular girls (captain and vice-captain) are always there?
A. 360 B. 210 C. 24 D. 120

19. How many 5 digit numbers can be formed by using the first 9 natural numbers, such that all the 5 digits of the number formed are in ascending order and at the hundredth place the digit is ‘5’?
A. 34 B. 31 C. 37 D. 36

20. In how many different ways can five players A, B, C, D and E be arranged in a line such that A is always to the left of B?
A. 60 B. 120 C. 48 D. 24

21. Find the number of squares on a chessboard?
A. 204 B. 100 C. 1296 D. 64

22. A telegraph has 5 arms and each arm has four distinct positions including the position of rest. What is the total number of signals that can be made?

A. 511 B. 625 C. 19 D. 1023

23. Out of the twenty six letters of the alphabet, in how many ways can a five letter word (with all letters distinct) be made if three letters of the word must be L, A and W?

A. 50,400 B. 30,360 C. 2,42,880 D. None of these

24. How many five-digit numbers divisible by 11 can be formed out of 3, 4, 5, 6 and 7 if the digits are not to be repeated?

A. 10 B. 12 C. 13 D. None of these

25. If ${}^{n}C_4 = 70$, find n.

A. 5 B. 8 C. 4 D. 7

26. If $5 \times {}^{n}P_3 = 4 \times {}^{n+1}P_3$ find n?

A. 10 B. 12 C. 11 D. 14

27. There are 12 yes or no questions. How many ways can these be answered?

A. 4096 B. 2048 C. 1024 D. 144

28. If ${}^{6}P_r = 360$ and ${}^{6}C_r = 15$ find r?

A. 3 B. 5 C. 4 D. 6

29. How many diagonals can be drawn in a pentagon?

A. 5 B. 7 C. 8 D. 10

30. The number of the triangles that can be formed joining the angular points of decagon, is

A. 30 B. 45 C. 90 D. 120

LEVEL – III

1. There are 5 floating stones on a river. A man wants to cross the river. He can move either 1 or 2 steps at a time. Find the number of ways in which he can cross the river?
A. 11 B. 12 C. 13 D. 14

2. How many integers, greater than 999 but not greater than 4000, can be formed with the digits 0, 1, 2, 3 and 4, if repetition of digits is allowed?
A. 366 B. 356 C. 376 D. 396

3. Each of the 11 letters A, H, I, M, O, T, U, V, W, X and Z appears same when looked at in a mirror. They are called symmetric letters. Other letters in the alphabet are asymmetric letters. How many three letter computer passwords can be formed (no repetition allowed) with at least one symmetric letter?
A. 12170 B. 12870 C. 12970 D. 12470

4. In how many ways can the letters of the word 'EQUIDISTANT' be arranged such that the vowels and consonants do not change their relative positions in the given word?
A. 11! B. 11! / 2!*2! C. 6!*5! / 2!*2! D. 11! / 4!

5. In how many ways can a student attempt at least one question in a multiple choice question paper having 10 questions such that half of the questions have three answer options and the remaining questions have two answer options for question?(each question has only one correct answer)
A. 12^5 B. $12^5 - 1$ C. $6^5 - 1$ D. 6^5

6. How many 4-digit numbers, with each digit being distinct, can be formed using natural numbers less than 5 such that the digit at unit's place is less than the sum of the digits at ten's and hundred's place?
A. 12 B. 24 C. 16 D. 18

7. In how many ways can we select a pair of prime numbers from the first 50 natural numbers such that the sum of the two numbers is a composite number?
A. 99 B. 210 C. 8 D. 14

8. Tanvi tore out several successive pages from a book. The number of the first page he tore out was 183, and it is known that the number of the last page is written with the same digits in some order. How many pages did Tanvi tear out of the book? (Both sides of the pages are numbered)
A. 138 B. 231 C. 68 D. 190

9. A frog wants to reach to the top of a staircase that has 7 steps. In how many ways it can reach to the top of the staircase, if at least 3 jumps are required to reach the top and the frog is initially on the ground? (the frog doesn't jump back).
A. 102 B. 57 C. 63 D. 28

10. If the letters of the word CHASM are rearranged to form 5 letter words such that none of the word repeat and the results arranged in ascending order as in a dictionary what is the rank of the word CHASM?
A. 32 B. 42 C. 52 D. 62

11. There are 6 boxes numbered 1,2,...6. Each box is to be filled up either with a red or a green ball in such a way that at least 1 box contains a green ball and the boxes containing green balls are consecutively numbered. The total number of ways in which this can be done is?
A. 11 B. 31 C. 21 D. 51

12. If the total numbers of terms in the expansion of $(x-y-2z)^n$ is 45. Then value of n is
A. 8 B. 9 C. 7 D. 22

13. The maximum number of different permutations of 5 letters of the word 'MORADABAD' is
A. 2150 B. 3640 C. 2930 D. 2250

14. The number of selections of four letters from the letters of the word ASSASSINATION is:
A. 72 B. 71 C. 66 D. 52

15. The letters of the word SURITI are written in all possible orders and these words are written out as in a dictionary. Then the rank of the word SURITI is
A. 236 B. 245 C. 307 D. 315

16. The sum of all numbers greater than 1000 formed by using digits 1, 3, 5, 7 no digit being repeated in any number is
A. 72, 215 B. 83, 911 C. 106, 656 D. 114, 712

17. a,b,c,d and e are five natural numbers. Find the number of ordered sets (a,b,c,d,e)possible such that a+b+c+d+e=64.
A. $^{64}C_5$ B. $^{63}C_4$ C. $^{65}C_4$ D. $^{63}C_5$

18. In how many ways can 15 people be seated around two round tables with seating capacities of 7 and 8 people?
A. 15!8! B. 7!×8! C. $^{15}C_8 \times 6! \times 7!$ D. $2 \times {}^{15}C_7 \times 6! \times 7!$

19. A five-digit number is formed using digits 1, 3, 5, 7 and 9 without repeating any one of them. What is the sum of all such possible numbers?
A. 6666600 B. 6666660 C. 6666666 D. None of these

20. A man has 9 friends, 4 boys and 5 girls. In how many ways can he invite them, if there have to be exactly 3 girls in the invitees?
A. 320 B. 160 C. 80 D. 200

PROBABILITY

Probability or chance is a common term used in day-to-day life. For example, we generally say, 'it may rain today'. This statement has a certain uncertainty.
Probability is quantitative measure of the chance of occurrence of a particular event. Probability deals with the analysis of random phenomena. It is a way of assigning every event a value between zero and one, with the requirement that the event made up of all possible results is assigned a value of one.
Experiment: An operation which can produce some well-defined outcome, is an experiment.
Random Experiment: If each trial of an experiment is conducted under identical conditions, the outcome is not unique, but may be of any possible outcome then such experiment is known as random experiment.
Example: Tossing of a fair coin, throwing of an unbiased die.
Sample Space: The set of all possible outcomes in Random Experiment is known as Sample space, provided no two or more of these outcomes can occur simultaneously and exactly one of these outcomes must occur whenever the experiment is conducted.
Example: When a die is thrown, any one of the numbers 1, 2, 3, 4, 5, 6 can come up.
Therefore, sample space: S = {1, 2, 3, 4, 5, 6}
Sample Point or Event Point: Each element of the sample spaces is called a sample point or an event point.
Example: When a die is thrown, the sample space is S = {1, 2, 3, 4, 5, 6} where 1, 2, 3, 4, 5 and 6 are the sample points.
Event: Any subset of a sample space is called an event.

Types of Events

i] Simple Event or Elementary Event: An event is called a Simple Event if it is a singleton subset of the sample space S.
Example: When a coin is tossed, then the sample space is S = {H, T}
Then A = {H} occurrence of head and
B = {T} occurrence of tail are called Simple events.
ii] Mixed Event or Compound Event or Composite Event: A subset of the sample space S which contains more than one element is called a mixed event or when two or more events occur together, their joint occurrence is called a Compound Event.
Example: When a dice is thrown, then the sample space is S = {1, 2, 3, 4, 5, 6}
Then let A = {2, 4 6} is the event of occurrence of even and B = {1, 2, 4} is the event of occurrence of exponent of 2 are Mixed events.
Compound events are of two types:
(a) Independent Events or Mutually Independent Events: Two or more events are said to be independent if occurrence or non-occurrence of any of them does not influence the occurrence or non-occurrence of the other events.
Example: Let bag contains 3 Red and 2 Black balls. Two balls are drawn one by one with replacement.
Let A is the event of occurrence of a red ball in first draw.
B is the event of occurrence of a black ball in second draw.
Then probability of occurrence of B has not been affected if A occurs before B. As the ball has been replaced in the bag and once again we have to select one ball out of 5(3R + 2B) given balls for event B.

(b) **Dependent Events:** Two or more events are said to be dependent if occurrence or non-occurrence of any of them influence the occurrence or non-occurrence of the other events.
Example: Two cards have been drawn from the deck of 52 cards without replacing the first one back.
Let A is the event of occurrence of getting first card as king
B is the event of occurrence of getting second card as queen.
Then probability of occurrence of B has been affected if A occurs before B.
iii] Certain and impossible events: If S is a sample space, the both S and null set φ both are events. S is called certain event and φ is called an impossible event.
iv] Equally Likely Events: The given events are said to be equally likely, if none of them is expected to occur in preference of the other.
v] Exhaustive events: In probability theory, system of events is called exhaustive, if at least one of the events of the system occurs. Eg: If a coin is tossed then Head and Tails forms exhaustive set of events.
vi] Mutually Exclusive events: Two or more events are said to be mutually exclusive if one of them occurs, others cannot occur. Thus if two or more events are said to be mutually exclusive, if not two of them can occur together.
Hence, A1, A2, A3, ..., An are mutually exclusive if and only if $A_i \cap A_j = \phi$, for $i \neq j$
Example: When a coin is tossed the event of occurrence of a head and the event of occurrence of a tail are mutually exclusive events because we cannot have both head and tail at the same time.

Probability of Occurrence of an Event
Let S be the same space, then the probability of occurrence of an event E is denoted by P(E) and is defined as
P(E) = n(E) / n(S) =number of elements in E / number of elements in S
P(E) = number of favourable (particular cases) / total number of cases

- Probability of the null event is 0.
- Probability of a sure event is 1.
- $0 \leq P(E) \leq 1$
- $\sum P(E) = 1$

Example 1: When a die is tossed, sample space S = {1, 2, 3, 4, 5, 6}
Let A is an event of occurrence of an odd number
And B is an event of occurrence of a number greater than 4
A = {1, 3, 5} and B = {5, 6}
P(A) = Probability of occurrence of an odd number = n(A) / n(S)
= 3/6 = 1/2
P(B) = Probability of occurrence of a number greater than 4 = n(B) / n(S)
= 2/6 = 1/3

Given below are some important theorems that might help us in formulating solutions to the problems.

- If A is a subset of B then, $P(A) \leq P(B)$.
- $P(\varphi) = 0$.
- P (S) = 1.
- $P(A^c) = 1 - P(A)$.
- P (B-A) = P [B-(A□ B)] = P(B)-P (A□ B).
- P (A□ B) = P(A) + P (B) – P (A□ B). [Addition Theorem]

- P (A□ B) = P(A) + P (B) when P (A□ B) = φ.
- P (A□ B□ C) = P(A) + P (B) + P (C) – P (A□ B)– P (B□ C)– P (C□ A) + P(A□ B□ C).

Conditional Probability: Let S be the sample space. Let A and B be any two events. A ≠ φ. Then, probability of the event B, if A have already been occurred, is called conditional probability of B restricted to the occurrence of A. It is represented as P(A/B). Thus, the probability of the event B restricted to the occurrence of the event A is the same as the probability of event A□ B while A is considered as sample space.

P(B/A) = n(A□ B)/ n(A) = P(A□ B)/P(A)
P(A□B) = P(A) * P(B/A)
If A ≠ φ & B ≠ φ then,
P(A□B) = P(A)*P(B/A) = P(A)*P(A/B).

Example 2: A card is drawn from the well-shuffled pack of card. What is the probability that the card drawn is of heart given that it is a king?

Solution: Let A = card is of heart and B = card is king
Therefore, P(A) = 13/52; P(B) = 4/52
Now P(A□ B) = 1/52
Thus, P(A/B) = P (King of heart) = P(A□ B)/P(A)
= (1/52) / (4/52) = 1/4

Independent Events: Two events are said to be independent if the probable occurrence or non-occurrence of any one is not affected by occurrence or non-occurrence of the other i.e. two events A and B are independent if

P(A/B) = P(A/B^c) = P(A)
Or, P(B/A) = P(B/A^c) = P(B)
Or, P(A□B) = P(A) * P(B)

Note: Three events A, B, and C are independent if
P(A□ B□ C) = P(A). P(B). P(C)
Three events A, B, and C are pairwise independent if
P(A□ B) = P(A). P(B),
P(B□ C) = P(B). P(C) &
P(A□ C) = P(A). P(C)

Relation between Independent and Mutually Exclusiveness of two events

- If two events A ≠ φ and B ≠ φ are independent, then they are not mutually exclusive.
- If two events A ≠ φ and B ≠ φ are mutually exclusive, then they are not independent.

Example 3: A problem is given to three students whose chances of solving it are ½, ⅓, and ¼ respectively. What is the probability that the problem will be solved?

Solution: Let there be three events A, B, and C where
A is the event when student with probability ½ solves the question,
where B is the event when student with probability ⅓ solves the question,
where C is the event when student with probability ¼ solves the question,
Therefore, P(A) = ½, P(B) = ⅓, and P(C) = ¼
Now let A^c, B^c and C^c is the event of not solving question by the students respectively.
P(A^c) = 1-½ = ½, P(B^c) = 1-⅓ = ⅔, P(C^c) = 1-¼ = ¾
Therefore, P(A^c□ B^c□ C^c) = P(A^c). P(B^c). P(C^c) = ½.⅔.¾ = ¼

Hence, the P [problem will be solved] = 1 – P [none solves the problem]

= 1 – ¼ = ¾

Bayes' Theorem: Suppose A_1, A_2, … An, are mutually exclusive and exhaustive set of events. Thus, they divide the sample into n parts and the event B occurs. Then the conditional probability that A_i happen given that B has happened is given by

$$P(A/B) = P(A_i).\ P(B/A_i)$$
$$\sum^{n} i=1\ P(A_i).\ P(B/A_i)$$

Example 4: An urn B1 contains 2 white and 3 black balls and another urn B2 contains 3 white and 4 black balls. One urn is selected at random and a ball is drawn from it. If the ball drawn is found black, find the probability that the urn chosen was B1.

Solution: Let E1, E2 denote the vents of selecting urns B1 and B2 respectively.

Then P(E1) = P(E2) = 1/2.

Let B denote the event that the ball chosen from the selected urn is black .

Then we have to find P(E1/B).

By hypothesis P(B/E1) = 3/5 and P(B/E2) = 4/7

By Bayes theorem P(E1/B) = P(E1)P(B/E1) / P(E1)P(B/E1)+P(E2)P(B/E2)

= (1/2∗3/5) / (1/2∗3/5+1/2∗4/7)

= 21/41

Binomial Probability distribution

A binomial experiment is a probability experiment which satisfies the following requirements.

1. Each trial can have only two outcomes. These outcomes can be considered as either success or failure.
2. There must be a fixed number of trials.
3. The outcomes of each trial must be independent of each other.
4. The probability of a success must remain the same for each trial.

In a binomial experiment, The probability of achieving exactly r successes in n trials can be given by

$$P\ (r \text{ successes in } n \text{ trials}) = ({}^{n}C_{r}) * p^{r} * q^{n-r}$$

where p = probability of success in one trial

q = 1 - p = probability of failure in one trial

${}^{n}C_{r} = n! / r!(n-r)!$

Odds of an event

Let E be an event associated with a random experiment. Let x outcomes are favourable to E and y outcomes are not favourable to E, then

Odds in favour of E are x:y , i.e., x/y

Odds against E are y:x , i.e., y/x

P (E (in favor)) = x / x+y

P (E^{c} (against)) = y / x+y

Example 5: What are the odds in favour of and against getting a 1 when a die is rolled?

Let E be an event of getting 1 when a die is rolled

Outcomes which are favourable to E, x=1

Outcomes which are not favourable to E, y=5

Odds in favour of getting 1 = x/y = 1/5

Odds against getting 1 = y/x = 5/1

LEVEL – I

1. Determine the probability that a digit chosen at random from the digits 1, 2, 3, …12 will be odd.
A. 1/2 B. 1/9 C. 5/9 D. 4/9

2. A dice is thrown, what is the probability that the number obtained is a prime number.
A. 1/6 B. 1/8 C. 1/2 D. 1/3

3. A card is drawn from a pack of 52 cards. What is the probability that the card is a Queen?
A. 1/52 B. 1/4 C. 1/16 D. None of these

4. Determine the probability that a number chosen at random from the digits 1, 2, 3, ……., 10 will be a multiple of 4.
A. 1/4 B. 1/3 C. 1/5 D. 1/2

5. Two brother X and Y appeared for an exam. Let A be the event that X is selected and B is the event that Y is selected. The probability of A is 1/7 and that of B is 2/9. Find the probability that both of them are selected.
A. 1/63 B. 2/35 C. 2/63 D. 9/14

6. Determine the probability that a digit chosen at random from digits 1, 2, 3, ….. 13 will be even.
A. 1/2 B. 1/9 C. 5/9 D. 6/13

7. A coin is tossed four times, if H = head and T = tail, what is the probability of the tosses coming up in the order HTHH?
A. 3/16 B. 1/16 C. 5/16 D. 7/16

8. Find the probability of throwing a total of 8 in a single throw with two dice.
A. 1/36 B. 5/36 C. 25/36 D. 12/36

9. An urn contains 6 red, 5 blue and 2 green marbles. If 2 marbles are picked at random, what is the probability that both are red?
A. 6/13 B. 5/26 C. 5/13 D. 7/26

10. Four dice are thrown simultaneously. Find the probability that all of them show the same face.
A. 1/216 B. 1/36 C. 4/216 D. 3/216

11. Two dice are thrown, what is the probability that both the dices are not having the same number.
A. 1/4 B. 5/6 C. 1/9 D. 1/12

12. A die is thrown. Let A be the event that the number obtained is greater than 3. Let B be the event that the number obtained is less than 5. Then P (AUB) is
A. 2/5 B. 3/5 C. 0 D. 1

13. A five-digit number is formed by using digits 1, 2, 3, 4 and 5 without repetition. What is the probability that the number is divisible by 4?
A. 1/5 B. 5/6 C. 4/5 D. None of these

14. A bag contains 5 red and 3 green balls. Another bag contains 4 red and 6 green balls. If one ball drawn from each bag. Find the probability that one ball is red and one is green.
A. 19/20 B. 17/20 C. 8/10 D. 21/40

15. A speaks truth in 75% of cases and B in 80% of cases. In what percent of cases are they likely to contradict each other in narrating the same event?
A. 35% B. 5% C. 45% D. 22.5%

16. A bag contains 6 white and 4 black balls .2 balls are drawn at random. Find the probability that they are of same colour.
A. 1/2 B. 7/15 C. 8/15 D. 1/9

17. In a charity show tickets numbered consecutively from 101 through 350 are placed in a box. What is the probability that a ticket selected at random (blindly) will have a number with a hundredth digit of 2?
A. 0.285 B. 0.40 C. 100/249 D. 99/250

18. A man and his wife appear in an interview for two vacancies in the same post. The probability of husband's selection is (1/7) and the probability of wife's selection is (1/5). What is the probability that only one of them is selected?
A. 2/7 B. 1/7 C. 3/4 D. 4/5

19. What is the probability of getting 53 Mondays in a leap year?
A. 1/7 B. 3/7 C. 2/7 D. 1

20. In a class, there are 15 boys and 10 girls. Three students are selected at random. The probability that 1 girl and 2 boys are selected, is:
A. 21/46 B. 1/5 C. 3/25 D. 1/50

LEVEL – II

1. Two cards are drawn in succession from a pack of 52 cards, without replacement. What is the probability, that the first is a Queen and the second is a Jack of a different suit?
A. 1/52 B. 1/13 C. 4/13 D. 1/221

2. One ticket is selected at random from 50 tickets numbered 0, 01, 02, ……, 49. Then, the probability that the sum of the digits on the selected ticket is 8, given that the product of these digits is zero equals.
A. 1/14 B. 1/7 C. 5/14 D. 1/50

3. It is given that the events A and B are such that P(A) = 1/4 , P(A|B) = 1/2 and P(B|A) = 2/3. Then P(B|A) = 2/3. Then P(B) is
A. 1/2 B. 1/6 C. 1/3 D. 2/3

4. A pair of fair dice is thrown independently three times. The probability of getting a total of exactly 9 twice is
A. 1/729 B. 8/9 C. 8/729 D. 8/243

5. A bag contains 12 white and 18 black balls. Two balls are drawn in succession without replacement. What is the probability that first is white and second is black?
A. 18/145 B. 18/29 C. 36/135 D. 36/145

6. The odds against an event are 5:3 and the odds in favour of another independent event are 7:5. Find the probability that at least one of the two events will occur.
A. 52/96 B. 69/96 C. 71/96 D. 13/96

7. If the chance that a vessel arrives safely at a port is 9/10 then what is the chance that out of 5 vessels expected at least 4 will arrive safely?
A. $14\times9^4 / 10^5$ B. $15\times9^5 / 10^4$ C. $14\times9^3 / 10^4$ D. $14\times9^6 / 10^5$

8. Derek throws three dice in a special game. If he knows that he needs 15 or higher in this throw to win, then find the chance of his winning the game.
A. 5/54 B. 17/216 C. 13/216 D. 15/216

9. An urn contains 6 red, 5 blue and 2 green marbles. If three marbles are picked at random, what is the probability that at least one is blue?
A. 28/143 B. 115/197 C. 28/197 D. 115/143

10. Four cards are drawn at random from a pack of 52 plating cards. Find the probability of getting all the four cards of the same suit.
A. 13/270725 B. 91/190 C. 178/20825 D. 44/4165

11. There are four hotels in a town. If 3 men check into the hotels in a day then what is the probability that each checks into a different hotel?
A. 6/7 B. 1/8 C. 3/8 D. 5/9

12. Two teams Arrogant and Overconfident are participating in a cricket tournament. The odds that team Arrogant will be champion is 5 to 3, and the odds that team Overconfident will be the champion is 1 to 4. What are the odds that either Arrogant or team Overconfident will become the champion?
A. 3 to 2 B. 5 to 2 C. 6 to 1 D. 33 to 7

13. A box contains 100 balls, numbered from 1 to 100. If three balls are selected at random and with replacement from the box, what is the probability that the sum of the three numbers on the balls selected from the box will be odd?
A. 1/2 B. 3/4 C. 3/8 D. 1/8

14. A bag contains 3 white balls and 2 black balls. Another bag contains 2 white and 4 black balls. A bag and a ball are picked random. The probability that the ball will be white is:
A. 7/11 B. 7/30 C. 5/11 D. 7/15

15. I forgot the last digit of a 7-digit telephone number. If 1 randomly dials the final 3 digits after correctly dialling the first four, then what is the chance of dialling the correct number?
A. 1/1001 B. 1/1000 C. 1/999 D. 1/990

16. In his wardrobe, Dexter has three trousers. One of them is black the second is blue, and the third brown. In his wardrobe, he also has four shirts. One of them is black and the other 3 are white. He opens his wardrobe in the dark and picks out one shirt and one trouser pair without examining the colour. What is the likelihood that neither the shirt nor the trouser is black?
A. 1/12 B. 1/2 C. 1/4 D. 1/6

17. A man can hit a target once in 4 shots. If he fires 4 shots in succession, what is the probability that he will hit his target?
A. 175/256 B. 1/256 C. 81/256 D. 1

18. The letters B,G,I,N and R are rearranged to form the word 'Bring'. Find its probability:
A. 1/120 B. 1/54 C. 1/24 D. 1/76

19. Abhishek has 9 pairs of dark blue socks and 9 pairs of black socks. He keeps them all in the same bag. If he picks out three socks at random, then what is the probability that he will get a matching pair?
A. 1 B. $2\times{}^{9}C_{2}\times{}^{9}C_{1}$ / ${}^{18}C_{3}$ C. ${}^{9}C_{3}\times{}^{9}C_{1}/{}^{18}C_{3}$ D. None of these

20. Four boys and three girls stand in queue for an interview. The probability that they stand in alternate positions is:
A. 1/17 B. 1/34 C. 1/35 D. 1/68

LEVEL – III

1. Two aeroplanes I and II bomb a target in succession. The probabilities of I and II scoring a hit correctly are 0.3 and 0.2, respectively. The second plane will bomb only if the first misses the target. The probability that the target is hit by the second plane, is

A. 0.06 B. 0.14 C. 0.32 D. 0.7

2. Two urns contain 5 white and 7 black balls and 3 white and 9 black balls respectively. One ball is transferred to the second urn and then one ball is drawn from the second urn. Find the probability that the first ball transferred is black, given that the ball drawn is black?

A. 13/23 B. 11/23 C. 14/23 D. 7/23

3. A bag contains 10 balls numbered from 0 to 9. The balls are such that the person picking a ball out of the bag is equally likely to pick anyone of them. A person picked a ball and replaced it in the bag after noting its number. He repeated this process 2 more times. What is the probability that the ball picked first is numbered higher than the ball picked second and the ball picked second is numbered higher than the ball picked third?

A. 72/100 B. 3/25 C. 4/5 D. 1/6

4. There are three similar boxes, containing

(i). 6 black and 4 white balls

(ii). 3 black and 7 white balls

(iii). 5 black and 5 white balls, respectively.

If you choose one of the three boxes at random and from that particular box picks up a ball at random, and find that to be black, what is the probability that the ball picked up from the second box?

A. 14/30 B. 3/14 C. 7/30 D. 7/14

5. If an integer n is to be chosen at random from the integers 1 to 96, inclusive, what is the probability that n(n+1)(n+2) will be divisible by 8?

A. 1/4 B. 3/8 C. 1/2 D. 5/8

6. A bag contains blue and red balls. Two balls are drawn randomly without replacement. The probability of selecting a blue and then a red ball is 0.2. The probability of selecting a blue ball in the first draw is 0.5. What is the probability of drawing a red ball, given that the first ball drawn was blue?

A. 0.4 B. 0.2 C. 0.1 D. 0.5

7. A die is rolled thrice. What is the probability that the sum of the rolls is atleast 5?

A. 1/216 B. 1/6 C. 3/216 D. 212/216

8. Out of all the 2-digit integers between 1 and 100, a 2-digit number has to be selected at random. What is the probability that the selected number is not divisible by 7?

A. 13/90 B. 12/90 C. 78/90 D. 77/90

9. There are 10 pair of socks in a cupboard from which 4 individual socks are picked at random. The probability that there is at least one pair is:

A. 195/323 B. 99/323 C. 198/323 D. 185/323

10. In a purse there are 30 coins, twenty one-rupee and remaining 50-paise coins. Eleven coins are picked simultaneously at random and are placed in a box. If a coin is now picked from the box, find the probability of it being a rupee coin?

A. 4/7 B. 1/2 C. 2/3 D. 5/6

11. In 2 bags, there are to be put together 5 red and 12 white balls, neither bag being empty. How must the balls be divided so as to give a person who draws 1 ball from either bag-
(i) the least chance of drawing a red ball ?
(ii) the greatest chance of drawing a red ball ?

A. 5/32, 5/8 B. 5/32, 1/2 C. 2/3, 5/8 D. 5/6, 1/2

12. In a zoo, there are 1 billion monkeys. Probability that a monkey has seen a banyan tree is 0.6. Prob. that monkey has seen a mango tree is 0.65. What is the minimum percentage of monkeys in the zoo who have seen both the trees?

A. 25% B. 39% C. 40% D. 60%

13. There are 5 different boxes named a,b,c,d,e. there are two balls red and green.a box is to be filled with one ball either red or blue. what is the probability that no two blue balls are adjacent to each other.

A. 11/32 B. 1/2 C. 13/32 D. 15/16

14. Raju and Reenu are standing in a row there are 9 peoples. what is the probability that at least 3 people will stand between Raju and Reenu?

A. 11/12 B. 5/12 C. 5/32 D. 11/16

15. Here is 15 dots. If you select 3 dots randomly, what is the probability that 3 dots make a triangle?

A. 440/455 B. 434/455 C. 449/455 D. 438/455

16. A bag contains 9 red and 7 white balls. Four balls are drawn out one by one and not replaced. What is the probability that they are alternatively of different colours?

A. 9/65 B. 6/65 C. 9/130 D. 8/130

17. A basket contains 5 white and 9 black balls. There is another basket which contains 7 white and 7 black balls. One ball is to drawn from either of the two baskets. What is the probability of drawing a white ball?

A. 4/7 B. 6/7 C. 3/7 D. 2/7

18. In a box carrying one dozen of oranges, one third have become bad. If 3 oranges are taken out from the box at random, what is the probability that at least one oranges out of the three oranges picked up is good?

A. 1/55 B. 54/55 C. 45/55 D. 3/55

19. 8 persons are seated at a round table. What is the probability that 3 particular persons sit together?

A. 2/7 B. 3/14 C. 3/14 D. 1/7

20. One card is drawn at random from a pack of 52 cards. What is the probability that the card drawn is either a red or a king?

A. 6/13 B. 1/2 C. 7/13 D. 27/52

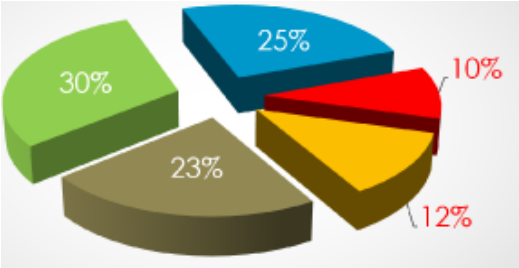
DATA INTERPRETATION

Data interpretation is an act of analysing data with the objective to gain useful information from it. It is done to draw conclusions from the given data. Different statistical tools are used to represent the data in organized structures.

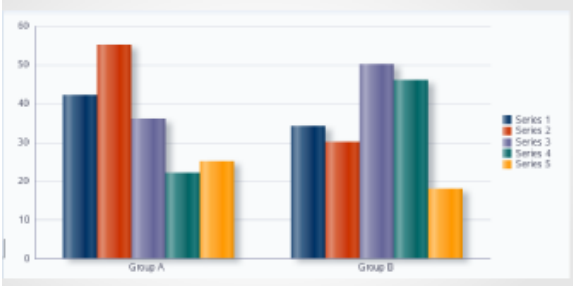
Different method in which data can be presented to solve Data Interpretation Questions:
1. Tables: Tables are the most convenient and versatile method to present data. Analyzing and drawing conclusions from tables is much easier than any other method. Tables are the fundamental method to represent data. In tables, the data is arranged in rows and columns which help us to scrutinize data efficiently.

Standard	Boys	Girls
1	32	26
2	24	28
3	38	31
4	41	21

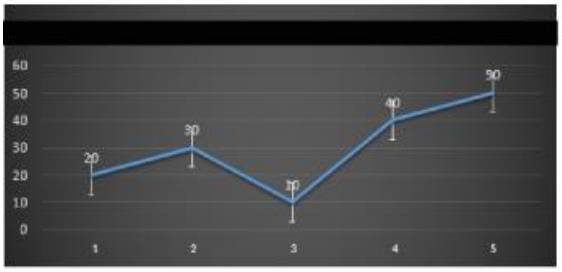
2. Pie chart: A Pie chart is a pictorial representation of data as part of a circle. The circle presents the total value and the different parts of the circle present certain portions of the data.
There are two types of pie chart: Normal and Exploded



3. Bar Graph: A bar graph is a way of representing data on the graph using X-axis and Y-axis. It is the most convenient way to present data. It is proven that using lengths in case of bar chart is a better indicator than pie charts where the data is categorized in terms of areas.



4. Line Graph: Line graph is the simplified version of the normal bar graph. It is simple to draw conclusions from Line Graph.



5. Mixed Graph: Pie Chart along with tabular data, bar graph along with tabular data.

Some important tricks to solve data interpretation questions:

1. Memorize some fractional and percentage values.
2. Don't waste time with lengthy calculations. Try to solve questions with approximation.
3. Use previous calculation if needed again.
4. Important topics to concentrate in data interpretation is Ratios, Percentages and Average.
5. Don't assume anything, There are few questions which ask to find out some data which is not available. Always be alert enough to see whether the data given is enough to answer the question or not and do not answer the question based on assumptions.

Example 1: Study the following table and answer the questions.
Classification of 100 Students based on the Marks Obtained by them in Physics and Chemistry in an Examination.

Subject	Marks out of 50				
	40 and above	**30 and above**	**20 and above**	**10 and above**	**0 and above**
Physics	9	32	80	92	100
Chemistry	4	21	66	81	100
Average (Aggregate)	7	27	73	87	100

I. What is the different between the number of students passed with 30 as cut-off marks in Chemistry and those passed with 30 as cut-off marks in aggregate?

Solution: Required difference = (No. of students scoring 30 and above marks in Chemistry)
– (Number of students scoring 30 and above marks in aggregate)
= 27 – 21 = 6.

II. If at least 60% marks in Physics are required for pursuing higher studies in Physics, how many students will be eligible to pursue higher studies in Physics?

Solution:

$$\text{We have 60\% of 50} = \left(\frac{60}{100} \times 50\right) = 30.$$

$\therefore$ Required number

= No. of students scoring 30 and above marks in Physics

= 32

III. The percentage of number of students getting at least 60% marks in Chemistry over those getting at least 40% marks in aggregate, is approximately?

Solution:

Number of students getting at least 60% marks in Chemistry

= Number of students getting 30 and above marks in Chemistry

= 21.

Number of students getting at least 40% marks in aggregate

= Number of students getting 20 and above marks in aggregate

= 73.

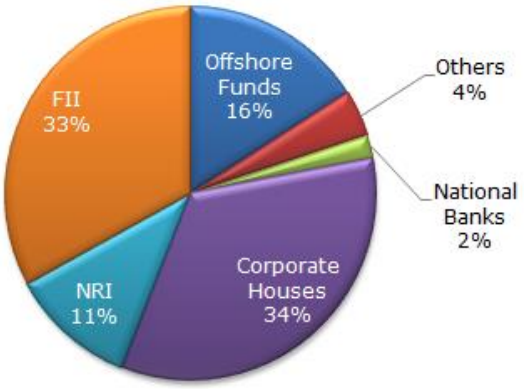
$$\text{Required percentage} = \left(\frac{21}{73} \times 100\right)\%$$

$$= 28.77\%$$

$$\approx 29\%.$$

Example 2: The following pie chart shows the amount of subscriptions generated for India Bonds from different categories of investors.

Subscriptions Generated for India Bonds



I. In the corporate sector, approximately how many degrees should be there in the central angle?

Solution: Since 1% = 3.6 degrees

Corporate Houses = 34%

34 x 3.6 = 122.4^0

II. If the investment by NRI's are Rs 4,000 crore, then the investments by corporate houses and FII's together is:

Solution: Corporate Houses and FII's together = 34 + 33 = 67%

NRI = 11%

Total investment by Corporate Houses and FII's together =

(67/11) x 4000 = 24, 363.6364

III. If the total investment other than by FII and corporate houses is Rs 335,000 crore, then the investment by NRI's and Offshore funds will be (approximately)?

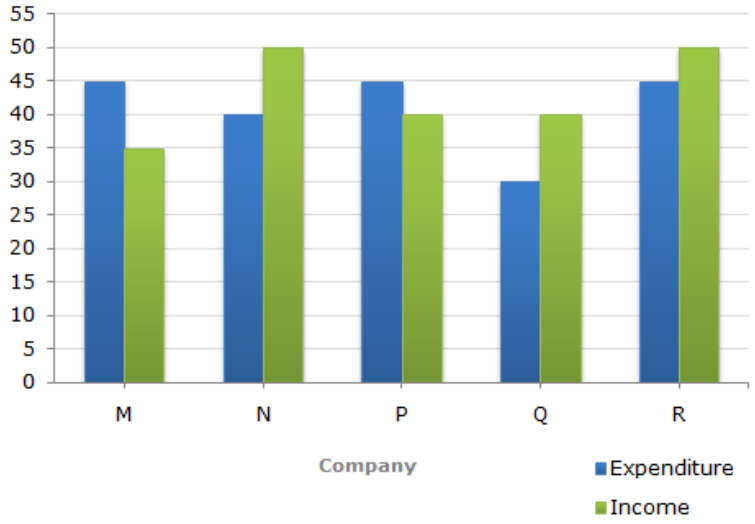
Solution: Investment other than NRI and corporate houses is 33% = 335000.

Also, investment by offshore funds and NRI's is equal to 27%.

Hence, 27 x 335,000/33 = 274, 090.909

Example 3: The following bar graph shows the Income and Expenditures (in million US $) of five companies in the year 2001. The percent profit or loss of a company is given by

$$\% \text{ Profit/Loss} = \frac{\text{Income - Expenditure}}{\text{Expenditure}} \times 100$$



Income and Expenditure (in million US $) of five companies in the year 2001

I. The companies M and N together had a percentage of profit/loss of?

Solution:

Total income of Companies M and N together

= (35 + 50) million US $

= 85 million US $

Total expenditure of Companies M and N together

= (45 + 40) million US $

= 85 million US $.

∴ Percent Profit/Loss of companies M and N together

$$\% \text{ Profit/Loss} = \left(\frac{85 - 85}{85} \times 100\right) = 0\%.$$

Thus, there was neither loss nor profit for companies M and N together.

II. In 2001, what was the approximate percentage of profit/loss of all the five Companies taken together?

Solution:

Total income of all five companies

= (35 + 50 + 40 + 40 + 50) million US $

= 215 million US $.

Total expenditure of all five companies

= (45 + 40 + 45 + 30 + 45) million US $

= 205 million US $.

$$\therefore \% \text{ Profit} = \left[\frac{(215 - 205)}{205} \times 100\right]\% = 4.88\% \approx 5\%.$$

III. Which company earned the maximum percentage profit in the year 2001?
Solution:

The percentage profit/loss in the year 2001 for various comapanies are:

For M = $\left[\frac{(35 - 45)}{45} \times 100\right]\% = -22.22\%$ i.e., Loss = 22.22%.

For N = $\left[\frac{(50 - 40)}{40} \times 100\right]\% = 25\%$ i.e., Profit = 25%.

For P = $\left[\frac{(40 - 45)}{45} \times 100\right]\% = -11.11\%$ i.e., Loss = 11.11%.

For Q = $\left[\frac{(40 - 30)}{30} \times 100\right]\% = 33.33\%$ i.e., Profit = 33.33%.

For R = $\left[\frac{(50 - 45)}{45} \times 100\right]\% = 11.11\%$ i.e., Profit = 11.11%.

Clearly, the Company Q earned the maximum profit in 2001.

IV. For Company R, if the expenditure had increased by 20% in year 2001 from year 2000 and the company had earned profit of 10% in 2000, what was the Company's income in 2000 (in million US $)?
Solution:

Let the expenditure of Company R in 2000 be x million US $.

Then, expenditure of Company R in 2001 = $\left(\frac{120}{100} \times x\right)$ million US $.

$\therefore \frac{120x}{100} = 45 \Rightarrow x = 37.5.$

i.e., expenditure of Company R in 2000 = 37.5 million US $.

Let the income of Company R in 2000 be I million US $.

Then, $10 = \frac{(I - 37.5)}{37.5} \times 100$ [$\because$ %Profit in 2000 = 10%]

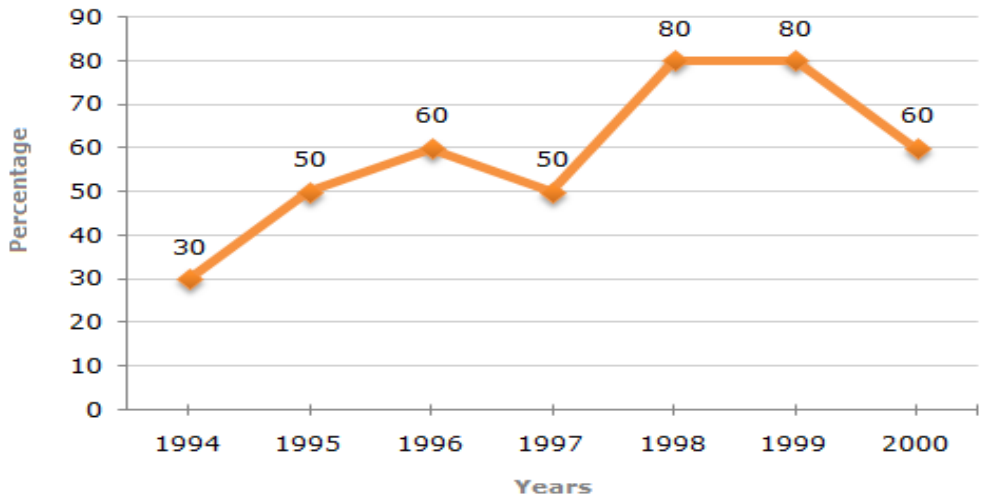
$\Rightarrow I - 37.5 = 3.75$

$\Rightarrow I = 41.25$

i.e., Income of Company R in 2000 = 41.25 million US $.

Example 4: The following line graph gives the percentage of the number of candidates who qualified an examination out of the total number of candidates who appeared for the examination over a period of seven years from 1994 to 2000.

Percentage of Candidates Qualified to Appeared in an Examination Over the Years



I. The difference between the percentages of candidates qualified to appear was maximum in which of the following pairs of years?

Solution: The differences between the percentages of candidates qualified to appear for the give pairs of years are:

For 1994 and 1995 = 50 – 30 = 20

For 1998 and 1999 = 80 – 80 = 0

For 1994 and 1997 = 50 – 30 = 20

For 1997 and 1998 = 80 – 50 = 30

For 1999 and 2000 = 80 – 60 = 20

Thus, the maximum difference is between the years 1997 and 1998.

II. If the number of candidates qualified in 1998 was 21200, what was the number of candidates appeared in 1998?

Solution:

The number of candidates appeared in 1998 be x.

Then, 80% of x = 21200 $\Rightarrow$ $x = \frac{21200 \times 100}{80}$ = 26500 (required number).

III. If the total number of candidates appeared in 1996 and 1997 together was 47400, then the total number of candidates qualified in these two years together was?

Solution: The total number of candidates qualified in 1996 and 1997 together, cannot be determined until we know at least, the number of candidates appeared in any one of the two years 1996 or 1997 or the percentage of candidates qualified to appeared in 1996 and 1997 together.

Hence, the data is inadequate

IV. The total number of candidates qualified in 1999 and 2000 together was 33500 and the number of candidates appeared in 1999 was 26500. What was the number of candidates in 2000?

Solution:

The number of candidates qualified in 1999 = (80% of 26500) = 21200.

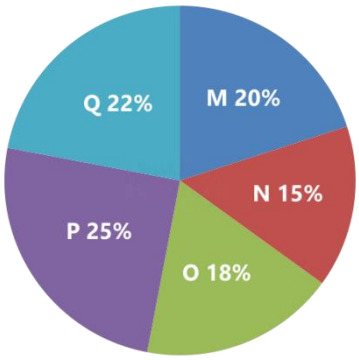
$\therefore$ Number of candidates qualified in 2000 = (33500 - 21200) = 12300.

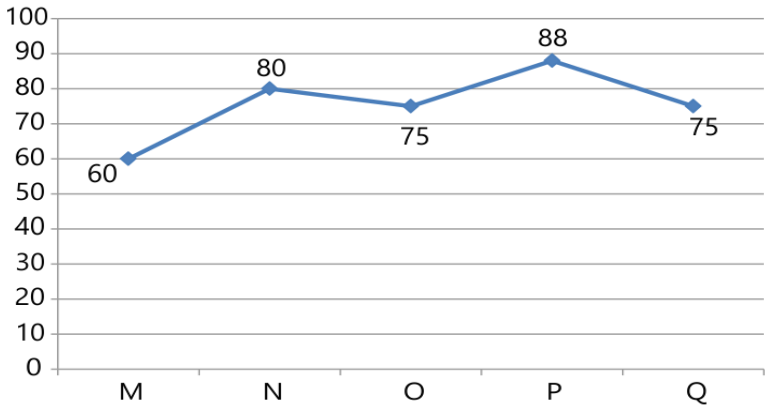
Let the number of candidates appeared in 2000 be x.

Then, 60% of x = 12300 $\Rightarrow$ $x = \left(\frac{12300 \times 100}{60}\right) = 20500.$

Example 5: Study the following information carefully and answer the question given below: Pie chart shows the production of rice by 5 different factories and line chart shows the percentage of sale.

Total production = 3600 kg





I. In which of the following factory the sale of rice is the highest?

Solution: Sale of rice by factory M = 3600 × 20% × 60% = 432 kg
Sale of rice by factory N = 3600 × 15% × 80% = 432 kg
Sale of rice by factory O = 3600 × 18% × 75% = 486 kg
Sale of rice by factory P = 3600 × 25% × 88% = 792 kg
Sale of rice by factory Q = 3600 × 22% × 75% = 594 kg
Sale of rice of factory P is the highest.

II. Rice sold by factory M and N together is how much percent more than the production of rice by factory M?

Solution: Rice sold by factory M = 3600 × 20% × 60% = 432 kg
Rice sold by factory N = 3600 × 15% × 80% = 432 kg
Production of rice by factory M = 3600 × 20% = 720 kg
% more = {[432 + 432 – 720] × 100} / 720
= (144 × 100) / 720= 20%

III. If the cost price of rice is Rs 45 per kg and profit earned by factory Q on 1 kg rice is 20% of the cost price, find the total profit earned by factory Q.

Solution: Rice sold by factory Q = 3600 × 22% × 75% = 594 kg
Profit on 1 kg rice = 45 × 20% = Rs 9
Total profit = 9 × 594 = Rs 5346

IV. What percent of total rice has been sold by all the factory?

Solution: Sale of rice by factory M = 3600 × 20% × 60% = 432 kg
Sale of rice by factory N = 3600 × 15% × 80% = 432 kg
Sale of rice by factory O = 3600 × 18% × 75% = 486 kg
Sale of rice by factory P = 3600 × 25% × 88% = 792 kg
Sale of rice by factory Q = 3600 × 22% × 75% = 594 kg
Total sale = 432 + 432 + 486 + 792 + 594 = 2736 kg
Required % = (2736 × 100) / 3600 = 76%

V. What is the ratio of rice sold by factory P and Q together to the rice sold by factory N and O together?

Solution: Rice sold by factory P = 3600 × 25% × 88% = 792 kg
Rice sold by factory Q = 3600 × 22% × 75% = 594 kg
Rice sold by factory N = 3600 × 15% × 80% = 432 kg
Rice sold by factory O = 3600 × 18% × 75% = 486 kg
Required Ratio = 792 + 594 : 432 + 486
= 1386 : 918 = 77 : 51

LEVEL – I

Directions (1-3): Classification of 100 students based on the marks obtained by them in Physics and Chemistry in an examination.

Marks out of 50 → / Subject ↓	40 and above	30 and above	20 and above	10 and above	0 and above
Physics	9	32	80	92	100
Chemistry	4	21	66	81	100
(Aggregate) Average	7	27	73	87	100

1. If at least 60% marks in Physics are required for pursuing higher studies in Physics, how many students will be eligible to pursue higher studies in Physics?

A. 27 B. 32 C. 34 D. 41

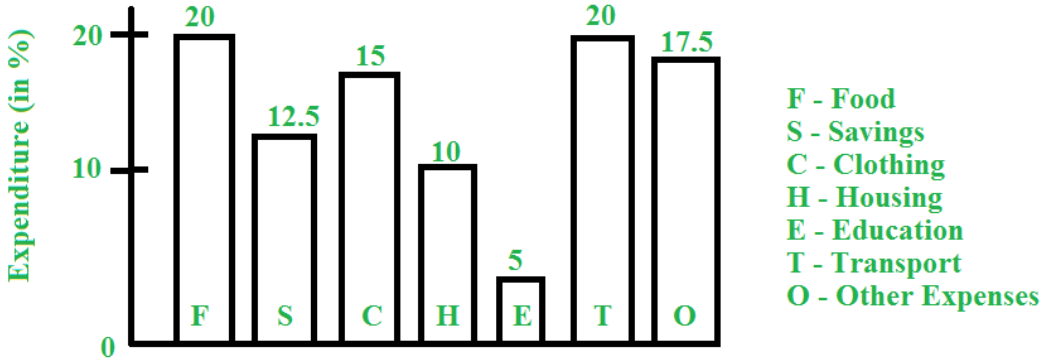
2. The percentage of the number of students getting at least 60% marks in Chemistry over those getting at least 40% marks in aggregate, is approximately:

A. 21% B. 27% C. 29% D. 31%

3. If it is known the at least 23 students were eligible for a Symposium on Chemistry, the minimum qualifying marks in Chemistry for eligibility to Symposium would lie in the range:

A. 40-50 B. 30-40 C. 20-30 D. Cannot be determined

Directions (4-6): Study the following bar graph and answer the questions that follow:
Total monthly income = Rs. 50,000



4. What amount is spent on food?

A. Rs. 10,000 B. Rs. 15,000 C. Rs. 20,000 D. Rs. 30,000

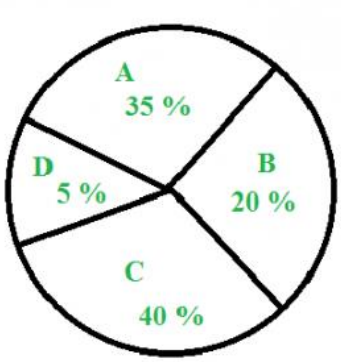
5. How much more money is spent on clothing and housing together than on transportation?

A. Rs. 1,000 B. Rs. 5,000 C. Rs. 2,000 D. Rs. 2,500

6. What percent of amount on food is spent as amount on education?

A. 10% B. 40% C. 25% D. 20%

Directions (7-9): Study the pie chart below and answer the questions that follow:



The above pie chart shows the sales of four different types of articles in a shop.

7. What is the central angle of type A?
A. 128 degrees B. 126 degrees C. 136 degrees D. 140 degrees

8. If the total sale is 1200, what is the sale of B?
A. 120 B. 360 C. 260 D. 240

9. What is the difference between the central angle of A and D?
A. 108 degrees B. 120 degrees C. 96 degrees D. 130 degrees

Directions (10-14): The following table shows the number of boys and girls of different schools that have participated in a scholarship test over five years.

School / Year	A		B		C		D	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
2001	300	80	280	60	320	84	450	70
2002	320	70	300	80	424	100	320	60
2003	340	90	420	120	230	70	360	90
2004	370	100	480	140	360	120	500	120

10. How many girls more participated in year 2004 as compared to 2003 for all schools taken together?
A. 110 B. 370 C. 480 D. 210

11. The ratio of boys: girls for school B over the years 2001-2004 is?
A. 17:34 B. 14:37 C. 37:10 D. 34:17

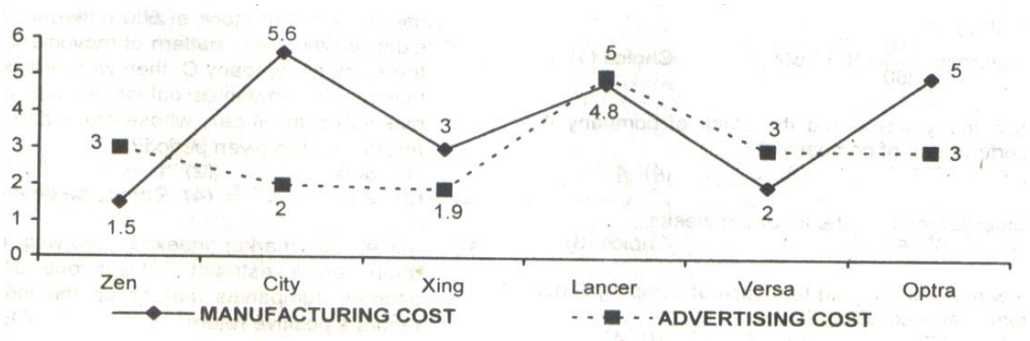
12. The percentage increase in participation of boys from school B in 2004 over those in 2001 is nearly?
A. 28% B. 71% C. 72% D. 72%

13. The total number of participants in year 2003 is
A. 2000 B. 1830 C. 1720 D. 1640

14. In year 2004 the number of participating girls is what percent of number of participating boys?
A. 17:56 B. 56:17 C. 57:16 D. 16:57

Directions (15-18): These questions are based on the line graph below.

(in Rs. lakhs)



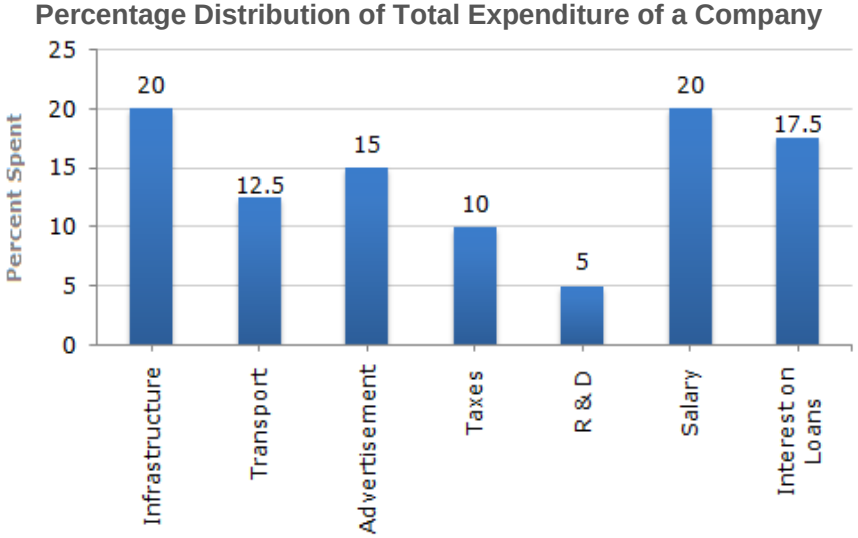
Total Cost = Manufacturing Cost + Advertising Cost

15. For which of the following cars is the manufacturing cost as a percentage of advertising cost the least?
A. Xing B. City C. Lancer D. Zen

16. In a certain year, 30, 000 "City" cars, are produced, and are sold at Rs. 9.3 lacs/car. If 2% of the total profit is given as a bonus to the 2,040 engineers, the amount received by each engineer as bonus is (in Rs.)
A. 5, 000 B. 50, 000 C. 5 lacs D. None of these

17. The company that manufactures Zen produces 500 Zen cars per day while the company that manufactures City produces 600 City per day. They sell them at Rs. 6 lacs/car and Rs. 8.4 lacs/car respectively. The profit made by the former is approximately what percentage of that of the latter?
A. 100% B. 156% C. 250% D. None of these

Directions (18-20): The bar graph given below shows the percentage distribution of the total expenditures of a company under various expense heads during 2003.



18. The expenditure on the interest on loans is by what percent more than the expenditure on transport?
A. 5% B. 40% C. 20% D. 10%

19. If the interest on loans amounted to Rs. 2.45 crores then the total amount of expenditure on advertisement, taxes and research and development is?
A. Rs. 7 crores B. Rs. 5.4 crores C. Rs. 4.2 crores D. Rs. 3 crores

20. The total amount of expenditures of the company is how many times of expenditure on research and development?
A. 20 B. 27 C. 18 D. 8

LEVEL – II

Directions (1-4): Study the following table carefully to answer these questions:
Number of workers employed in six units of a factory over the years.

Unit Year	A	B	C	D	E	F
1998	145	88	115	120	140	136
1999	128	76	122	112	152	132
2000	136	96	132	124	158	140
2001	183	92	125	135	166	126
2002	160	107	140	118	170	146
2003	152	110	148	128	175	150

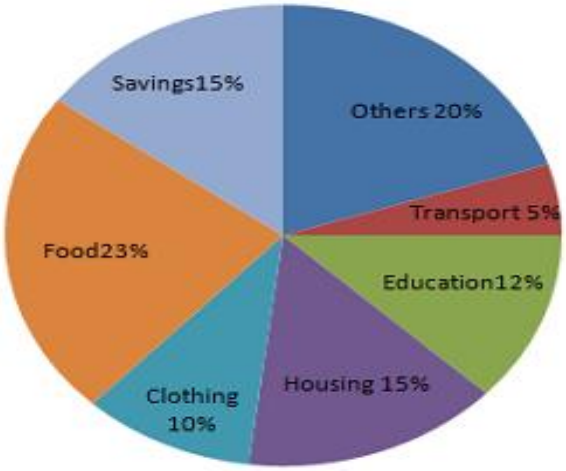
1. In the year 2000 the number of workers employed by unit 'C' is what percent of the total number of workers employed by all the units in the same year (rounded off to two places of decimal)?
A. 16.39 B. 17.21 C. 16.88 D. None of these

2. For all the given years what is the difference between the average number of workers in units D and E?
A. 37 B. 33 C. 32 (2/3) D. 37 (1/3)

3. In which year is the percentage increase/decrease in the number of workers employed the minimum for unit 'F'?
A. 2003 B. 1999 C. 2002 D. 2000

4. What is the approximate ratio of the number of workers employed in all the units in 1998 to that in 1999?
A. 13:14 B. 37:36 C. 10:9 D. 13:11

Directions (5-7): Pie chart shows the percent of money spent by family on various item during 1999. Study the graph and answer these questions.



5. If the total amount spent was Rs. 46,000, how much money was spent on clothing and housing together?

A. Rs. 11500 B. Rs. 1150 C. Rs. 10000 D. Rs. 15000

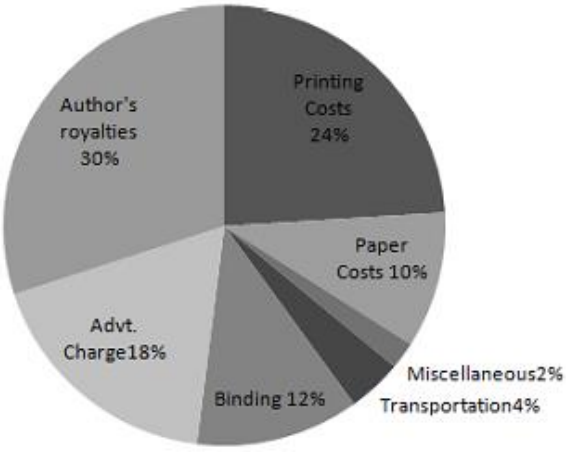
6. The ratio of the total amount of money spent on housing to that spent on education was

A. 5:2 B. 2:5 C. 4:5 D. 5:4

7. If the total expenditure of the family for the year 1999 was Rs. 46,000, the family saved during the year

A. Rs. 1500 B. Rs. 15000 C. Rs. 6900 D. Rs. 3067 approx.

Directions (8-10): These questions are based on the circle graph which shows the expenditure incurred in bringing out a book by a publisher.



8. What should be the central angle of the sector for transportation charges?

A. 4^o B. 14.4^o C. 12.4^o D. 8.4^o

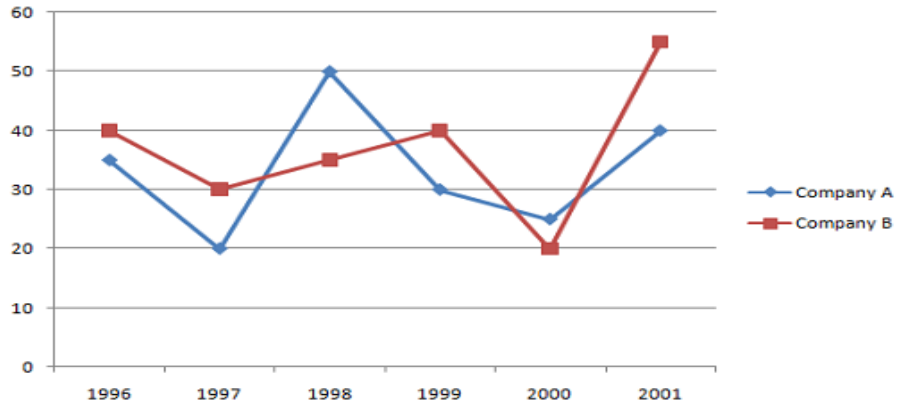
9. If the advertisement charges amount to Rs. 18,000, the total expenditure incurred in bringing out the book is Rs.

A. 60,300 B. 63,000 C. 9,000 D. 1,00,000

10. If the author's royalties amount to Rs. 30,000, the binder's charges amount to Rs.
A. 6,000 B. 10,500 C. 12,000 D. 15,000

Directions (11-15): Study the following graph to answer these questions:

Percent profit earned by two companies A & B over the years.



Profit = Income - Expenditure

% Profit = Profit/Expenditure * 100

11. If the income of company A in 1998 was Rs. 1,42,500 what was its expenditure in that year?
A. 1,05,000 B. 95,000 C. 99,500 D. 1,05,555

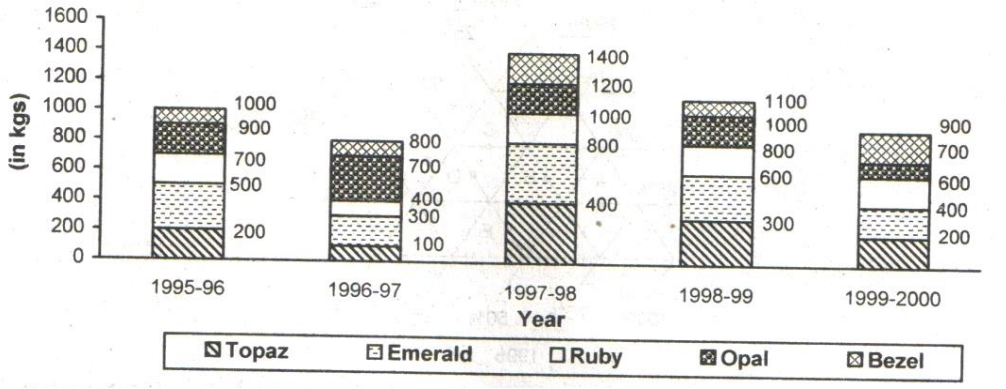
12. Expenditure of company B in 1999 was 90% of its expenditure in 1998. Income of company B in 1999 was what percent of its income in 1998?
A. 130.5 B. 96 (2/3) C. 121.5 D. 99 (1/3)

13. If the expenditure of company A in 1997 was Rs. 70 lakhs and income of company A in 1997 was equal to its expenditure in 1998, what was the total income (in Rs. lakh) of the company A in 1997 & 1998 together?
A. 175 B. 131.25 C. 218.75 D. Cannot be determined

14. Expenditure of company B in years 1996 and 1997 were in the ratio of 5:7 respectively. What was the respective ratio of their incomes?
A. 10:13 B. 8:13 C. 13:14 D. 11:14

15. Total expenditure of companies A & B together in 2001 was Rs. 13.5 lakhs. What was the total income of the two companies (in Rs. lakh) in that year?
A. 19.575 B. 20.25 C. 19.75 D. Cannot be determined

Directions (16-19): The following questions are based on the stacked bar graph given below.
Sales of various precious stones in India for the period of 1995-1996 to 1999-2000



16. What is the total sale of ruby as a percent of the total sales of precious stones for the given period?
A. 17.3% B. 19.23% C. 23.1% D. None of these

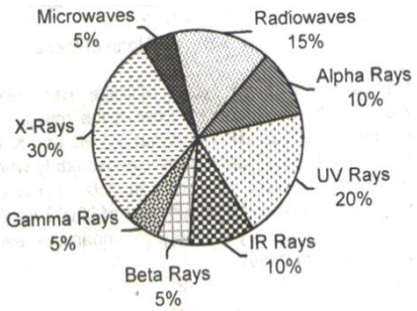
17. By what percent is the average annual sale of Emerald for the given period more than the sales of Opal in 1998-1999?
A. 120% B. 50% C. 25% D. 40%

18. For how many years is the sale of Bezel as a percentage of the total sales of precious stones less than that of Topaz?
A. One B. Two C. Three D. Four

19. If the sales of Topaz increased from 1994-1995 to 1995-1996 by 25% and increased from 1999-2000 to 2000-01 by 50%, then what is the difference between the sales of Topaz in 1994-95 and that in 2000-01?
A. 50, 000 tonnes B. 100, 000 tonnes C. 140, 000 tonnes D. 160, 000 tonnes

20. The question is based on the pie chart given below.

Constituents of Sunrays received in 1 minute



Total sunrays received in 1 minute = 3600 units

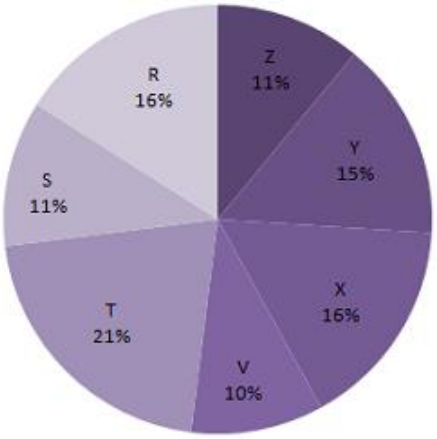
If the human body can withstand a maximum of 9720 units of IR rays, when exposed to the sun continuously, then what is the maximum time (in minutes) that any person could stand in the sun without crossing the threshold limit of IR rays?

A. 19 B. 23 C. 27 D. 29

LEVEL – III

Directions (1-5): Study the following pie-chart and the table and answer the question based on them.

Proportion of population of seven villages in 1997



Village %	Population Below Poverty Line
X	38
Y	52
Z	42
R	51
S	49
T	46
V	58

1. Find the population of village S if the population of village X below poverty line in 1997 is 12160.
A. 18500 B. 20500 C. 22000 D. 26000

2. The ratio of population of village T below poverty line to that of village Z below poverty line in 1997 is?
A. 11:23 B. 13:11 C. 23:11 D. 11:13

3. If the population of village R in 1997 is 32000, then what will be the population of village Y below poverty line in that year?
A. 14100 B. 15600 C. 16500 D. 17000

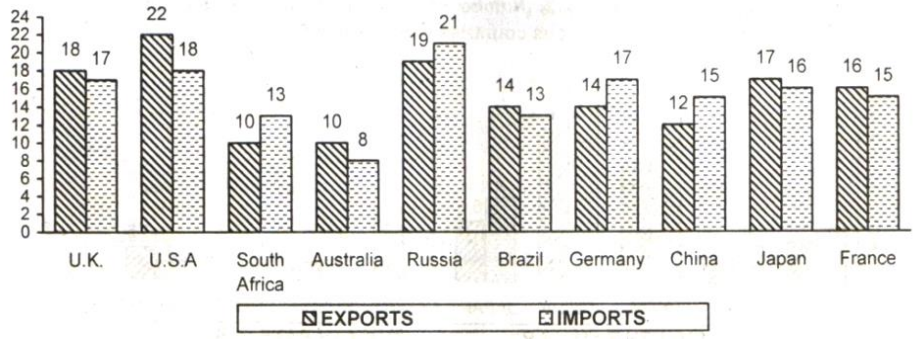
4. If in 1998, the population of village Y and V increase by 10% each and the percentage of population below poverty line remains unchanged for all the villages, then find the population of village V below poverty line in 1998, given that the population of village Y in 1997 was 30000.
A. 11250 B. 12760 C. 13140 D. 13780

5. If in 1999, the population of village R increased by 10% while that of village Z reduces by 5% compared to that in 1997 and the percentage of population below poverty line remains unchanged for all the villages, then find the approximate ratio of population of village R below poverty line to the ratio of population of village Z below poverty line for the year 1999.
A. 2:1 B. 3:2 C. 4:3 D. 5:4

Directions (6-10): These questions are based on the following graph.

The Country wise break up Exports/Import of Country 'XYZ' in 1996

(in Rs. thousand crores)



Trade Surplus = Exports – Imports; Trade Deficit = Imports – Exports

6. The cumulative trade deficit of country XYZ is approximately what percent of its average imports from each of the above mentioned countries?
A. 65% B. 9% C. 6.5% D. 0.6%

7. If the average cost of exports is Rs. 2000 per ton and that of imports of Rs. 3000 per ton, then by what percent is the total tonnage of exports more/less than the total tonnage of imports
A. 33.3% more B. 49% less C. 32.8 % more/less D. 49% more

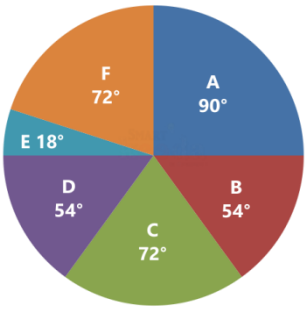
8. By what percentage are the imports from the country to which the exports are the highest more than the exports to the country from which the imports are the least?
A. 175% B. 80% C. 55.55% D. 125%

9. Which of the following statements is definitely true?
A. Country XYZ has a cumulative trade surplus of Rs. 1 crore
B. The cumulative trade deficit of country XYZ is approximately one-fifteenth of its total imports.
C. The trade deficit of country XYZ considering its trade with China alone is 300% more than its cumulative trade deficit/surplus.
D. The difference between the highest exports to any country and the lowest imports from any country is equal to the average of the exports to Brazil and Germany.

10. What is the ratio of the total imports from Brazil, Japan, South Africa, Russia and China, to the total exports to the other five countries?
A. 0.975 B. 1.026 C. 0.96 D. None of these

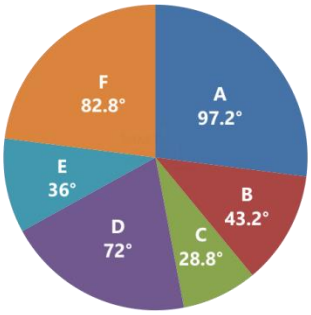
Directions (11-15): In the following pie-charts, pie chart I shows the angular distribution of the total number of employees among six companies and pie-chart II shows the angular distribution of the total number female employees among these companies.

Chart I



Total Female Employees = 14000

Chart II



Total Female Employees = 6000

11. What is the total number of male employees in Company B?
A. 720 B. 1040 C. 1260 D. 1380

12. What is the difference between the total number of male employees and the total number of female employees in Company A?
A. 220 B. 240 C. 260 D. 280

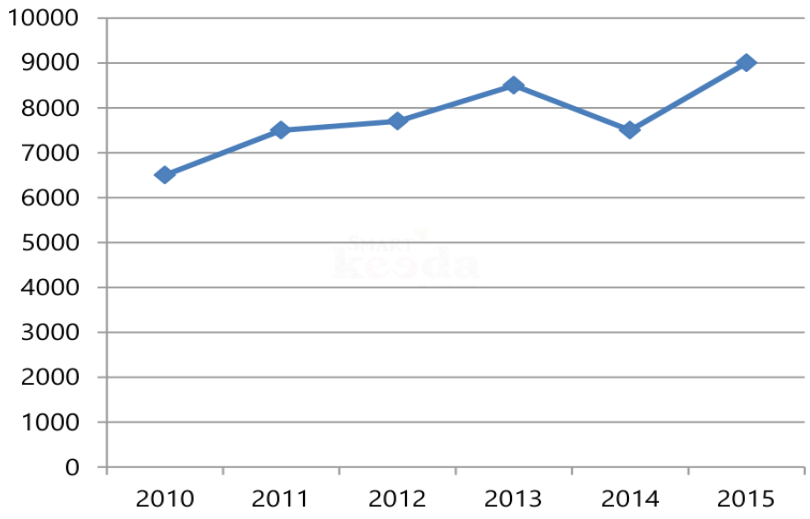
13. The total number of female employees of Company C is approximately what per cent of the total number of employees of Company B?
A. 17% B. 23% C. 27% D. 30%

14. What is the difference between the total number of female employees of Company F and the total number of female employees of Company E?
A. 740 B. 760 C. 780 D. 820

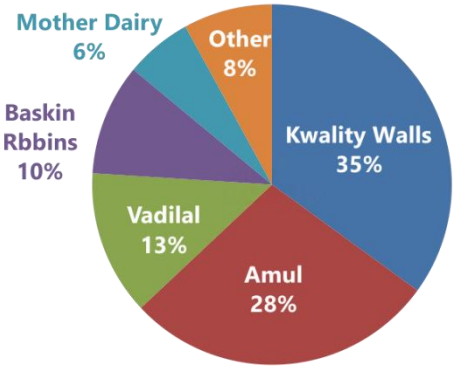
15. The total number of female employees of Company A is approximately what per cent of the total number female employees of Company D?
A. 74% B. 120% C. 135% D. 150%

Directions (16-20): Refer to the line graph and pie-chart below and answer the question that follows. The line graph shows Ice-cream market size (in crores) in India from the year 2010 to 2015 and the pie chart depicts percentage market shares of different Ice-cream brands in 2013.

Ice-cream market in India



Market Share of various companies in 2013



16. If the market share of Vadilal increases by 38% from 2013 to 2015, what would be the approximate market share of Vadilal in 2015?
A. 12% B. 17% C. 14% D. 21%

17. What is the difference between the market share of Amul and that of Mother Dairy in 2013?
A. ₹ 1650 crore B. ₹ 1950 crore C. ₹ 1870 crore D. ₹ 1750 crore

18. If the market share of all the companies remains the same in 2014, what was the increase/decrease in the turnover of Amul from 2013 to 2014?
A. decreased by 280 crore B. increased by 520 crore
C. decreased by 420 crore D. increased by 620 crore

19. What is the market share of Mother Dairy in 2016, if the market share of each company remains the same as in 2013 and the ice-cream market increased by 20% from 2013 to 2016?
A. ₹ 640 B. ₹ 720 C. ₹ 612 D. ₹ 900

20. If the market share of the companies in 2015 is the same as in 2013 and in 2016 the ice-cream market increases by 10% from the previous year but the share of Kwality Walls falls by 20%. What is the percentage change in the market share of Kwality Walls from 2015 to 2016?
A. 18.24% B. 13.14% C. 12.54% D. 9.54%

ANSWER KEYS

Chapter 1- Number System									
Level – I									
Q. No.	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**
1	C	2	A	3	D	4	B	5	A
6	C	7	B	8	C	9	A	10	A
11	C	12	C	13	B	14	A	15	D
16	D	17	B	18	A	19	C	20	A
Level – II									
Q. No.	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**
1	B	2	C	3	B	4	C	5	B
6	C	7	B	8	A	9	B	10	B
11	D	12	C	13	C	14	C	15	B
16	C	17	B	18	B	19	C	20	A
Level – III									
Q. No.	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**
1	D	2	C	3	C	4	C	5	D
6	D	7	D	8	C	9	C	10	C
11	B	12	A	13	C	14	C	15	C
16	D	17	D	18	B	19	D	20	D

Chapter 2- Average									
Level – I									
Q. No.	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**
1	C	2	B	3	B	4	A	5	D
6	C	7	B	8	A	9	D	10	A
11	A	12	C	13	D	14	C	15	C
16	B	17	A	18	A	19	D	20	C
Level – II									
Q. No.	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**
1	A	2	D	3	B	4	D	5	B
6	D	7	C	8	B	9	C	10	A
11	B	12	C	13	A	14	C	15	D
16	C	17	A	18	D	19	D	20	B
Level – III									
Q. No.	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**
1	B	2	A	3	D	4	D	5	D
6	B	7	D	8	A	9	D	10	B
11	D	12	C	13	D	14	B	15	D
16	A	17	A	18	A	19	B	20	C

Chapter 3- Mathematical Operations									
Level – I									
Q. No.	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**
1	B	2	C	3	C	4	B	5	B
6	C	7	C	8	C	9	D	10	C
11	A	12	C	13	D	14	A	15	A
16	B	17	D	18	C	19	B	20	B
Level – II									
Q. No.	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**
1	C	2	B	3	A	4	B	5	B
6	B	7	B	8	A	9	C	10	D
11	D	12	C	13	A	14	B	15	B
16	A	17	B	18	B	19	B	20	C
Level – III									
Q. No.	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**
1	D	2	B	3	B	4	C	5	A
6	B	7	C	8	D	9	C	10	D
11	B	12	C	13	B	14	B	15	C
16	C	17	A	18	A	19	C	20	B

Chapter 4 – Percentage									
Level – I									
Q. No.	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**
1	B	2	B	3	A	4	C	5	C
6	D	7	A	8	A	9	D	10	A
11	C	12	B	13	C	14	A	15	D
16	B	17	B	18	A	19	B	20	A
Level – II									
Q. No.	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**
1	B	2	D	3	C	4	A	5	D
6	D	7	B	8	D	9	C	10	C
11	A	12	C	13	D	14	B	15	D
16	D	17	C	18	B	19	B	20	A
Level – III									
Q. No.	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**
1	A	2	A	3	D	4	A	5	B
6	C	7	A	8	D	9	C	10	B
11	B	12	A	13	B	14	A	15	C
16	C	17	D	18	B	19	D	20	C

Chapter 5 – Profit and Loss

Level – I

Q. No.	Answer	Q. No.	Answer	Q. No.	Answer	Q. No.	Answer	Q. No.	Answer
1	B	2	B	3	C	4	B	5	C
6	A	7	C	8	C	9	C	10	D
11	A	12	D	13	C	14	A	15	D
16	B	17	B	18	C	19	B	20	C

Level – II

Q. No.	Answer	Q. No.	Answer	Q. No.	Answer	Q. No.	Answer	Q. No.	Answer
1	A	2	D	3	B	4	B	5	A
6	B	7	A	8	B	9	A	10	B
11	C	12	A	13	D	14	B	15	A
16	C	17	A	18	B	19	B	20	B

Level – III

Q. No.	Answer	Q. No.	Answer	Q. No.	Answer	Q. No.	Answer	Q. No.	Answer
1	A	2	D	3	C	4	B	5	B
6	A	7	A	8	D	9	C	10	D
11	D	12	C	13	C	14	C	15	C
16	B	17	D	18	C	19	A	20	C

Chapter 6- Direction Sense Test

Level – I

Q. No.	Answer	Q. No.	Answer	Q. No.	Answer	Q. No.	Answer	Q. No.	Answer
1	D	2	B	3	D	4	B	5	C
6	C	7	A	8	C	9	D	10	A
11	B	12	B	13	C	14	A	15	B
16	B	17	A	18	B	19	A	20	B

Level – II

Q. No.	Answer	Q. No.	Answer	Q. No.	Answer	Q. No.	Answer	Q. No.	Answer
1	C	2	D	3	C	4	D	5	D
6	D	7	A	8	A	9	B	10	B
11	D	12	A	13	D	14	C	15	A
16	A	17	D	18	B	19	D	20	C

Level – III

Q. No.	Answer	Q. No.	Answer	Q. No.	Answer	Q. No.	Answer	Q. No.	Answer
1	D	2	B	3	C	4	C	5	C
6	A	7	A	8	C	9	C	10	B
11	B	12	A	13	B	14	D	15	D
16	A	17	D	18	D	19	B	20	C

Chapter 7- Blood Relation									
Level – I									
Q. No.	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**
1	A	2	B	3	B	4	A	5	A
6	A	7	D	8	C	9	C	10	A
11	B	12	D	13	C	14	A	15	D
16	A	17	A	18	A	19	C	20	C
Level – II									
Q. No.	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**
1	A	2	B	3	B	4	C	5	C
6	B	7	D	8	B	9	D	10	D
11	C	12	B	13	A	14	B	15	A
16	D	17	D	18	C	19	A	20	A
Level – III									
Q. No.	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**
1	C	2	D	3	D	4	A	5	D
6	B	7	B	8	D	9	D	10	C
11	B	12	D	13	B	14	B	15	B
16	D	17	B	18	D	19	B	20	C

Chapter 8- Logical Reasoning – I									
Statement and Arguments									
Level – I									
Q. No.	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**
1	A	2	D	3	C	4	C	5	A
6	C	7	C	8	C	9	A	10	A
11	A	12	A	13	B	14	E	15	B
Level – II									
16	C	17	D	18	B	19	A	20	C
21	C	22	E	23	A	24	C	25	A
26	A	27	E	28	A	29	D	30	A

Statement and Assumptions

Level – I

Q. No.	Answer	Q. No.	Answer	Q. No.	Answer	Q. No.	Answer	Q. No.	Answer
1	D	2	A	3	D	4	D	5	B
6	E	7	D	8	D	9	D	10	A
11	A	12	A	13	D	14	D	15	B

Level – II

16	A	17	B	18	B	19	E	20	B
21	E	22	D	23	B	24	D	25	A
26	D	27	D	28	A	29	D	30	D

Statement and Course of Action

Level – I

Q. No.	Answer	Q. No.	Answer	Q. No.	Answer	Q. No.	Answer	Q. No.	Answer
1	C	2	A	3	A	4	C	5	D
6	A	7	A	8	A	9	C	10	E
11	E	12	A	13	A	14	D	15	D

Level – II

16	A	17	C	18	E	19	D	20	A
21	A	22	A	23	E	24	A	25	A
26	A	27	A	28	E	29	D	30	C

Statement and Conclusion

Level – I

Q. No.	Answer	Q. No.	Answer	Q. No.	Answer	Q. No.	Answer	Q. No.	Answer
1	D	2	A	3	E	4	B	5	D
6	D	7	D	8	E	9	B	10	B
11	D	12	D	13	D	14	A	15	E

Level – II

16	B	17	D	18	A	19	A	20	E
21	E	22	B	23	B	24	D	25	D
26	E	27	A	28	E	29	E	30	D

Chapter 9 - Ratio and Proportion, Variation and Partnership									
Level – I									
Q. No.	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**
1	C	2	D	3	B	4	B	5	A
6	C	7	C	8	A	9	C	10	A
11	B	12	C	13	B	14	A	15	A
16	C	17	D	18	B	19	A	20	D
21	B	22	C	23	C	24	B	25	D
26	C	27	B	28	D	29	A	30	D
Level – II									
Q. No.	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**
1	C	2	C	3	B	4	B	5	D
6	B	7	B	8	B	9	A	10	C
11	B	12	C	13	B	14	A	15	D
16	D	17	D	18	A	19	A	20	B
Level – III									
Q. No.	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**
1	C	2	C	3	B	4	A	5	C
6	A	7	B	8	D	9	C	10	A
11	D	12	D	13	D	14	D	15	D
16	C	17	A	18	C	19	A	20	C

Chapter 10 - Mixture and Alligation									
Level – I									
Q. No.	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**
1	A	2	B	3	D	4	A	5	C
6	B	7	A	8	A	9	D	10	D
11	C	12	C	13	C	14	A	15	C
16	B	17	A	18	A	19	C	20	D
Level – II									
Q. No.	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**
1	D	2	C	3	B	4	D	5	B
6	A	7	D	8	A	9	D	10	D
11	B	12	D	13	A	14	A	15	A
16	B	17	B	18	C	19	A	20	B

Chapter 11- Number, Ranking and Time Sequence

Level – I

Q. No.	Answer	Q. No.	Answer	Q. No.	Answer	Q. No.	Answer	Q. No.	Answer
1	B	2	A	3	D	4	A	5	C
6	C	7	C	8	B	9	C	10	C
11	C	12	A	13	C	14	B	15	B
16	B	17	C	18	C	19	D	20	D

Level – II

Q. No.	Answer	Q. No.	Answer	Q. No.	Answer	Q. No.	Answer	Q. No.	Answer
1	C	2	B	3	D	4	B	5	D
6	C	7	B	8	D	9	B	10	A
11	C	12	B	13	C	14	D	15	A
16	D	17	D	18	C	19	A	20	C

Level – III

Q. No.	Answer	Q. No.	Answer	Q. No.	Answer	Q. No.	Answer	Q. No.	Answer
1	D	2	D	3	C	4	B	5	A
6	B	7	D	8	B	9	A	10	D
11	A	12	B	13	A	14	A	15	D
16	C	17	C	18	D	19	B	20	A

Chapter 12 – Problem on Ages and Numbers

Level – I

Q. No.	Answer	Q. No.	Answer	Q. No.	Answer	Q. No.	Answer	Q. No.	Answer
1	A	2	C	3	A	4	A	5	B
6	A	7	B	8	A	9	D	10	B
11	B	12	D	13	C	14	B	15	D
16	B	17	C	18	A	19	A	20	D

Level – II

Q. No.	Answer	Q. No.	Answer	Q. No.	Answer	Q. No.	Answer	Q. No.	Answer
1	D	2	C	3	B	4	A	5	D
6	B	7	C	8	D	9	A	10	C
11	C	12	A	13	C	14	D	15	B
16	D	17	C	18	B	19	D	20	A

Level – III

Q. No.	Answer	Q. No.	Answer	Q. No.	Answer	Q. No.	Answer	Q. No.	Answer
1	D	2	C	3	A	4	B	5	C
6	B	7	D	8	D	9	C	10	A
11	B	12	C	13	A	14	B	15	D
16	B	17	D	18	A	19	B	20	C

Chapter 13 - Venn Diagram and Set Theory									
Level – I									
Q. No.	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**
1	A	2	D	3	D	4	C	5	C
6	A	7	C	8	D	9	B	10	C
11	A	12	B	13	B	14	A	15	A
16	B	17	A	18	D	19	B	20	B
Level – II									
Q. No.	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**
1	B	2	D	3	B	4	D	5	B
6	B	7	D	8	A	9	D	10	C
11	D	12	D	13	B	14	B	15	C
16	A	17	A	18	B	19	D	20	C
Level – III									
Q. No.	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**
1	A	2	C	3	B	4	B	5	D
6	A	7	C	8	C	9	A	10	C
11	B	12	C	13	D	14	B	15	D
16	D	17	B	18	A	19	D	20	C

Chapter 14 - Syllogism									
Level – I									
Q. No.	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**
1	A	2	E	3	A	4	A	5	C
6	D	7	A	8	A	9	B	10	E
11	A	12	E	13	A	14	E	15	B
16	E	17	D	18	D	19	D	20	D
Level – II									
Q. No.	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**
1	E	2	A	3	D	4	A	5	E
6	C	7	B	8	C	9	A	10	D
11	B	12	D	13	E	14	B	15	A
16	B	17	C	18	B	19	E	20	D
Level – III									
Q. No.	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**
1	E	2	E	3	C	4	E	5	D
6	B	7	C	8	E	9	A	10	E
11	D	12	B	13	C	14	B	15	A
16	B	17	E	18	B	19	B	20	D

Chapter 15 – Permutation and Combination

Level – I

Q. No.	Answer	Q. No.	Answer	Q. No.	Answer	Q. No.	Answer	Q. No.	Answer
1	C	2	D	3	C	4	A	5	A
6	C	7	B	8	A	9	D	10	D
11	C	12	B	13	C	14	D	15	B
16	A	17	C	18	B	19	D	20	A

Level – II

Q. No.	Answer	Q. No.	Answer	Q. No.	Answer	Q. No.	Answer	Q. No.	Answer
1	A	2	D	3	C, B, D	4	A, B	5	A
6	D	7	B	8	B	9	C	10	C
11	D	12	C	13	B	14	D	15	A
16	B	17	C	18	B	19	D	20	A
21	A	22	D	23	B	24	B	25	B
26	D	27	A	28	C	29	A	30	D

Level – III

Q. No.	Answer	Q. No.	Answer	Q. No.	Answer	Q. No.	Answer	Q. No.	Answer
1	C	2	C	3	B	4	C	5	B
6	D	7	A	8	C	9	B	10	A
11	C	12	A	13	D	14	A	15	A
16	C	17	B	18	C	19	A	20	B

Chapter 16 – Probability

Level – I

Q. No.	Answer	Q. No.	Answer	Q. No.	Answer	Q. No.	Answer	Q. No.	Answer
1	A	2	C	3	D	4	C	5	C
6	D	7	B	8	B	9	B	10	A
11	B	12	D	13	A	14	D	15	A
16	B	17	B	18	A	19	C	20	A

Level – II

Q. No.	Answer	Q. No.	Answer	Q. No.	Answer	Q. No.	Answer	Q. No.	Answer
1	D	2	A	3	C	4	D	5	D
6	C	7	A	8	A	9	D	10	D
11	C	12	D	13	A	14	D	15	B
16	B	17	A	18	A	19	A	20	C

Level – III

Q. No.	Answer	Q. No.	Answer	Q. No.	Answer	Q. No.	Answer	Q. No.	Answer
1	C	2	C	3	B	4	B	5	D
6	A	7	D	8	D	9	B	10	C
11	A	12	B	13	C	14	B	15	C
16	A	17	C	18	B	19	D	20	C

Chapter 17 – Data Interpretation									
Level – I									
Q. No.	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**
1	B	2	C	3	C	4	A	5	D
6	C	7	B	8	D	9	A	10	A
11	C	12	B	13	C	14	D	15	D
16	B	17	D	18	B	19	C	20	A
Level – II									
Q. No.	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**
1	D	2	D	3	A	4	B	5	A
6	D	7	C	8	B	9	D	10	C
11	B	12	D	13	C	14	A	15	D
16	D	17	C	18	C	19	A	20	C
Level – III									
Q. No.	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**	**Q. No.**	**Answer**
1	C	2	C	3	B	4	B	5	A
6	C	7	D	8	B	9	D	10	A
11	D	12	C	13	B	14	C	15	C
16	B	17	C	18	A	19	C	20	D