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CHAPTER

# Number System

## DIGITS

The ten symbols 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 are called *digits*, which can represent any number.

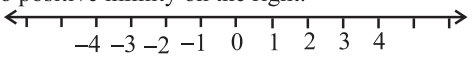
### Face Value and Place Value

Face value is absolute value of a digit. Place value is value of a digit in relation to its position in the number. For example, face value and place value of 9 in 14921 are 9 and 900 respectively.

Note that to find the place value of a digit in a number, we put as many zero (0) after the digit as the number of digits after the digit whose place value is to be find in the given number.

## THE NUMBER LINE

The number line is a straight line between negative infinity on the left to positive infinity on the right.




Each point on the number line represents a unique number on the number line.

## NUMBERS

### Natural Numbers

These are the numbers (1, 2, 3, etc.) that are used for counting. It is denoted by $N$.

There are infinite natural numbers and the smallest natural number is 1 (one).

### Whole Numbers

The natural numbers along with zero (0), form the system of whole numbers.

It is denoted by $W$.

There is no largest whole number and

the smallest whole number is 0.

### Integers

The number system consisting of natural numbers, their negative and zero is called integers.

It is denoted by $Z$ or $I$.

The smallest and the largest integers cannot be determined.

### Even Numbers

An integers which are divisible by 2 are even numbers. It is denoted by $E$.

$E = -24, -4, -2, 2, 4, 6, 8, ...$

Smallest even natural number is 2. There is no largest even number.

### Odd Numbers

Integers which are not divisible by 2 are odd numbers.

It is denoted by $O$.

$O = 1, 3, 5, 7, ...$

Smallest odd natural number is 1.

There is no largest odd number.

### Prime Numbers

Natural numbers which have exactly two factors, 1 and the number itself are called prime numbers.

The lowest prime number is 2.

2 is also the only even prime number.

All prime number (Except 2 and 3) can be expressed in the form of $6N \pm 1$, where $N = 1, 2, 3, .....$

All prime numbers less than 100 are 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89, 97.

### Composite Numbers

It is a natural number that has atleast one divisor different from unity and itself.

Every composite number can be factorised into its prime factors.

***For Example :*** $24 = 2 \times 2 \times 2 \times 3$. Here, 24 is a composite number and 2, 3 are prime numbers.

The smallest composite number is 4.

### CO-prime Numbers

Those numbers are said to be co-prime if they do not have any common factors other than 1.

***For Example :*** 14 and 15 are co-prime numbers. 14 and 15 have only common factor as 1.

**Remember...**

- 1 is neither prime nor composite.
- 1 is an odd integer.
- 0 is neither positive nor negative.
- 0 is an even integer.
- 2 is prime & even both.
- All prime numbers (except 2) are odd.

## REAL NUMBERS

All numbers that can be represented on the number line by the points on it are called real numbers.

It is denoted by $R$.

$R^+$ : Positive real numbers and

$R^-$ : Negative real numbers.

Real numbers = Rational numbers + Irrational numbers.

### (i) Rational Numbers

Any number that can be put in the form of $\frac{p}{q}$, where $p$ and $q$ are integers and $q \neq 0$, is called a rational number.

It is denoted by $Q$.

Every integer is a rational number.

Zero (0) is also a rational number. The smallest and largest rational numbers cannot be determined.

**Note that** every integer is a rational number. Average of any two rational numbers is also a rational number. There are infinite number of rational number between any two rational numbers.

Decimal representation of any rational number is either terminating decimal number or non-terminating recurring (repeating) decimal number. So, all terminating decimal numbers (2.348, 0.07315, etc.) and all non-terminating repeating (recurring) decimal numbers $(54.3\overline{42}, 0.06\bar{3}, 5.\bar{2}$, etc.) are also rational numbers.

**Remember...**

- If $x$ and $y$ are two rational numbers, then $\frac{x+y}{2}$ is also a rational number and its value lies between the given two rational numbers $x$ and $y$.
- An infinite number of rational numbers can be determined between any two rational numbers.

### (ii) Irrational Numbers

The numbers which are not rational or which cannot be put in the form of $\frac{p}{q}$, where $p$ and $q$ are integers and $q \neq 0$, is called irrational number.

It is denoted by $Q'$ or $Q^c$.

$\sqrt{2}, \sqrt{3}, \sqrt{5}, 2+\sqrt{3}, 3-\sqrt{5}, 3\sqrt{3}$ are irrational numbers.

Decimal representation of any irrational number is always non-terminating non-recurring (repeating) decimal number. So, all non-terminating and non-recurring (repeating) decimal numbers (68.3010010001....., 0.233223332223333..... etc.) are irrational numbers.

**Note**

- $\sqrt{2}+\sqrt{3} \neq \sqrt{5}$
- $\sqrt{5}-\sqrt{3} \neq \sqrt{2}$
- $\sqrt{3} \times \sqrt{2} = \sqrt{3\times 2} = \sqrt{6}$
- $\sqrt{6} \div \sqrt{2} = \sqrt{\frac{6}{2}} = \sqrt{3}$
- Some times, product of two irrational numbers is a rational number.

  ***For example :*** $\sqrt{2} \times \sqrt{2} = \sqrt{2\times 2} = 2$

  $(2+\sqrt{3}) \times (2-\sqrt{3}) = (2)^2 - (\sqrt{3})^2 = 4-3 = 1$
- Both rational and irrational numbers can be represented on number line. Thus real numbers is the set of the union of rational and irrational numbers.

  $R = Q \cup Q'$
- Every real number is either rational or irrational.

## CONVERSION OF RECURRING DECIMAL INTO THE RATIONAL NUMBER OF THE FORM $\frac{p}{q}$

First, write the non-terminating repeating decimal number in recurring form i.e., write

64.20132132132..... as $64.20\overline{132}$

Then, using formula given below we find the required $\frac{p}{q}$ form of the given number.

Rational number in the form $\frac{p}{q}$

$$= \frac{\left[\begin{array}{l}\text{Complete number neglecting}\\ \text{the decimal and bar over}\\ \text{repeating digit(s)}\end{array}\right] - \left[\begin{array}{l}\text{Non- recurring part of}\\ \text{the number neglecting}\\ \text{the decimal}\end{array}\right]}{m \text{ times 9 followed by } n \text{ times 0}}$$

where $m$ = number of recurring digits in decimal part and

$n$ = number of non-recurring digits in decimals part

Thus, $\frac{p}{q}$ form of $64.20\overline{132} = \frac{6420132-6420}{99900}$

$\frac{6413712}{99900} = \frac{534476}{8325}$

In short ; $0.\bar{a} = \frac{a}{9}, 0.\overline{ab} = \frac{ab}{99}, 0.\overline{abc} = \frac{abc}{999}$, etc. and

$0.a\bar{b} = \frac{ab-a}{90}, 0.\overline{abc} = \frac{abc-a}{990}, 0.ab\bar{c} = \frac{abc-ab}{900}$,

$0.ab\overline{cd} = \frac{abcd-ab}{9900}, ab \cdot cd\bar{e} = \frac{abcde-abc}{990}$, etc.

**Example 1. Convert $2.\overline{46102}$ in the $\frac{p}{q}$ form of rational number.**

**Sol.** Required $\frac{p}{q}$ form $= \frac{246102-2}{99999} = \frac{246100}{99999}$

**Example 2. Convert $0.167\overline{3206}$ in the $\frac{p}{q}$ form of rational number.**

**Sol.** Required $\frac{p}{q}$ form $= \frac{1673206 - 167}{9999000} = \frac{1673039}{9999000}$

## TEST OF A PRIME NUMBER

A prime number is only divisible by 1 and by the number itself. The first prime number is 2. All other prime number are odd. To test whether any given number $p$ is a prime number of not, following steps are to be considered :

**Step 1 :** If $p$ is odd, then go to step 2. If even, then it is not a prime.

**Step 2 :** Find an integer $x > \sqrt{p}$ .

**Step 3 :** Test the divisibility of the given number $p$ by every prime number less than $x$.

**Step 4 :**

- If the given number is divisible by any of them in Step 3, then the given number is NOT a prime number.
- If the given number is not divisible by any of them in Step 3, then the given number is a **prime number**.

***Example :*** Consider a number 437. Test if it is a prime number or not.

**Step 1 :** It is odd

**Step 2 :** The approximate square root 437 is 20 plus. Take $x = 21$.

**Step 3 :** Check the divisibility of 437 by the prime number less than 21 i.e., by 2, 3, 5, 7, 11, 13, 17, 19.

**Step 4 :** 437 is divisible by 19. Thus 437 is not a prime number.

## FRACTION

A fraction is a quantity which expresses a part of the whole.

$$\text{Fraction} = \frac{\text{Numerator}}{\text{Denominator}}$$

### Types of Fractions

**(i) Proper fraction :** If numerator is less than its denominator, then it is a proper fraction.

***For example :*** $\frac{2}{5}, \frac{6}{18}$

**(ii) Improper fraction :** If numerator is greater than or equal to its denominator, then it is a improper fraction.

***For example :*** $\frac{5}{2}, \frac{18}{7}, \frac{13}{13}$

### Note

If in a fraction, numerator and denominator are of equal value then fraction is equal to unity i.e. 1.

**(iii) Mixed fraction :** It consists of an integer and a proper fraction.

***For example :*** $1\frac{1}{2},\ 3\frac{2}{3}, 7\frac{5}{9}$

### Note

Mixed fraction can always be changed into improper fraction and vice versa.

***For example :*** $7\frac{5}{9} = \frac{7\times 9+5}{9} = \frac{63+5}{9} = \frac{68}{9}$

and $\frac{19}{2} = \frac{9\times 2+1}{2} = 9+\frac{1}{2} = 9\frac{1}{2}$

**(iv) Equivalent fractions/Equal fractions :** Fractions with same value.

***For example :*** $\frac{2}{3}, \frac{4}{6}, \frac{6}{9}, \frac{8}{12}\left(=\frac{2}{3}\right)$.

**(v) Like fractions:** Fractions with same denominators.

***For example :*** $\frac{2}{8}, \frac{3}{8}, \frac{9}{8}, \frac{11}{8}$

**(vi) Unlike fractions :** Fractions with different denominators.

***For example :*** $\frac{2}{5}, \frac{4}{7}, \frac{9}{8}, \frac{9}{2}$

### Note

Unlike fractions can be converted into like fractions.

***For example :*** $\frac{3}{5}$ and $\frac{4}{7}$

$\frac{3}{5}\times\frac{7}{7} = \frac{21}{35}$ and $\frac{4}{7}\times\frac{5}{5} = \frac{20}{35}$

**(vii) Simple fraction :** Numerator and denominator are integers.

***For example :*** $\frac{3}{7}$ and $\frac{2}{5}$.

**(viii) Complex fraction :** Numerator or denominator or both are fractional numbers.

***For example :*** $\frac{\frac{2}{5}}{\frac{7}{}}, \frac{2\frac{1}{3}}{5\frac{2}{3}}, \frac{2+\frac{1+\frac{2}{7}}{3}}{2}$

**(ix) Decimal fraction :** Denominator with the powers of 10.

***For example :*** $\frac{2}{10} = (0.2), \frac{9}{100} = (0.09)$

**(x) Vulgar fraction :** Denominators are not the power of 10.

***For example :*** $\frac{3}{7}, \frac{9}{2}, \frac{5}{193}$ .

## ROUNDING OFF OF DECIMAL NUMBERS

There are some decimals in which numbers are found upto large number of decimal places.

***For example :*** 3.4578 and 21.358940789

Many time in such cases, we want to consider the decimal number only upto a certain place after decimal. For this

- We will take the number upto the required place without any change, if the next digit after the required place is less than 5 (this is called **rounding down**).
- We will take the number upto the required place by increasing the required place digit by 1, if the next digit after the required place is 5 or greater than 5 (this is called **rounding up**).

**Example 3. Rounding off the following numbers upto 3 decimal places:**

**(i) 5.67325698 (ii) 0.0045286 (iii) 62.586631**

**Sol. (i)** 5.673 [as the fourth place digit (2) after decimal is less than 5].

**(ii)** 0.005 [as the fourth place digit (5) after decimal is 5]

**(iii)** 62.587 [as the fourth place digit (6) after decimal is greater than 5]

## PROPERTIES OF OPERATIONS

The following operations of addition, subtraction, multiplication and division are valid for real numbers.

**(i)** Commutative property of addition :
$a + b = b + a$

**(ii)** Associative property of addition :
$(a + b) + c = a + (b + c)$

**(iii)** Commutative property of multiplication :
$a \times b = b \times a$

**(iv)** Associative property of multiplication :
$(a \times b) \times c = a \times (b \times c)$

**(v)** Distributive property of multiplication with respect to addition :
$a \times (b + c) = a \times b + a \times c$

## DIVISIBILITY RULES

**Divisibility by 2**

A number is divisible by 2 if it's unit digit is either even number or 0.

**Divisibility by 3**

A number is divisible by 3 if the sum of it's digits are divisible by 3.

**Divisibility by 4**

A number is divisible by 4 if the number formed by the last 2 digits are divisible by 4, or if the last two digits are 0's.

**Divisibility by 5**

A number is divisible by 5 if it's unit digit is either 5 or 0.

**Divisibility by 6**

A number is divisible by 6 if it is simultaneously divisible by 2 and 3.

**Divisible by 7**

A number is divisible by 7 if unit's place digit is multiplied by 2 and subtracted from the remaining digits and the number obtained is divisible by 7.

***For example :*** $1680\boxed{7} \rightarrow 1680 - 7 \times 2 = 1666$

It is difficult to decide whether 1666 is divisible by 7 or not. In such cases, we continue the process again and again till it become easy to decide whether the number is divisible by 7 or not.

$166\boxed{6} \longrightarrow 166 - 6 \times 2 = 154$

Again $15\boxed{4} \longrightarrow 15 - 4 \times 2 = 7$, divisible by 7

Hence 16807 is divisible by 7.

**Divisible by 11**

In a number, if difference of sum of digit at even places and sum of digit at odd places is either 0 or multiple of 11, then the number is divisible by 11.

***For example,*** $12342 \div 11$

Sum of even place digit = 2 + 4 = 6

Sum of odd place digit = 1 + 3 + 2 = 6

Difference = 6 – 6 = 0

$\therefore$ 12342 is divisible by 11.

**Divisible by 13**

A number is divisible by 13 if its unit's place digit is multiplied by 4 and added to the remaining digits and the number obtained is divisible by 13.

***For example :*** $219\boxed{7} \longrightarrow 219 + 7 \times 4 = 247$

Again $24\boxed{7} \longrightarrow 24 + 7 \times 4 = 52$, divisible by 13.

Hence 2197 is divisible by 13.

**Divisible by 17**

A number is divisible by 17 if its unit's place digit is multiplied by 5 and subtracted from the remaining digits and the number obtained is divisible by 17.

***For example:*** $491\boxed{3} \longrightarrow 491 - 3 \times 5 = 476$

Again, $47\boxed{6} \longrightarrow 47 - 6 \times 5 = 17$, divisible by 17.

Hence 4913 is divisible by 17.

**Divisible by 19**

A number is divisible by 19 if its unit's place digit is multiplied by 2 and added to the remaining digits and the number obtained is divisible by 19.

***For example:*** $4873\boxed{7} \longrightarrow 4873 + 7 \times 2 = 4887$

$488\boxed{7} \longrightarrow 488 + 7 \times 2 = 502$

$50\boxed{2} \longrightarrow 50 + 2 \times 2 = 54$ not divisible by 19.

Hence 48737 is not divisible by 19.

### Divisibility by a Composite Number

A number is divisible by a given composite number if it is divisible by all prime factors of composite number.

### Properties of Divisibility

**(i)** The product of 3 consecutive natural numbers is divisible by 6.

**(ii)** The product of 3 consecutive natural numbers, the first of which is even, is divisible by 24.

**(iii)** Difference between any number and the number obtained by writing the digits in reverse order is divisible by 9.

**(iv)** Any number written in the form $(10^n - 1)$ is divisible by 3 and 9.

**(v)** Any number with number of digits equal to multiple of 6, is divisible by each of 7, 11 and 13 if all of its digits are same.

***For example:*** 666666, 888888, 333333333333 are all divisible by 7, 11 and 13.

**Note that** multiples of 6 are 6, 12, 18, 24, 30,.... etc.

**(vi)** Any number in the form *abcabc* (*a*, *b*, *c* are three different digits) is divisible by 1001.

**(vii)** (a) $(a^n - b^n)$ is divisible both by $(a + b)$ and $(a - b)$, when $n$ is even.

(b) $(a^n - b^n)$ is divisible only by $(a - b)$, when $n$ is odd.

## DIVISION ALGORITHM

$$\text{Divisor})\overline{\text{Dividend}}(\text{Quotient}$$
$$\underline{\text{Remainder}}$$

Dividend = (Divisor × Quotient) + Remainder

where, Dividend = The number which is being divided

Divisor = The number which performs the division process

Quotient = Greatest possible integer as a result of division

Remainder = Rest part of dividend which cannot be further divided by the divisor.

- Two different numbers $x$ and $y$ when divided by a certain divisor $D$ leave remainder $r_1$ and $r_2$ respectively. When the sum of them is divided by the same divisor, the remainder is $r_3$. Then,

$$\boxed{\text{Divisor } (D) = r_1 + r_2 - r_3}$$

## POWERS OR EXPONENTS

When a number is multiplied by itself, it gives the square of the number. i.e., $a \times a = a^2$ (Example $5 \times 5 = 5^2$)

If the same number is multiplied by itself twice we get the cube of the number i.e., $a \times a \times a = a^3$ (Example $4 \times 4 \times 4 = 4^3$)

In the same way $a \times a \times a \times a \times a = a^5$

and $a \times a \times a \times ...$ upto $n$ times $= a^n$

There are some basic rules of powers known as Law of Indices and Law of Surds.

### Law of Indices

If $a$ and $b$ are any two real numbers and $m$ and $n$ are positive integers, then

**(i)** $a^m \times a^n = a^{m+n}$ (Example: $5^3 \times 5^4 = 5^{3+4} = 5^7$)

**(ii)** $\dfrac{a^m}{a^n} = a^{m-n}$, if $m > n$ $\left(\text{Example}: \dfrac{6^5}{6^2} = 6^{5-2} = 6^3\right)$

$\dfrac{a^m}{a^n} = \dfrac{1}{a^{n-m}}$, if $m < n$ $\left(\text{Example}: \dfrac{4^3}{4^8} = \dfrac{1}{4^{8-3}} = \dfrac{1}{4^5}\right)$

and $\dfrac{a^m}{a^n} = a^0 = 1$, if $m = n$ $\left(\text{Example}: \dfrac{3^4}{3^4} = 3^{4-4} = 3^0 = 1\right)$

**(iii)** $(a^m)^n = a^{mn} = (a^n)^m$ (Example: $(6^2)^4 = 6^{2 \times 4} = 6^8 = (6^4)^2$)

**(iv)** (a) $(ab)^n = a^n \cdot b^n$ (Example: $(6 \times 4)^3 = 6^3 \times 4^3$)

(b) $\left(\dfrac{a}{b}\right)^n = \dfrac{a^n}{b^n}, b \neq 0$ $\left(\text{Example}: \left(\dfrac{5}{3}\right)^4 = \dfrac{5^4}{3^4}\right)$

**(v)** $a^{-n} = \dfrac{1}{a^n}$ $\left(\text{Example}: 5^{-3} = \dfrac{1}{5^3}\right)$

**(vi)** For any real number $a$, $a^0 = 1$ (Example : $8^0 = 1$)

### Law of Surds

**(i)** $(a^{1/n})^n = a$ (Example: $(8^{1/3})^3 = 8$)

**(ii)** $a^{1/n} \cdot b^{1/n} = (ab)^{1/n}$ (Example: $5^{1/3} \cdot 8^{1/3} = (5 \times 8)^{1/3} = (40)^{1/3}$)

**(iii)** $(a^{1/n})^{1/m} = a^{\frac{1}{mn}}$ (Example : $(5^{1/3})^{1/5} = 5^{\frac{1}{3\times5}} = 5^{1/15}$)

**(iv)** $a^{1/n} = \sqrt[n]{a}$ (Example : $5^{1/3} = \sqrt[3]{5}$ )

**(v)** $a^{m/n} = \sqrt[n]{a^m}$ (Example : $5^{3/7} = \sqrt[7]{5^3}$ )

## ADDITION AND SUBTRACTION OF SURDS

***Example:***

$$5\sqrt{2} + 20\sqrt{2} - 3\sqrt{2} = (5 + 20 - 3)\sqrt{2} = 22\sqrt{2}$$

***Example:***

$$\sqrt{45} - 3\sqrt{20} + 4\sqrt{5} = 3\sqrt{5} - 6\sqrt{5} + 4\sqrt{5} = (3 - 6 + 4)\sqrt{5} = \sqrt{5}$$

## GENERAL OR EXPANDED FORM OF 2 AND 3 DIGITS NUMBERS

**(i)** In a two digits number $AB$, $A$ is the digit of tenth place and $B$ is the digit of unit place, therefore $AB$ is written using place value in expanded form as

$AB = 10A + B$

***For example:*** $35 = 10 \times 3 + 5$

**(ii)** In a three digits number $ABC$, $A$ is the digit of hundred place, $B$ is the digit of tenth place and $C$ is the digit of unit place, therefore $ABC$ is written using place value in expanded form as

$ABC = 100A + 10B + C$

***For example:*** $247 = 100 \times 2 + 10 \times 4 + 7$

These expanded forms are used in forming equations related to 2- and 3- digits numbers.

**Example 4. In a two digit prime number, if 18 is added, we get another prime number with reversed digits. How many such numbers are possible ?**

**Sol.** Let a two-digit number be $10p + q$.

$\therefore \quad 10p + q + 18 = 10q + p$

$\Rightarrow \quad -9p + 9q = 18 \quad \Rightarrow \quad q - p = 2$

Satisfying this condition and also the condition of being a prime number there are 2 numbers 13 and 79.

## PRIME FACTORISATION

It is a process of representing a given number as a product of two or more prime numbers.

Each prime number which is present in the product is called a **prime factor** of the given number.

***For example:*** 12 is expressed in the factorised form in terms of its prime factors as $12 = 2\times2\times3 = 2^2 \times 3$.

## METHOD TO FIND THE NUMBER OF DIFFERENT DIVISORS OR FACTORS (INCLUDING 1 AND ITSELF) OF ANY COMPOSITE NUMBER *N* :

**Step I :** Express $N$ as a product of prime numbers as

$N = x^a \times y^b \times z^c$ .....

**Step II :** Number of different divisors (including 1 and itself)

$= (a + 1)(b + 1)(c + 1)$ .....

## NUMBER OF WAYS OF EXPRESSING A COMPOSITE NUMBER AS A PRODUCT OF TWO FACTORS

**(i)** Number of ways of expressing a composite number $N$ which is not a perfect square as a product of two factors

$= \frac{1}{2} \times$ (Number of prime factors of the $N$)

**(ii)** Number of ways of expressing a perfect square number $M$ as a product of two factors

$= \frac{1}{2}$ [(Number of prime factors of $M$) + 1]

**Example 5. Find the number of ways of expressing 180 as a product of two factors.**

**Sol.** $180 = 2^2 \times 3^2 \times 5^1$

Number of factors = (2 + 1) (2 + 1) (1 + 1) = 18

Since 180 is not a perfect square, hence there are total $\frac{18}{2} = 9$ ways in which 180 can be expressed as a product of two factors.

**Example 6. Find the number of ways expressing 36 as a product of two factors.**

**Sol.** $36 = 2^2 \times 3^2$

Number of factors = (2 + 1) (2 + 1) = 9

Since 36 is a perfect square, hence the number of ways of expressing 36 as a product of two factors $= \frac{9+1}{2} = 5$,

as $36 = 1 \times 36, 2 \times 18, 3 \times 12, 4 \times 9$ and $6 \times 6$.

## COUNTING NUMBER OF ZEROS

Sometimes we come across problems in which we have to count number of zeros at the end of factorial of any number. For example:

Number of zeros at the end of 10!

$10! = 10 \times 9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1$

Here basically we have to count number of fives, because multiplication of five by any even number will result in 0 at the end of final product. In 10! we have 2 fives (as $10 = 2 \times 5$). There are more than two even number also in 10! Thus total number of zeros are 2.

**Note**

'10!' is read as 'Ten factorial'.

Here '!' indicates 'factorial'.

We find the factorial of only natural numbers.

If '$n$' is a natural number, then $n! = n(n-1)(n-2)$ ..... 4.3.2.1

***Remember...***

Number of zeros at the end of n! is the integral part of the value of

$$\frac{n}{5} + \frac{n}{5^2} + \frac{n}{5^3} + \frac{n}{5^4} + \cdots\cdots\cdots$$

**Example 7. Number of zeros at the end of 100!**

**Sol.** Number of zeros at the end of 100!

$= $ Integral part of $\frac{100}{5} + \frac{100}{5^2} + \frac{100}{5^3} + \cdots\cdots\cdots$

$= 20 + 4 = 24$ zeros.

**Example 8. Number of zeros at the end of 126!**

**Sol.** Number of zeros at the end of 126!

$= $ Integral part of $\frac{126}{5} + \frac{126}{5^2} + \frac{126}{5^3} + \cdots\cdots\cdots$

$= 25 + 5 + 1 = 31$ zeros.

**Example 9. Number of zeros at the end of 90!**

**Sol.** Number of zeros at the end of 90!

$= $ Integral part of $\frac{90}{5} + \frac{90}{5^2} + \frac{90}{5^3} + \cdots\cdots\cdots$

$= 18 + 3 = 21$ zeros

## HIGHEST POWER OF A PRIME NUMBER CONTAINED IN A FACTORIAL

Highest power of a prime number $P$ in $N!$

$$= \left[\frac{N}{P}\right] + \left[\frac{N}{P^2}\right] + \left[\frac{N}{P^3}\right] + \text{---} + \left[\frac{N}{P^r}\right],$$

where $[x]$ denotes the greatest integers less than or equal to $x$ and is a natural number. Also $P^r < N$.

**Example 10. Find highest power of 7 in 50!**

**Sol.** The highest power 7 in 50!

$$= \left[\frac{50}{7}\right] + \left[\frac{50}{7^2}\right] = 7 + 1 = 8$$

## TO FIND THE LAST DIGIT OR DIGIT AT THE UNIT'S PLACE OF $a^n$.

**(i)** If the last digit or digit at the unit's place of a is 1, 5 or 6, then whatever be the value of $n$, it will have the same digit at unit's place, i.e.,

$(.....1)^n = (.....1)$

$(.....5)^n = (.....5)$

$(.....6)^n = (.....6)$

**(ii)** If the last digit or digit at the units place of a is 2, 3, 7 or 8, then the last digit of $a^n$ depends upon the value of $n$ and follows a repeating pattern in terms of 4 as given below :

| $n$ | last digit of $(...2)^n$ | last digit of $(...3)^n$ | last digit of $(...7)^n$ | last digit of $(...8)^n$ |
|---|---|---|---|---|
| 1 | 2 | 3 | 7 | 8 |
| 2 | 4 | 9 | 9 | 4 |
| 3 | 8 | 7 | 3 | 2 |
| 4 | 6 | 1 | 1 | 6 |
| 5 | 2 | 3 | 7 | 8 |

**(iii)** If the last digit or digit at the unit's place of a is either 4 or 9, then the last digit of $a^n$ depends upon the value of $n$ and follows repeating pattern in terms of 2 as given below.

| $n$ | last digit of $(....4)^n$ | last digit of $(....9)^n$ |
|---|---|---|
| 1 | 4 | 9 |
| 2 | 6 | 1 |
| 3 | 4 | 9 |

**Example 11. Find unit digit of $963^{63} \times 73^{73}$.**

**Sol.** $(963)^{63} = (963)^{4\times15} \times (963)^3$

$\therefore$ Unit digit of $963^{63} = 7$

$(73)^{73} = (73)^{4\times18} \times (73)^1$

Unit digit of $73^{73} = 3$

So unit digit of $963^{63} \times 73^{73} \Rightarrow 7 \times 3 \Rightarrow 21$. i.e., 1.

**Example 12. Find unit digit of $17^{17} \times 27^{27} \times 37^{37}$.**

**Sol.** Unit digit of $17^{17} = 7$

Unit digit of $27^{27} = 3$

Unit digit of $37^{37} = 7$

So unit digit of $17^{17} \times 27^{27} \times 37^{37} = 7 \times 3 \times 7 = 147$

i.e., unit digit = 7

**Example 13. Find unit digit of $18^{18} \times 28^{28} \times 288^{288}$.**

**Sol.** Unit digit of $18^{18}$ is 4.

Unit digit of $28^{28}$ is 6.

Unit digit of $288^{288}$ is 6

So unit digit of $18^{18} \times 28^{28} \times 288^{288}$ .

$\Rightarrow$ $4 \times 6 \times 6 \Rightarrow 144$ i.e. unit digit = 4

**Example 14. Find unit digit of $11^{11} + 12^{12} + 13^{13} + 14^{14} + 15^{15}$.**

**Sol.** Unit digit of $11^{11} = 1$

Unit digit of $12^{12} = 6$

Unit digit of $13^{13} = 3$

Unit digit of $14^{14} = 6$

Unit digit of $15^{15} = 5$

So unit digit of given sum will be

$1 + 6 + 3 + 6 + 5 = 21$ i.e., 1

**Example 15. Find unit digit of $21^{21} \times 22^{22} \times 23^{23} \times 24^{24} \times 25^{25}$.**

**Sol.** $25^{25}$ will give 5 in unit place, which when multiplied by an even number i.e. 0, 2, 4, 6, 8. It will give zero at unit place. So, zero will be at the unit digit of given question.

## REMAINDER THEOREM

Remainder of expression $\frac{a\times b\times c}{n}$ [i.e. $a \times b \times c$ when divided by $n$] is equal to the remainder of expression $\frac{a_r \times b_r \times c_r}{n}$ [i.e. $a_r \times b_r \times c_r$ when divided by $n$] , where

$a_r$ is remainder when $a$ is divided by $n$.

$b_r$ is remainder when $b$ is divided by $n$. and

$c_r$ is remainder when $c$ is divided by $n$.

**Example 16. Find the remainder of $15 \times 17 \times 19$ when divided by 7.**

**Sol.** On dividing 15 by 7, we get 1 as remainder.

On dividing 17 by 7, we get 3 as remainder.

On dividing 19 by 7, we get 5 as remainder.

Remainder of $\frac{15\times17\times19}{7}$ = Remainder of $\frac{1\times3\times5}{7}$

= Remainder of $\frac{15}{7}$ = Remainder of $2\frac{1}{7}$ i.e. 1

**Example 17. Find the remainder of expression $\frac{19\times20\times21}{9}$**

**Sol.** Remainder of given expression = Remainder of $\frac{1\times2\times3}{9}$

= Remainder of $\frac{6}{9}$, i.e., 6.

## POLYNOMIAL THEOREM

When $(x + a)^n$ is divided by $x$, then remainder is equal to the remainder of the expression $\frac{a^n}{x}$.

**Example 18. Find the remainder of $\frac{9^{99}}{8}$.**

**Sol.** $\frac{9^{99}}{8} = \frac{(8+1)^{99}}{8}$

According to polynomial theorem, remainder of $\frac{9^{99}}{8}$ will be equal to remainder of the expression $\frac{1^{99}}{8} \Rightarrow \frac{1}{8}$ i.e., Remainder =1

**Example** **19. Find the remainder of $\frac{8^{99}}{7}$.**

**Sol.** $\frac{8^{99}}{7} \Rightarrow \frac{(7+1)^{99}}{7} \Rightarrow \frac{1^{99}}{7}$ i.e. Remainder = 1

**Example** **20. Find remainder of $\frac{11\times13\times17}{6}$.**

**Sol.** $\frac{11\times13\times17}{6} \Rightarrow \frac{5\times1\times5}{6} \Rightarrow \frac{1}{6}$ i.e., Remainder =1

**Example** **21. Find remainder of $\frac{9^{100}}{7}$.**

**Sol.** $\frac{9^{100}}{7} \Rightarrow \frac{(7+2)^{100}}{7} \Rightarrow \frac{2^{100}}{7} \Rightarrow \frac{2^{99}\times2}{7}$

$\Rightarrow \frac{2^{3\times33}\times2}{7} \Rightarrow \frac{8^{33}\times2}{7} \Rightarrow \frac{(7+1)^{33}}{7}\times2$

$\Rightarrow \frac{1\times2}{7}=\frac{2}{7}$ i.e. Remainder = 2

**Example** **22. Find remainder of $\frac{9^{50}}{7}$.**

**Sol.** $\frac{9^{50}}{7} \Rightarrow \frac{(7+2)^{50}}{7} \Rightarrow \frac{2^{50}}{7}$

$\Rightarrow \frac{\left(2^3\right)^{16}\times2^2}{7} \Rightarrow \frac{8^{16}\times4}{7}$

$\Rightarrow \frac{(7+1)^{16}\times4}{7} \Rightarrow \frac{1\times4}{7}$ i.e., Remainder = 4

**Example** **23. Find remainder of $\frac{25^{50}}{7}$.**

**Sol.** $\frac{25^{50}}{7} \Rightarrow \frac{(3\times7+4)^{50}}{7} \Rightarrow \frac{4^{50}}{7}$

$\Rightarrow \frac{2^{100}}{7} \Rightarrow \frac{\left(2^3\right)^{33}\times2}{7} \Rightarrow \frac{(7+1)^{33}}{7}\times2 \Rightarrow \frac{1\times2}{7}$

$\Rightarrow$ Remainder is 2.

**Example** **24. Find remainder of $\frac{3^{50}}{7}$.**

**Sol.** $\frac{3^{50}}{7} \Rightarrow \frac{(3^2)^{25}}{7} \Rightarrow \frac{(7+2)^{25}}{7} \Rightarrow \frac{2^{25}}{7} \Rightarrow \frac{(2^3)^8\times2}{7}$

$\Rightarrow \frac{(7+1)^8\times2}{7} \Rightarrow \frac{1\times2}{7} \Rightarrow$ Remainder is 2.

**Example** **25. Find remainder of $\frac{3^{250}}{7}$**

**Sol.** $\frac{(3^2)^{125}}{7} \Rightarrow \frac{(7+2)^{125}}{7} \Rightarrow \frac{2^{125}}{7}$

$\Rightarrow \frac{(2^3)^{41}\times2^2}{7} \Rightarrow \frac{(8)^{41}\times2^2}{7} \Rightarrow \frac{(7+1)^{41}\times4}{7} \Rightarrow \frac{1\times4}{7}$

$\Rightarrow$ Remainder is 4

## SHORTCUTS

### Shortcut Approach – 1

When two numbers are divided by a third number, leave the same remainder, then the difference of these two numbers is always perfectly divisible by third number.

**Example** **26. 24345 and 33334 are divided by certain number of three digits and the remainder is the same in both the cases. Find the divisor and the remainder.**

**(a) 103, 6 (b) 809, 3 (c) 101, 4 (d) 109, 5**

**Sol. (c)** Difference = 33334 – 24345 = 8989
Since, 8989 = 101 × 89
$\therefore$ 101 is the required 3 digit divisor
On dividing any of the given numbers by 101, we get 4 as remainder.

### Shortcut Approach – 2

Sum of the digits of a given two digit number is $S$. When its digits are interchange their places, the number decreased by $D$. Then,

Given number $= 5\left(S+\frac{D}{9}\right)+\frac{1}{2}\left(S-\frac{D}{9}\right)$

**Example** **27. Sum of the digits of a given 2–digit number is 12. When its digits interchange their places, the number decreases by 54. Find the number.**

**(a) 93 (b) 84 (c) 75 (d) 66**

**Sol. (a)** $\therefore$ Given number $= 5\left[S+\frac{D}{9}\right]+\frac{1}{2}\left[S-\frac{D}{9}\right]$

$= 5\left[12+\frac{54}{9}\right]+\frac{1}{2}\left[12-\frac{54}{9}\right] = 5\times18+\frac{1}{2}\times6 = 93$

### Shortcut Approach – 3

(i) $(a^n + b^n)$ is divisible by $(a + b)$ when $n$ is odd

(ii) $(a^n - b^n)$ is divisible by both $(a+b)$ and $(a-b)$ when $n$ is even

(iii) $(a^n - b^n)$ is divisible by only $(a - b)$ when $n$ is odd

**Example** **28. If $(67^{67}+ 67)$ is dividing by 68, the remainder is :**

**(a) 61 (b) 67 (c) 63 (d) 66**

**Sol. (d)** $\because$ $(x^n + y^n)$ is divisible by $(x + y)$ when $n$ is odd
So, $((67^{67} + 1^{67}) + 66)$
$(67^{67} + 1^{67})$ is divisible by 68,
Hence remainder is 66.

### Shortcut Approach – 4

When $(x^n + k)$ is divided by $(x – 1)$,

(a) Remainder = $1 + k$; if $k < (x – 1)$

(b) Remainder = 1 + (Remainder obtained when $k$ is divided by $x – 1$); if $k > x – 1$

**Example** **29. Find the remainder on dividing $(9^{16} + 6)$ by 8.**

**(a) 5 (b) 7 (c) 2 (d) 3**

**Sol. (b)** Here $k = 6$ and $x - 1 = 8$

$\therefore \quad k < (x - 1)$

So, Remainder $= 1 + k = 1 + 6 = 7$

### Shortcut Approach – 5

To find the value of $\sqrt{x+\sqrt{x+\sqrt{x+.....}}}$, find the factors of $x$, such that the difference between the factors is 1, then the larger factor will be the result.

**Example 30.** $\sqrt{6+\sqrt{6+\sqrt{6+...}}}$ **is equal to**

**(a) 3 (b) 4 (c) 5 (d) 6**

**Sol. (a)** $\sqrt{6+\sqrt{6+\sqrt{6+.....}}}$

The factors of 6 with difference one are 2 and 3

Here 3 is the larger factors.

Hence $\sqrt{6+\sqrt{6+\sqrt{6+.....}}} = 3$

**Example 31.** $\sqrt{12+\sqrt{12+\sqrt{12+\sqrt{12.....}}}} = ?$

**(a) 3 (b) 4 (c) 6 (d) 12**

**Sol. (b)** $\sqrt{12+\sqrt{12+\sqrt{12+\sqrt{12+...}}}}$

The two factors of 12 with difference one are 4 and 3.

Here, 4 is the bigger factor.

Hence, $\sqrt{12+\sqrt{12+\sqrt{12+\sqrt{12+.....}}}} = 4$

**Example 32. The value of** $\sqrt{20+\sqrt{20+\sqrt{20+.....}}}$ **is**

**(a) 4 (b) 5**

**(c) 6 (d) greater than 6**

**Sol. (b)** As given expression is

$\Rightarrow \quad \sqrt{20+\sqrt{20+\sqrt{20+.....}}}$

The factors of 20 with difference 1 are 4 and 5.

Here 5 is the larger factor.

Hence $\sqrt{20+\sqrt{20+\sqrt{20+.....}}} = 5$

**Example 33.** $\left(\sqrt{56+\sqrt{56+\sqrt{56+.....}}}\right) \div 2^2 = ?$

**(a) 0 (b) 1 (c) 2 (d) 8**

**Sol. (c)** As given expression

$\Rightarrow \quad \left(\sqrt{56+\sqrt{56+\sqrt{56+....}}}\right) \div 2^2$

The factor of 56 with difference one are 7 and 8.

Here 8 is the larger factor

Hence, $\left(\sqrt{56+\sqrt{56+\sqrt{56+....}}}\right) = 8 \quad \Rightarrow \quad 8 \div 2^2 = 2$

### Shortcut Approach – 6

To find the value of $\sqrt{x-\sqrt{x-\sqrt{x-.....}}}$ find the factors of $x$, such that the difference between the factors is 1, then the smaller factor will be the result.

**Example 34.** $\sqrt{2-\sqrt{2-\sqrt{2-\sqrt{2.....}}}} = ?$

**(a) 0 (b) 1 (c) 2 (d) 3**

**Sol. (b)** As given expression is

$\sqrt{2-\sqrt{2-\sqrt{2-\sqrt{2}}}}$

The factors of 2 with difference one are 1 and 2.

Here 1 is the smaller factor

Hence, $\sqrt{2-\sqrt{2-\sqrt{2-\sqrt{2}}}} = 1$

### Shortcut Approach – 7

$\sqrt{x\sqrt{x\sqrt{x..... \ n \text{ times}}}} = (x)^{\frac{2^n-1}{2^n}}$

**Example 35. The value of** $\sqrt{2\sqrt{2\sqrt{2\sqrt{2\sqrt{2}}}}}$ **will be**

**(a) 2 (b) $2^{15/32}$ (c) $2^{31/32}$ (d) 4**

**Sol. (c)** $\sqrt{2\sqrt{2\sqrt{2\sqrt{2\sqrt{2}}}}} = (2)^{\left[\frac{2^5-1}{2^5}\right]} = 2^{(31/32)}$

### Shortcut Approach – 8

$\sqrt{x\sqrt{x\sqrt{x\sqrt{x.....\infty}}}} = x$

**Example 36.** $\sqrt{3\sqrt{3\sqrt{3...}}}$ **is equal to**

**(a) $\sqrt{3}$ (b) 3 (c) $2\sqrt{3}$ (d) $3\sqrt{3}$**

**Sol. (b)** $\sqrt{3\sqrt{3\sqrt{3.....}}} = 3$

**Alternate Method :**

Let $\sqrt{3\sqrt{3\sqrt{3.....}}} = x$

or, $\sqrt{3x} = x$

Squaring both side

$3x = x^2$

$0 = x^2 - 3x$

$0 = x(x - 3)$

$x = 3$

**Example 37. If** $\sqrt{7\sqrt{7\sqrt{7\sqrt{7...}}}} = (343)^{y-1}$**, then $y$ will be equal to**

**(a) 2/3 (b) 1 (c) 4/3 (d) 3/4**

**Sol. (c)** $\sqrt{7\sqrt{7\sqrt{7\sqrt{7.....}}}} = (343)^{y-1}$

$\sqrt{7\sqrt{7\sqrt{7\sqrt{7.....}}}} = 7$

$7 = (343)^{y-1} \quad \Rightarrow \quad (7)^1 = (7)^{3(y-1)}$

$\Rightarrow \quad 3(y-1) = 1 \quad \Rightarrow \quad 3y - 3 = 1$

$\Rightarrow \quad 3y = 4 \quad \Rightarrow \quad y = 4/3$

# EXERCISE

**1.** The product of two consecutive even numbers is 12768. What is the greater number ?
(a) 110 (b) 108 (c) 114 (d) 112
(e) None of these

**2.** An amount of ₹ 50176 is distributed equally amongst 32 persons. How much amount would each person get?
(a) ₹ 1,555 (b) ₹ 1,478
(c) ₹ 1,460 (d) ₹ 1,568
(e) None of these

**3.** The sum of four consecutive even numbers. $A$, $B$, $C$, and $D$ is 180. What is the sum of the set of next four consecutive even numbers ?
(a) 214 (b) 212 (c) 196 (d) 204
(e) None of these

**4.** If the fractions $\frac{5}{14}, \frac{6}{11}, \frac{7}{9}, \frac{8}{13}$ and $\frac{9}{10}$ are arranged in ascending order of their values, which one will be the fourth?
(a) $\frac{7}{9}$ (b) $\frac{}{14}$ (c) $\frac{8}{13}$ (d) $\frac{9}{10}$
(e) None of these

**5.** What is the least number to be added to 1500 to make it a perfect square?
(a) 20 (b) 21 (c) 22 (d) 23
(e) None of these

**6.** The sum of three consecutive integers is 39. Which of the following is the largest among the three?
(a) 12 (b) 15 (c) 13 (d) 16
(e) None of these

**7.** The cost of 3 chairs and 10 tables is ₹ 9856. What is the cost of 6 chairs and 20 tables?
(a) ₹ 17227 (b) ₹18712
(c) ₹ 19172 (d) Cannot be determined
(e) None of these

**8.** If the fractions $\frac{1}{2}, \frac{2}{3}, \frac{5}{9}, \frac{6}{13}$ and $\frac{7}{9}$ are arranged in ascending order of their values, which one will be the fourth?
(a) $\frac{2}{3}$ (b) $\frac{6}{13}$ (c) $\frac{5}{9}$ (d) $\frac{7}{9}$
(e) None of these

**9.** If the following fractions $\frac{7}{8}, \frac{4}{5}, \frac{8}{14}, \frac{3}{5}$ and $\frac{5}{6}$ are arranged in descending order which will be the last in the series?
(a) $\frac{8}{14}$ (b) $\frac{7}{8}$ (c) $\frac{4}{5}$ (d) $\frac{3}{5}$
(e) $\frac{5}{6}$

**10.** If $(12)^3$ is subtracted from the square of a number the answer so obtained is 976. What is the number?
(a) 58 (b) 56 (c) 54 (d) 52
(e) None of these

**11.** $A$, $B$, $C$, $D$ and $E$ are five consecutive odd numbers. The sum of $A$ and $C$ is 146. What is the value of $E$?
(a) 75 (b) 81 (c) 71 (d) 79
(e) None of these

**12.** The sum of the squares of two consecutive even numbers is 6500. Which is the smaller number?
(a) 54 (b) 52 (c) 48 (d) 56
(e) None of these

**13.** How many perfect squares lie between 120 and 300 ?
(a) 5 (b) 6 (c) 7 (d) 8

**14.** The remainder when $3^{21}$ is divided by 5 is
(a) 1 (b) 2 (c) 3 (d) 4

**15.** The last digit of $(1001)^{2008} + 1002$ is
(a) 0 (b) 3 (c) 4 (d) 6

**16.** If $x * y = (x + 3)^2 (y - 1)$, then the value of 5 * 4 is
(a) 192 (b) 182 (c) $\sqrt{2}$ (d) 356

**17.** If $a * b = a^b$, then the value of 5 * 3 is
(a) 125 (b) 243 (c) 53 (d) 15

**18.** (1 + 0.6 + 0.06 + 0.006 .....) is
(a) $1\frac{2}{3}$ (b) $1\frac{1}{3}$ (c) $2\frac{1}{3}$ (d) $2\frac{2}{3}$

**19.** A number, when divided by 114, leaves remainder 21. If the same number is divided by 19, then the remainder will be
(a) 1 (b) 2 (c) 7 (d) 17

**20.** A number, when divided by 136, leaves remainder 36. If the same number is divided by 17, the remainder will be
(a) 9 (b) 7 (c) 3 (d) 2

**21.** A 4–digit number is formed by repeating a 2–digit number such as 1515, 3737, etc. Any number of this form is exactly divisible by
(a) 7 (b) 11 (c) 13 (d) 101

**22.** If '$n$' be any natural number, then by which largest number $(n^3 - n)$ is always divisible ?
(a) 3 (b) 6 (c) 12 (d) 18

**23.** A number when divided by 49 leaves 32 as remainder. This number when divided by 7 will have the remainder as
(a) 4 (b) 3 (c) 2 (d) 5

**24.** If $17^{200}$ is divided by 18, the remainder is
(a) 1 (b) 2 (c) 16 (d) 17

**25.** The unit digit in the sum of $(124)^{372} + (124)^{373}$ is
(a) 5 (b) 4 (c) 2 (d) 0

**26.** Which one of the following will completely divide $5^{71} + 5^{72} + 5^{73}$?
(a) 150 (b) 160 (c) 155 (d) 30

**27.** When '$n$' is divisible by 5 the remainder is 2. What is the remainder when $n^2$ is divided by 5?
(a) 2 (b) 3 (c) 1 (d) 4

**28.** '$a$' divides 228 leaving a remainder 18. The biggest two-digit value of '$a$' is
(a) 21 (b) 70 (c) 35 (d) 30

**29.** If the sum of the digits of any integer lying between 100 and 1000 is subtracted from the number, the result always is
(a) divisible by 5 (b) divisible by 6
(c) divisible by 2 (d) divisible by 9

**30.** A number $x$ when divided by 289 leaves 18 as the remainder. The same number when divided by 17 leaves $y$ as a remainder. The value of $y$ is
(a) 3 (b) 1 (c) 5 (d) 2

**31.** There are four consecutive positive odd numbers and four consecutive positive even numbers. The sum of the highest even number and highest odd number is 33. What is the sum of all the four consecutive odd and even numbers?
(a) 94 (b) 108 (c) 88 (d) 86
(e) 120

**32.** In a fraction, if numerator is increased by 40%, and denominator is increased by 80%. Then what fraction of the old fraction is the new fraction?
(a) $\frac{1}{2}$ (b) $\frac{7}{9}$
(c) $\frac{7}{18}$ (d) Date inadequate
(e) None of these

**33.** $\frac{4}{15}$ of $\frac{5}{7}$ of a number is greater than $\frac{4}{9}$ of $\frac{2}{5}$ of the same number by 8. What is half of that number?
(a) 630 (b) 315 (c) 210 (d) 105
(e) None of these

**34.** If the digits of a two digit number are interchanged the newly formed number is more than the original number by 18, and sum of the digit is 8 then what was the original number?
(a) 53 (b) 26
(c) 35 (d) Cannot be determined
(e) None of these

**35.** What least number would be subtracted from 427398 so that the remaining number is divisible by 15?
(a) 6 (b) 3 (c) 16 (d) 11
(e) None of these

**36.** If the numerator of a fraction increased by 200% and the denominator of the fraction is increased by 120%, the resultant fraction is $\frac{4}{11}$. What is the original fraction?
(a) $\frac{4}{15}$ (b) $\frac{3}{11}$ (c) $\frac{5}{12}$ (d) $\frac{6}{11}$
(e) None of these

**37.** Two sum of the two digits of a two digit number is 12 and the difference between the two digits of the two digit number is 6. What is the two-digit number?
(a) 39 (b) 84
(c) 93 (d) Cannot be determined
(e) None of these

**38.** There are 7 dozen candles kept in a box. If there are 14 such boxes, how many candles are there is all the boxes together?
(a) 1176 (b) 98
(c) 1216 (d) 168
(e) None of these

**39.** Which of the following smallest numbers should be added to 6659 to make it a perfect square?
(a) 230 (b) 65 (c) 98 (d) 56
(e) None of these

**40.** $a, b, c, d$ and $e$ are five consecutive even numbers. If the sum of '$a$' and '$d$' is 162, what is the sum of all the numbers?
(a) 400 (b) 380
(c) 420 (d) Cannot be determined
(e) None of these

**41.** For numbers $a$ and $b$, define as $a * b = (a + b) \div (a - b)$. Then the value of $(1 * 2) * 3$ is
(a) $-\frac{2}{3}$ (b) $-\frac{1}{5}$ (c) 0 (d) $\frac{1}{2}$

**42.** The unit's digit of $3^{2003}$ is
(a) 1 (b) 3 (c) 7 (d) 9

**43.** The six-digit number 5 *A B B* 7 *A* is a multiple of 33 for digits *A* and *B*. Which of the following could be possible value of $A + B$?
(a) 8 (b) 9 (c) 10 (d) 14

**44.** The remainder when $7^{1987}$ is divided by 5 is
(a) 1 (b) 2 (c) 3 (d) 4

**45.** Which is the largest?
(a) $10^{10}$ (b) $(2^{10})^5$
(c) $(5^{10})^2$ (d) $(4^5)^4$

**46.** The difference between a two-digit number and the number obtained by interchanging the two digits of the number is 18. The sum of the two digits of the number is 12. What is the product of the two digits of the two digits number ?
(a) 35 (b) 27
(c) 32 (d) Cannot be determined
(e) None of these

**47.** The prime number 1999 can be written as $a^2 - b^2$, where $a$ and $b$ are natural numbers. Then the value of $a^2 + b^2$ is
(a) 1998000 (b) 1998001
(c) 1999000 (d) 1999001

**48.** If a two digits number is $k$ times the sum of its digits, then the number formed by interchanging the digits is the sum of the digits multiplied by:
(a) $9 + k$ (b) $10 + k$ (c) $11 - k$ (d) $k - 1$

**49.** Which is the smallest number by which 4320 be divided to make it a perfect cube?
(a) 15 (b) 20 (c) 24 (d) 25

**50.** In every 30 minutes the time of a watch increases by 3 minutes. After setting the correct time at 5 am., what time will the watch show after 6 hours?
(a) 10 : 54 a.m. (b) 11 : 30 a.m.
(c) 11 : 36 a.m. (d) 11 : 42 a.m.
(e) 11 : 38 p.m.

**51.** If two numbers are each divided by the same divisor, the remainders are respectively 3 and 4. If the sum of the two numbers be divided by the same divisor, the remainder is 2. The divisor is :
(a) 9 (b) 7 (c) 5 (d) 3

**52.** If the digits in the unit and the ten's places of a Two digit number are interchanged, a new number is formed, which is greater than the original number by 63. Suppose the digit in the unit place of the original number the $x$. Then, all the possible values of $x$ are
(a) 7, 8, 9 (b) 2, 7, 9 (c) 0, 1, 2 (d) 1, 2, 8

**53.** The numerator of a fraction is 4 less than its denominator. If the numerator is decreased by 2 and the denominator is increased by 1, the denominator becomes eight times the numerator. Find the fraction. ***(IBPS PO Pre – 2016)***
(a) $\frac{3}{8}$ (b) $\frac{3}{7}$ (c) $\frac{4}{8}$ (d) $\frac{2}{7}$
(e) $\frac{5}{7}$

**54.** Given that, three numbers are such that the second number is twice the first and thrice the third. Also the average of the three numbers is 44. Then the difference of the first and the third is :
(a) 10 (b) 11 (c) 12 (d) 13

**55.** Let $x$ be an odd natural number. If $x$ is divided by 6, it leaves a remainder $y$. If $y^2$ is divided by 4, it leaves remainder of $z$. Which of the following must be true for $z$?
(a) $z = 3$ (b) $z = 5$
(c) $z = 1$ (d) $z$ is even

**56.** When 9 is subtracted from a two digit number, the number so formed is reverse of the original number. Also, the average of the digits of the original number is 7.5. What is definitely the original number? ***(IBPS PO Pre – 2017)***
(a) 87 (b) 92 (c) 90 (d) 69
(e) 96

**57.** The sum of a series of 5 consecutive odd numbers is 195. The second lowest number of this series is 9 less than the second highest number of another series of 5 consecutive even numbers. What is 40% of the second lowest number of the series of consecutive even numbers?
***(IBPS PO Pre – 2018)***
(a) 16.8 (b) 18.8 (c) 19.4 (d) 17.6
(e) 16.4

**58.** The sum of a series of 5 consecutive odd numbers is 225. The second number of this series is 15 less than the second lowest number of another series of 5 consecutive even numbers. What is 60% of the highest number of this series of consecutive even numbers?
(a) 36.0 (b) 34.6 (c) 38.4 (d) 40.8
(e) 39.2

**59.** $(x^{2a})^b = \sqrt{x^{\frac{4b}{c}}}$ and $\frac{x^{4b}}{x^{3a}} = x^{3(a-b)}x^b$. $a$, $b$ and $c$ being natural numbers.
(a) $a \neq b \neq c$ (b) $a = b < c$
(c) $a < b = c$ (d) $a = b = c$
(e) None of these

**60.** A classroom has equal number of boys and girls. Eight girls left to play Kho-Kho, leaving twice as many boys as girls in the classroom. What was the total number of girls and boys present initially?
(a) Cannot be determined (b) 16
(c) 24 (d) 32
(e) None of these

**61.** The sum of four numbers is 64. If you add 3 to the first number, 3 is subtracted from the second number, the third is multiplied by 3 and the fourth is divided by three, then all the results are equal. What is the difference between the largest and the smallest of the original numbers?
(a) 32 (b) 27
(c) 21 (d) Cannot be determined
(e) None of these

**62.** In a two digit number the digit in the unit's place is twice the digit in the ten's place and the number obtained by interchanging the digits is more than the original number by 27. What is 50% of the original number?
***(IBPS PO Pre – 2018)***
(a) 36 (b) 63 (c) 48 (d) 18
(e) None of these

**63.** What is the greater of two numbers whose product is 1092 and the sum of the two numbers exceeds their difference by 42?
(a) 48 (b) 44 (c) 52 (d) 54
(e) None of these

**64.** Two numbers are such that the sum of twice the first number and thrice the second number is 36 and the sum of thrice the first number and twice the second number is 39. Which is the smaller number?
(a) 9 (b) 5 (c) 7 (d) 3
(e) None of these

**65.** In a three digit number the digit in the unit's place is twice the digit in the ten's place and 1.5 times the digit in the hundred's place. If the sum of all the three digits of the number is 13, what is the number?
***(IBPS RRB PO Pre – 2019)***
(a) 364 (b) 436 (c) 238 (d) 634
(e) None of these

**66.** The denominators of two fractions are 5 and 7 respectively. The sum of these fractions is $\frac{41}{35}$. On interchanging the numerators, their sum becomes $\frac{43}{35}$. The fractions are

(a) $\frac{2}{5}$ and $\frac{4}{7}$ (b) $\frac{3}{5}$ and $\frac{4}{7}$

(c) $\frac{4}{5}$ and $\frac{2}{7}$ (d) $\frac{3}{5}$ and $\frac{5}{7}$

(e) None of these

**67.** The number $25^{64} \times 64^{25}$ is the square of a natural number $n$. The sum of digits of $n$ is

(a) 7 (b) 14
(c) 21 (d) 28

**68.** Let $x$ be the product of two numbers 3, 659, 893, 456, 789, 325, 678 and 342, 973, 489, 379, 256. The number of digits in $x$ is

(a) 32 (b) 34
(c) 35 (d) 36

**69.** The number $(2^{48} - 1)$ is exactly divisible by two numbers between 60 and 70. The numbers are:

(a) 63 and 65 (b) 63 and 67
(c) 61 and 65 (d) 65 and 67

**70.** If $(2^{36} - 1) = 68$ a 19476735, where a is any digit, then the value of a is

(a) 1 (b) 3
(c) 5 (d) 7

**71.** Given the numbers: $2^{5555}$, $3^{3333}$, $6^{2222}$. These can be written in ascending order as

(a) $2^{5555}$, $3^{3333}$, $6^{2222}$
(b) $3^{3333}$, $2^{5555}$, $6^{2222}$
(c) $2^{5555}$, $6^{2222}$, $3^{3333}$
(d) $6^{2222}$, $2^{5555}$, $3^{3333}$
(e) None of these

**72.** Rachita enters a shop to buy ice-creams, cookies and pastries. She has to buy atleast 9 units of each. She buys more cookies than ice-creams and more pastries than cookies. She picks up a total of 32 items. How many cookies does she buy?

(a) Either 12 or 13
(b) Either 11 or 12
(c) Either 10 or 11
(d) Either 9 or 11
(e) Either 9 or 10

**73.** The fare of a bus is ₹ $x$ for the first five kilometres and ₹13 per kilometres thereafter. If a passenger pays ₹ 2,402 for a journey of 187 kilometres, what is the value of $X$?

(a) ₹ 29 (b) ₹ 39
(c) ₹ 36 (d) ₹ 31
(e) None of these

**74.** In an examination, a student scores 4 marks for every correct answer and losses 1 mark for every wrong answer. A student attempted all the 200 questions and scored in all 200 marks. The number of questions, he answered correctly was :

(a) 82 (b) 80
(c) 68 (d) 60

**75.** A number consists of two digits and the digit in the ten's place exceeds that in the unit's place by 5. If 5 times the sum of the digits be subtracted from the number, the digits of the number are reversed. Then the sum of digits of the number is : ***(IBPS PO Pre – 2019)***

(a) 11 (b) 7 (c) 9 (d) 13
(e) 8

**76.** The sum of two digits of a number is 10. If the digits are interchanged, then its value increases by 18. Find the number. ***(RRB NTPC 2016)***

(a) 46 (b) 64
(c) 19 (d) 28

**77.** Find out which of the following sets form co-prime numbers. ***(RRB NTPC 2017)***

(a) (12, 7) (b) (21, 42)
(c) (43, 129) (d) (3, 9)

**78.** The least number that should be added to 2055 so that the sum is exactly divisible by 27 : ***(SSC CGL 1st Sit. 2015)***

(a) 24 (b) 27
(c) 31 (d) 28

**79.** What least value must be assigned to '*' so that the numbers 451*603 is exactly divisible by 9? ***(SSC CGL 1st Sit. 2016)***

(a) 7 (b) 8 (c) 5 (d) 9

**80.** What is the smallest value that must be added to 709, so that the resultant is a perfect square? ***(SSC Sub. Ins. 2017)***

(a) 8 (b) 12
(c) 20 (d) 32

**81.** If the seven digit number 74$x$29$y$6 is divisible by 72, then what will be the value of $(2x + 3y)$? ***(SSC Sub. Ins. 2018)***

(a) 21 (b) 20
(c) 19 (d) 16

**82.** What is the value of $x$ so that the seven digit number 8439$x$53 is divisible by 99? ***(SSC CGL-2018)***

(a) 9 (b) 4 (c) 3 (d) 6

**83.** Which among the following numbers is exactly divisible by 11.13 and 7? ***(SSC CHSL-2018)***

(a) 259237 (b) 259248
(c) 259270 (d) 259259

**84.** If the number $x$3208 is divisible by 3, what can be the face value of $x$? ***(RRB Group.D-2018)***

(a) 4 (b) 3 (c) 5 (d) 6

**85.** Which of the following numbers is perfectly divisible by 4? ***(RRB Group.D-2018)***

(a) 7253566 (b) 6542176
(c) 4187290 (d) 5632654

**86.** If the number 1005$x$4 is completely divisible by 8, then the smallest integer in place of $x$ will be : ***(SSC CGL 2019-20)***
(a) 1 (b) 0 (c) 4 (d) 2

**87.** Table given below shows the number of students having obtained different marks. ***(SSC MTS 2019-20)***

| Marks | Number of students | Marks | Number of students |
|---|---|---|---|
| 9 – 11 | 6 | 11 – 13 | 5 |
| 13 – 15 | 2 | 15 – 17 | 2 |
| 17 – 19 | 5 | | |

What is the mean marks per student?
(a) 13.5 (b) 12.25 (c) 15.5 (d) 14.25

**88.** When ($77^{77}$ + 77) is divided by 78, the remainder is: ***(SSC CHSL 2019-20)***
(a) 74 (b) 77
(c) 75 (d) 76

**89.** Find the greatest value of $b$ so that 30$a$68$b$ ($a > b$) is divisible by 11. ***(SSC CGL 2020-21)***
(a) 4 (b) 6 (c) 3 (d) 9

**90.** If the nine-digit number '8475639AB' is divisible by 99, then what is the value of A and B? ***(SSC CHSL 2020-21)***
(a) A = 4, B = 8 (b) A = 3, B = 9
(c) A = 5, B = 3 (d) A = 4, B = 6

**91.** In a week, the weights of a bag of tea were 350 kg, 340 kg, 270 kg, 360 kg, 310 kg, 300 kg. The range (in kg) is: ***(SSC MTS 2020-21)***
(a) 80 (b) 70 (c) 90 (d) 100®

**92.** If a nine-digit number 785$x$3678$y$ is divisibie by 72, then the value of ($x – y$) is: ***(SSC Sub-Inspector 2020-21)***
(a) – 2 (b) 0 (c) 2 (d) – 1

**93.** What is the least number which when divided by 15, 18 and 36 leaves the same remainder 9 in each case and is divisible by 11? ***(SSC Sub-Inspector 2020-21)***
(a) 1269 (b) 1071 (c) 1089 (d) 1080

**94.** If 14331433 × 1422 × 1425 is divided by 12, then what is the remainder ? ***(SSC Sub-Inspector 2020-21)***
(a) 3 (b) 6 (c) 9 (d) 8

**95.** Find the greatest number 23a68b, which is divisible by 3 but NOT divisible by 9. ***(SSC CGL Tier-1 2022)-***
**(a)** 238689 (b) 239685 (c) 239688 (d) 237687

# Hints & Solutions

**1. (c)** Let the two consecutive even number are $x$ and ($x$ + 2)
ATQ, $x(x + 2) = 12768$
$x^2 + 2x – 12768 = 0$
$(x + 114)(x – 112) = 0$
$x = 112$ ($\because x \neq$ –ve value)
$\therefore$ Larger number ($x$ + 2) = 114

**2. (d)** Amount received by each person = ₹ $\frac{50176}{32}$ = ₹1568

**3. (b)** Let the first even number is $x$. Then,
$x + x + 2 + x + 4 + x + 6 = 180$
$4x + 12 = 180$
$x = 42$.
$\therefore$ Next four consecutive even numbers are
50 + 52 + 54 + 56 = 212

**4. (a)** The decimal equivalent of fractions:
$\frac{5}{14} = 0.36$; $\frac{6}{11} = 0.545$; $\frac{7}{9} = 0.78$; $\frac{8}{13} = 0.62$
$\frac{9}{10} = 0.9$
Clearly, 0.36 < 0.545 < 0.62 < 0.78 < 0.9
i.e. $\frac{5}{14} < \frac{6}{11} < \frac{8}{13} < \frac{7}{9} < \frac{9}{10}$

**5. (b)** We have, $38^2 = 1444$
$39^2 = 1521$
Now, 1444 < 1500 < 1521
$(38)^2 < 150 < (39)^2$
$\therefore$ Required number = 1521 – 1500 = 21

**6. (e)** Let the three consecutive integers be $x$, $x$ + 1 and $x$+2
According to the question,
$x + x + 1 + x + 2 = 39$
or, $3x + 3 = 39$ or, $3x = 39 – 3 = 36$
or, $x = \frac{36}{3} = 12$
$\therefore$ Required largest number = $x$ + 2 = 12 + 2 = 14

**7. (e)** Let the cost of one chair be ₹ $x$ and that of a table be ₹ $y$
According to the question,
$3x + 10y =$ ₹ 9856 or, $2 \times (3x + 10y) = 2 \times 9856$
$\therefore$ $6x + 20y =$ ₹19712

**8. (a)** The given fractions are $\frac{1}{2}, \frac{2}{3}, \frac{5}{9}, \frac{6}{13}$ and $\frac{7}{9}$
LCM of their denominators is 234
$\therefore$ $\frac{117, 78, 26, 18, 26}{234}$
$\frac{117, 2\times78, 5\times26, 6\times18, 7\times26}{234}$
$\frac{117, 156, 130, 108, 182}{234}$
On arranging the numerators in ascending order
108, 117, 130, 156, 182.
$\therefore$ Ascending order of the fraction is
$\frac{6}{13} < \frac{1}{2} < \frac{5}{9} < \frac{2}{3} < \frac{7}{9}$

**9. (a)** Decimal equivalents of fractions

$\frac{7}{8} = 0.875,\ \frac{4}{5} = 0.8$

$\frac{8}{14} = 0.57,\ \frac{3}{5} = 0.6$

$\frac{5}{6} = 0.83$

$\therefore \quad 0.875 > 0.83 > 0.8 > 0.6 > 0.57$

$\therefore \quad \frac{7}{8} > \frac{5}{6} > \frac{4}{5} > \frac{3}{5} > \frac{8}{14}$

**10. (d)** Let the number be $x$.

$x^2 - (12)^3 = 976$

$\therefore \quad x^2 = 976 + 1728 = 2704$

$\therefore \quad x = \sqrt{2704} = 52$

**11. (d)** $A + C = 146$

or $\quad A + A + 4 = 146 \quad$ or $\quad A = \frac{146 - 4}{2} = 71$

$\therefore \quad E = A + 8 = 71 + 8 = 79$

**12. (d)** Let the two numbers be $x$ and $(x + 2)$.

Then, $x^2 + (x + 2)^2 = 6500$

$\Rightarrow \quad x^2 + x^2 + 4x + 4 = 6500$

$\Rightarrow \quad 2x^2 + 4x - 6496 = 0$

$\Rightarrow \quad x^2 + 2x - 3248 = 0$

$\Rightarrow \quad x^2 + 58x - 56x - 3248 = 0$

$\Rightarrow \quad (x + 58)(x - 56) = 0 \quad \Rightarrow \quad x = 56$

Again, using options, it is clear that

$(56)^2 + (58)^2 = 6500$

**13. (c)** $11^2 = 121,\ 12^2 = 144,\ 13^2 = 169,\ 14^2 = 196$

$15^2 = 225,\ 16^2 = 256,\ 17^2 = 289$

Square no above $120 = 121 = 11^2$

Square no below $300 = 289 = 17^2$

Total $11^2, 12^2, 13^2, 14^2, 15^2, 16^2, 17^2$, i.e. 7 no.

**14. (c)** $3^1 = 3;\ 3^2 = 9;\ 3^3 = 27;\ 3^4 = 81;\ 3^4 = 243$

i.e. unit's digit is repeated after index 4.

Remainder after dividing 21 by $4 \Rightarrow 1$

$\therefore$ Unit's digit in the expansion of $(3)^{21}$

$(3)^{4 \times 5 + 1} = 3^1 = 3$

$\therefore \quad$ Remainder after dividing by $5 \Rightarrow \frac{3}{5} = 3$

**15. (b)** Last digit of $(1001)^{2008} + 1002 = 1 + 2 = 3$

**16. (a)** $x * y = (x + 3)^2 (y - 1)$

$\therefore \quad 5 * 4 = (5 + 3)^2 (4 - 1) = 64 \times 3 = 192$

**17. (a)** $a * b = a^b$

$\therefore \quad 5 * 3 = 5^3 = 5 \times 5 \times 5 = 125$

**18. (a)** $1 + 0.6 + 0.06 + ..... = 1.6666 .....$

$= 1.\overline{6} = \frac{16 - 1}{9} = \frac{15}{9} = \frac{5}{3} = 1\frac{2}{3}$

**19. (b)** If the first divisor is a multiple of second divisor. Then, remainder by the second divisor.

$\therefore \quad$ Remainder $= 21 \div 19 = 2$

**20. (d)** If the first divisor be a multiple of the second divisor, then required remainder = remainder obtained by dividing the first remainder (36) by the second divisor (17) = 2

$\because \quad$ 17 is a factor of 136

$\therefore \quad$ Remainder when 36 is divided by 17 = 2

**21. (d)** $xyxy = xy \times 100 + xy = xy\,(100 + 1) = 101 \times xy$

Hence, the number is exactly divisible by 101.

**22. (b)** $n^3 - n = (n^2 - 1)n$

$\Rightarrow \quad n\,(n + 1)\,(n - 1)$

For $n = 2,\ n^3 - n = 6$

$2^3 - 2 = 6$

i.e. $n^3 - n$ is always divisible by 6.

**23. (a)** Here, the first divisor i.e. 49 is multiple of second divisor i.e. 7.

$\therefore$ Required remainder = Remainder obtained on dividing 32 by 7 =4

**24. (a)** Remainder when $(x - 1)^n$ is divided by $x$ is $(-1)^n$

$\therefore \quad (17)^{200} = (18 - 1)^{200}$

$\therefore \quad$ Remainder $= (-1)^{200} = 1$

**25. (d)** $4^1 = 4;\ 4^2 = 16;\ 4^3 = 64;\ 4^4 = 256;\ 4^5 = 1024$

Unit place changes as follows :

$(4)^{\text{even}} = 6$

$(4)^{\text{odd}} = 4$

Remainder on dividing 372 by 4 = 0

Remainder on dividing 373 by 4 = 1

$\therefore \quad$ Required unit digit

= Unit's digit of the sum = 6 + 4 = 0

**26. (c)** $5^{71} + 5^{72} + 5^{73}$

$= 5^{71}\,(1 + 5 + 5^2) = 5^{70} \times 5 \times 31$

$= 5^{70} \times 155$ which is exactly divisible by 155.

**27. (d)** Required remainder

= Remainder obtained by dividing $2^2$ by 5.

Remainder = 4

**28. (b)** 228 – 18 = 210 is exactly divisible biggest two digit no. i.e. 70

**29. (d)** $(100x + 10y + z) - (x + y + z) = 99x + 9y$

$= 9\,(11x + y)$

Thus, the number is divisible by 9.

**30. (b)** Here, the first divisor (289) is a multiple of second divisor (17).

$\therefore \quad$ Required remainder

= Remainder obtained on dividing 18 by 17 = 1

**31. (b)** Let four consecutive even numbers are:

$x - 3,\ x - 1,\ x + 1$ and $x + 3$ and the odd numbers are:

$y - 3,\ y - 1,\ y + 1$ and $y + 3$

ATQ
$(x + 3) + (y + 3) = 33$
$x + y = 27$ ...(i)
Sum of all the four consecutive even and odd numbers
$= (x - 3) + (x - 1) + (x + 1) + (x + 3) + (y - 3) + (y - 1) + (y + 1) + (y + 3)$
$= 4(x + y) = 4 \times 27 = 108$

**32. (b)** Let the fraction $= \frac{x}{y}$

the new fraction

$$= \frac{x + x \times \frac{40}{100}}{y + y \times \frac{80}{100}} = \frac{\frac{140}{100} \text{ of } x}{\frac{180}{100} \text{ of } y} = \frac{7}{9}\left(\frac{x}{y}\right)$$

$\therefore$ The new fraction $= \frac{7}{9}$ of original fraction.

**33. (b)** Let the number be $x$

$$\left(\frac{4}{15} \text{ of } \frac{5}{7} \text{ of } x\right) - \left(\frac{4}{9} \text{ of } \frac{2}{5} \text{ of } x\right) = 8$$

$$\Rightarrow \quad \frac{4}{15} \times \frac{5}{7}x - \frac{4}{9} \times \frac{2}{5}x = 8 \quad \Rightarrow \quad \frac{4}{21}x - \frac{8}{45}x = 8$$

$$\Rightarrow \quad \frac{60x - 56x}{315} = 8 \quad \Rightarrow \quad \frac{4}{315}x = 8$$

$$\Rightarrow \quad x = 315 \times \frac{8}{4} \quad \Rightarrow \quad x = 630 \therefore \frac{x}{2} = \frac{630}{2} = 315$$

**34. (c)** Let the unit's digit by $y$ and ten's digit be $x$
$\therefore$ Number $= 10x + y$
$\therefore$ New number after interchanging digits $= 10y + x$
As given,
$10y + x - 10x - y = 18$
$\Rightarrow \quad 9(y - x) = 18$
$\Rightarrow \quad y - x = 2$ ...(i)
Again, $x + y = 8$ ..(ii)
From (i) and (ii)
$2y = 10 \quad \Rightarrow \quad y = 5 \quad \therefore \quad x = 3$ [From (i)]
Number $= 10x + y = 10 \times 3 + 5 = 35$

**35. (b)** $427398 = 15 \times 28493 + 3$
$\therefore$ The least number which should be subtracted from 427398 so that it becomes divisible by 15 = 3.

**36. (a)** Let the original fraction be $\frac{x}{y}$.
According to the question,

$$\frac{x \times \frac{300}{100}}{y \times \frac{220}{100}} = \frac{4}{11} \quad \Rightarrow \frac{30x}{22y} = \frac{4}{11}$$

$$\Rightarrow \quad \frac{x}{y} = \frac{4}{11} \times \frac{22}{30} = \frac{4}{15}$$

**37. (d)** **Case I:** Let the two digit number be $= 10x + y$ where $x > y$
According to the question, $x + y = 12$ and $x - y = 6$
Adding these equations,

$$\begin{array}{r} x + y = 12 \\ x - y = 6 \\ \hline 2x = 18 \end{array}$$

$$\Rightarrow \quad x = \frac{18}{2} = 9$$

$\therefore \quad y = 12 - 9 = 3 \quad \therefore$ Number $= 93$
**Case II:** Again, let the number be $10x + y$ where, $x < y$
Then, $x + y = 12$ and $y - x = 6$
Adding these equations,
$2y = 18 \quad \Rightarrow \quad y = \frac{18}{2} = 9$
$\therefore \quad x = 3 \quad \therefore$ Number $= 39$
Thus we get two numbers. This doesn't satisfy the uniqueness of answer:

**38. (a)** Total number of candles $= 7 \times 12 \times 14 = 1176$

**39. (b)** $81 \times 81 = 6561$
$82 \times 82 = 6724$
Now, $6561 < 6659 < 6724$
$\Rightarrow \quad (81)^2 < 6659 < (82)^2$
$\therefore$ To make 6659 a perfect square, the number to be added $= 6724 - 6659 = 65$

**40. (e)** Let the five consecutive even numbers be $x$, $x + 2$, $x + 4$, $x + 6$ and $x + 8$ respectively.
According to the questions,
$x + x + 6 = 162$
$\Rightarrow \quad 2x = 162 - 6 = 156$
$\Rightarrow \quad x = \frac{156}{2} = 78$
$\therefore$ Sum of all numbers $= 78 + 80 + 82 + 84 + 86 = 410$

**41. (c)** $1 * 2 = (1 + 2) \div (1 - 2) = -3$

$$\therefore \quad (1 * 2) * 3 = -3 * 3 = (-3 + 3) \div (-3 - 3) = \frac{0}{-6} = 0$$

**42. (c)** $3^1 = 3$; $3^2 = 9$; $3^3 = 27$; $3^4 = 81$; $3^5 = 243$
On dividing 2003 by 4, the remainder = 3
$\therefore$ Unit's digit in the expansion of $3^{2003}$
= Unit's digit in the expansion of $3^3 = 7$

**43. (b)** A number is divisible by 33 if it is divisible by 3 and 11 both
For divisibility by 11,
$\therefore \quad 5 + B + 7 = A + B + A$
$\therefore \quad 2A = 12 \quad \Rightarrow \quad A = 6$
$\therefore$ For divisibility of 5 6 $B$ $B$ 7 6 by 3,
Sum of its digit should be divisible by 3
$5 + 6B + B + 7 + 6 = 24 + 2B$, $B = 3$
$\therefore$ Number = 563376
$\therefore \quad A + B = 6 + 3 = 9$

**44. (c)** $7^1 = 7$; $7^2 = 49$; $7^3 = 343$; $7^4 = 2401$; $7^5 = 16807$
Hence, unit's digit repeats after index 4.
Remainder when 1987 is divided by 4 = 3
Unit's digit of $7^3 = 3$
Hence, remainder on division by 5 = 3

**45. (b)** $(2^{10})^5 = (2^5)^{10} = (32)^{10}$
$(5^{10})^2 = (5^2)^{10} = (25)^{10}$
$(4^5)^4 = (4^2)^{10} = (16)^{10}$ and $10^{10}$
So, increasing order : $(32)^{10} > (25)^{10} > (16)^{10} > (10)^{10}$
$\therefore$ Largest number = $(2^{10})^5$.

**46. (a)** Let the two-digit number be = $10x + y$, where $x > y$
According to the question,
$10x + y - 10y - x = 18$ or, $9x - 9y = 18$
or, $x - y = \frac{18}{9} = 2$ ...(i)
and, $x + y = 12$ ...(ii)
From equations (i) and (ii)
$2x = 14 \Rightarrow x = 7$
From equation (i)
$y = 7 - 2 = 5$
$\therefore$ Required product = $xy = 7 \times 5 = 35$

**47. (b)** $a^2 - b^2 = 1999$
$\Rightarrow (a + b)(a - b) = 1999$
$\Rightarrow (1000 + 999)(1000 - 999) = 1999$
$\therefore a^2 + b^2 = (1000)^2 + (999)^2$
$= 1000000 + 998001 = 1998001$

**48. (c)** $10x + y = k(x + y)$
$\therefore 10y + x = 11y + 11x - 10x - y$
$= 11(x + y) - k(x + y) = (11 - k)(x + y)$

**49. (b)**

| | |
|---|---|
| 2 | 4320 |
| 2 | 2160 |
| 2 | 1080 |
| 2 | 540 |
| 2 | 270 |
| 5 | 135 |
| 3 | 27 |
| 3 | 9 |
| 3 | 3 |
| | 4 |

$\therefore 4320 = 2 \times 2 \times 2 \times 2 \times 2 \times 5 \times 3 \times 3 \times 3 = 2^5 \times 3^3 \times 5$
$\therefore$ Required number = $2^2 \times 5 = 20$

**50. (c)** Time gained in 6 hours = $12 \times 3 = 36$ minutes
$\therefore$ Required time = 11 : 36 a.m.

**51. (c)** Divisor = Remainder 1 + Remainder 2 – Remainder 3
$= 3 + 4 - 2 = 7 - 2 = 5$

**52. (c)** Let the two digit no. be $10x + y$ where $y > x$
$10y + x - 10x - y = 63$
$9y - 9x = 63$
$y - x = 7$
$y = 7, 8, 9$ and $x = 0, 1, 2$

**53. (b)** Let *'d'* be denominator so numerator be $(d - 4)$
According to question
$\Rightarrow \frac{(d-4)-2}{d+1} = \frac{1}{8} \quad \Rightarrow \frac{d-6}{d+1} = \frac{1}{8}$
$\Rightarrow 8d - 48 = d + 1$
$7d = 49$
$d = 7$
numerator $\Rightarrow d - 4 = 7 - 4 = 3$
denominator (d) $\Rightarrow 7$
$\therefore$ fraction = $\frac{3}{7}$

**54. (c)** Let three numbers are $3x$, $6x$, $2x$
Avg. = $\frac{11x}{3} = 44$
$x = 12$
Difference of first and third number
$= 3x - 2x = x = 12$.

**55. (c)** $x = 6Q + y$
$y^2 = 4Q^1 + z$
The value of $z$ may be 1, 2 or 3.
The value of $y$ may be 1, 3, or 5 as if 2 or 4 be the value, $y^2$ will be exactly divisible by 4.
$\therefore z = 1$

**56. (a)** Let the two-digit number be $10x + y$
According to the questions,
$10x + y - 9 = 10y + x$
$\Rightarrow 10x + y - 10y - x = 9$
$\Rightarrow 9x - 9y = 9$
$\Rightarrow x - y = 1$ ...(i)
and, $\frac{x+y}{2} = 7.5$
$\Rightarrow x + y = 15$ ...(ii)
On adding equations (i) and (ii),
$2x = 16$
$\Rightarrow x = 8$
from equation (i),
$8 - y = 1$
$\Rightarrow y = 8 - 7 = 7$
$\therefore$ Required number = $10 \times 8 + 7 = 87$

**57. (a)** Five consecutive odd numbers
$\Rightarrow x, x + 2, x + 4, x + 6$ and $x + 8$
$\therefore x + x + 2 + x + 4 + x + 6 + x + 8 = 195$
$\Rightarrow 5x + 20 = 195$
$\Rightarrow 5x = 195 - 20 = 175$
$\Rightarrow x = \frac{175}{5} = 35$
$\therefore$ Second lowest number = $35 + 2 = 47$
$\therefore$ Second highest even number = $37 + 9 = 46$
$\therefore$ Second lowest even number = 42
$\therefore$ 40% of 42 = $\frac{42 \times 40}{100} = 16.8$

**58. (c)** Let the odd number be: $x$, $x + 2$, $x + 4$, $x + 6$ and $x + 8$
$\therefore x + x + 2 + x + 4 + x + 6 + x + 8 = 225$

$\Rightarrow \quad 5x + 20 = 225 \Rightarrow \quad 5x = 225 - 20 = 205$

$\Rightarrow \quad x = \frac{205}{5} = 41 \quad \therefore$ Second number = 43

Second lowest even number = 43 + 15 = 58

$\therefore$ Largest even number = 58 + 6 = 64

$\therefore \quad 60\%$ of $64 = \frac{64 \times 60}{100} = 38.4$

**59. (d)** $(x^{2a})^b = (x)^{\frac{4b}{2c}}$

$\Rightarrow \quad 2ab = \frac{2b}{c} \quad \Rightarrow \quad ac = 1$

$a = c = 1$ [$\because$ Both $a$ and $c$ are natural numbers] ...(i)

$\frac{x^{4b}}{x^{3a}} = x^{3(a-b)} . x^b \quad \Rightarrow \quad x^{4b-3a} = x^{3a-2b}$

$\Rightarrow \quad 4b - 3a = 3a - 2b \quad \Rightarrow \quad 6b = 6a$

$\Rightarrow \quad a = b$ ....(ii)

From (i) and (ii) we have,

$a = b = c$

**60. (d)** Let the no. of boys and girls each be $x$.

$2(x - 8) = x$

$2x - 16 = x$

$x = 16$

$\therefore$ Total no. of boys and girls present initially in the classroom = $2x = 32$

**61. (a)** Let the four numbers be $a$, $b$, $c$ and $d$.

$a + b + c + d = 64$

Also, $a + 3 = b - 3 = 3c = \frac{d}{3}$

$b = a + 6$

$c = \frac{a}{3} + 1; \; d = 3a + 9$

$\therefore \quad a + a + 6 + \frac{a}{3} + 1 + 3a + 9 = 64$

$\Rightarrow \quad 5a + \frac{a}{3} + 16 = 64 \quad \Rightarrow \quad \frac{16}{3}a = 48$

$\Rightarrow \quad a = 48 \times \frac{3}{16} \quad \Rightarrow \quad a = 9 \quad \therefore \quad b = a + 6 = 15$

$c = \frac{9}{3} + 1 = 4$

$d = 3a + 9 = 36$

Hence, difference between the largest and the smallest numbers = 36 – 4 = 32

**62. (d)** Let the ten's digit be $x$, then, unit's digit = $2x$

$\therefore$ Original number = $10x + 2x = 12x$

On interchanging the digits, the new number

$= 10 \times 2x + x = 21x$

According to question,

$21x - 12x = 27$

$\Rightarrow \quad 9x = 27 \quad \Rightarrow \quad x = \frac{27}{9} = 3$

$\therefore$ Original number = $12x = 12 \times 3 = 36$

Hence, 50% of original number = $36 \times \frac{50}{100} = 18$

**63. (c)** Let the numbers be $x$ and $y$.

According to the question,

$x + y - (x - y) = 42 \quad \Rightarrow \quad 2y = 42$

$\Rightarrow \quad y = \frac{42}{2} = 21 \quad \therefore \quad x = \frac{1092}{21} = 52$

**64. (e)** Let the numbers be $x$ and $y$.

According to the question,

$2x + 3y = 36$ ...(i)

$3x + 2y = 39$ ...(ii)

By equation (i) × 3 – (ii) × 2,

$6x + 9y - 6x - 4y = 108 - 78$

$\Rightarrow \quad 5y = 30 \quad \Rightarrow \quad y = \frac{30}{5} = 6$

From equation (i), we have,

$2x + 3 \times 6 = 36$

$\Rightarrow \quad 2x = 36 - 18 = 18$

$\Rightarrow \quad x = \frac{18}{2} = 9$ and, $y = 6$

$\therefore$ The smaller number = 6

**65. (b)** Let the ten's digit be $x$.

then, Unit's digit = $2x$

and hundred's digits = $\frac{2x}{1.5}$

According to the question,

$x + 2x + \frac{2x}{1.5} = 13 \quad \Rightarrow \quad \frac{1.5x + 3x + 2x}{1.5} = 13$

$\Rightarrow \quad 6.5x = 13 \times 1.5 \quad \Rightarrow x = \frac{13 \times 1.5}{6.5} = 3$

$\therefore$ Unit's digit = 6, ten's digit = 3 and hundred's digit

$= \frac{6}{1.5} = 4$

$\therefore$ Number = 436

**Note:** This question can be solved by oral calculation, taking the alternatives into consideration.

**66. (b)** From given alternatives,

$\frac{3}{5} + \frac{4}{7} = \frac{21 + 20}{35} = \frac{41}{35}$ and

$\frac{4}{5} + \frac{3}{7} = \frac{28 + 15}{35} = \frac{43}{35}$

**67. (b)** $n^2 = 25^{64} \times 64^{25} = (5^2)^{64} \times (2^6)^{25} = 5^{128} \times 2^{128} \times 2^{22}$

$\therefore \quad n = 5^{64} \times 2^{64} \times 2^{11}$

$= (5 \times 2)^{64} \times 2048 = 10^{64} \times 2048$

$\therefore$ Sum of digits = 2 + 0 + 4 + 8 = 14

**68. (b)** $365989345689325678 = 37 \times 10^{17}$

and $342973489379256 = 3 \times 10^{14}$

$\therefore \quad 37 \times 10^{17} \times 3 \times 10^{14} = 111 \times 10^{31}$

$\therefore$ Number of digits = 31 + 3 = 34

**69. (a)** $2^{48} - 1 = (2^{24} + 1)(2^{24} - 1)$

$= (2^{24} + 1)(2^{12} + 1)(2^6 + 1)(2^6 - 1)$

$\therefore$ Required numbers = $2^6 + 1$ and $2^6 - 1 = 65$ and 63.

**70. (a)** $2^2 - 1 = 4 - 1 = 3$
$2^4 - 1 = 16 - 1 = 15$
$2^6 - 1 = 64 - 1 = 63$
$2^8 - 1 = 256 - 1 = 255$
Hence, if $n$ = even number, then $(2^n - 1)$, is divisible by 3.
We know a number is divisible by 3. If the sum of its digits is divisible by 3.
$\therefore \quad a = 1$

**71. (b)** $2^{5555} = (2^5)^{1111} = (32)^{1111}$
$3^{3333} = (3^3)^{1111} = (27)^{1111}$
$6^{2222} = (6^2)^{1111} = (36)^{1111}$
$3^{3333} < 2^{5555} < 6^{2222}$

**72. (c)** According to the question,
Ice-creams + Cookies + Pastries = 32
$\Rightarrow \quad 9 + 11 + 12 = 32$
or, $\quad 9 + 10 + 13 = 32$
$\quad 10 + 11 + 12 \neq 32$
Hence, either she but 10 or 11 Cookies.

**73. (c)** According to the question,
$x + 182 \times 13 = 2402$
$\Rightarrow \quad x + 2366 = 2402$
$\Rightarrow \quad x = 2402 - 2366 = ₹\ 36$

**74. (b)** Let the correct answer are '$n$'
According to question

| Correct marks | | Incorrect marks | | Total marks |
|---|---|---|---|---|
| $4n$ | $-$ | $(200 - n) \times 1$ | | $= 200$ |

$4n - 200 + n = 200$
$5n = 400$
$n = 80$

**75. (c)** Let the unit's digits be $x$
then ten's digit be $x + 5$
Number $= 10(x + 5) + x = 10x + 50 + x$
$11x + 50$
Digits are reversed $= 10x + x + 5$
According to question
$11x + 50 - 5(2x + 5) = 10x + x + 5$
$x + 25 = 11x + 5$
$10x = 20$
$x = 2$
Sum of digits $= 2x + 5 = 2 \times 2 + 5 = 9$

**76. (a)** Let the two digits be $x$ (ten's place) and $y$ (units place)
ATQ $x + y \quad = 10 \qquad \ldots(1)$
Also $10y + x - 10x - y \quad = 18$
$\Rightarrow \quad 9y - 9x = 18$
$\Rightarrow \quad y - x = 2 \qquad \ldots(2)$
From (1) and (2)
$\quad x = 4$ and $y = 6$
$\therefore \quad$ The required no. is 46

**77. (a)** Two Natural numbers are said to be co-primes if their HCF is 1.
(12, 7) are coprimes

**78. (a)** Number has to be less than 27. Let the number be $x$.
On Dividing 2055 by 27, we get remainder as 3
Now, $3 + x = 27$
$\therefore \quad x = 24$

**79. (b)** To divide 451 * 603 by 9
$(4 + 5 + 1 + * + 6 + 0 + 3) = (19 + *)$
$(19 + *)$ must be multiple of 9
$\therefore \quad 19 + * = 27$
$\quad * = 8$

**80. (c)** According to question
$26 < \sqrt{709} < 27$
Now, $(27)^2 = 729$
$\therefore \quad 729 - 709 = 20$
$\therefore \quad$ 20 must be added to 709 to make it a perfect square.

**81. (c)** Any number that is divisible by 72 must be divisible by 3, 4, 8, and 9.
Now, a number is divisible by 4 when a number formed by its last two digits of that number is divisible by 4. '$y^6$' is divisible by 4, for
$y = 1, 3, 5, 7, 9$
Again $a$, number is divisible by 8, when a number formed by its last 3 digits is divisible by 8.
'$9y^6$' is divisible by '8' for $y = 3, 7$
Now, for divisibility by 9, sum of its digits should be divisible by 9.
for $y = 3$, '$7 + 4 + x + 2 + 9 + 3 + 6$' $= 31 + x$
so, for $x = 5, 36$ is divisible by 9.
Now, is '7452936' which is divisible by '24' also, so, it is divisible '72'.
Now, $(2x + 3y) = 2 \times 5 + 3 \times 3 = 19$.

**82. (b)** 8439 $x$ 53 is divisible by 99 i.e.
given number is divisible by 11
$\therefore \quad (3 + x + 3 + 8) - (5 + 9 + 4) = 0$
$\quad x = 4$

**83. (d)** L. C. M. of 11, 13 and
$7 = 11 \times 13 \times 7 = 1001$.
Now, from given option '259259' is divisible by '1001'.
Hence, '259259' is divisible by 11, 13 and 7.

**84. (c)** A number is divisible by 3 if sum of digits of the number is a multiple of 3
So, $x + 3 + 2 + 0 + 8 = x + 13$
From the given option, only option (c) is satified
i .e. $5 + 13 = 18$ is a multiple of 3

**85. (b)** If the digits at unit's and Ten's place of any no. is divisible by 4 then the whole no. is divisible by 4.
Here in 6542176
76 is divisible by 4.
$\therefore \quad$ 6542176 is divisible by 4.

**86. (b)** The rule of 8 $\Rightarrow$ If the last three digit of a whole number are divisible by 8 then the entire number is divisible by 8
Put $x = 0$ and we see that 504 is divided by 8.
So, 0 is smallest integer.

**87. (a)** Men Marks

$$=\frac{10\times6+12\times5+14\times2+16\times2+18\times5}{20}=\frac{270}{20}=13.5$$

**88. (d)** We know that $(x^n + 1)$ is divisible by $(x + 1)$, for all odd values of $n$.

$\therefore 77^{77}+77=\{(77^{77}+1)+76\}$

Now, $(77^{77} + 1)$ will be divisible by $(77 + 1) = 78$

Hence, remainder = 76.

**89. (c)** 30 *a* 68 *b*

When a number is divisible by 11, then the difference of sum of odd places digits and the sum of even places digits is 0 or multiple of 11.

$(8 + a + 3) – (b + 6 + 0)$

$= (11 + a) – (6 + b)$

From the option,

If $b = 3$ then, $a = 9$

and it will divisible by 11.

**90. (a)** If a number is divisible by 99, then it will also divisible by 9 and 11.

8 4 7 5 6 3 9 A B

**Divisibility by 11:** The difference between the sum of odd places digits and sum of even places digits from right hand side should be zero or the factor of 11.

**Divisibility by 9:** The sum of digits should be divisible by 9.

Sum of digits = 8 + 4 + 7 + 5 + 6 + 3 + 9 + A + B

= 42 + (A + B)

$\therefore$ (A + B) should be 3 or 12.

Difference of odd places digits and even places digits

= (B + 9 + 6 + 7 + 8) – (A + 3 + 5 + 4)

= B + 30 – (A + 12)

= (B – A ) + 18

$\therefore$ (B – A) should be 4

From the options, option '*a*' satisfy the conditions.

$\therefore$ A = 4, B = 8

A + B = 12

B – A = 4

**91. (c)** Weights of bag of tea,

350 kg, 280 kg, 340 kg, 270 kg, 360 kg, 310 kg, 300 kg

$\therefore$ Range = highest weight – lowest weight

= 360 – 270 = 90 kg

**92. (c)** 785*x* 3678*y*

divisibility of 8 = last three digits divisible by 8

$\frac{78y}{8} \Rightarrow y = 4$

divisibility of 9 = sum of digits divisible by 9

$x = 6$

$x – y = 6 – 4 = 2$

**93. (c)** 1089 is divisible by 11.

$\frac{1089}{15}$ = Remainder 9

$\frac{1089}{18}$ = Remainder 9

$\frac{1089}{36}$ = Remainder 9

**94. (b)** $\frac{14331433\times1422\times1425}{12}$

$=\frac{1\times6\times9}{12}=\frac{54}{12}$

= Remainder 6

**95. (b)** 239685 is the graetest number which is divisible by 3 but not by 9.

2 + 3 + 9 + 6 + 8 + 5 = 33 is divisible by 3.

# 2 CHAPTER HCF, LCM and Simplification

## HCF AND LCM

### HIGHEST COMMON FACTOR (HCF) OR GREATEST COMMON DIVISOR (GCD)

The highest (i.e. largest) number that divides two or more given numbers is called the highest common factor (HCF) of those numbers.

#### Methods to Find the HCF or GCD

There are two methods to find HCF of the given numbers.

**(i) Prime Factorization Method**

When a number is written as the product of prime numbers, then it is called the prime factorization of that number. For example, $72 = 2 \times 2 \times 2 \times 3 \times 3 = 2^3 \times 3^2$. Here, $2 \times 2 \times 2 \times 3 \times 3$ or $2^3 \times 3^2$ is called prime factorization of 72.

To find the HCF of given numbers by this methods, we perform the prime factorization of all the numbers and then check for the common prime factors in it. For every prime factor common to all the numbers, we choose the least index of that prime factor among the given numbers. The HCF is the product of all such prime factors with their respective least indices.

**Example 1. Find the HCF of 72, 288 and 1080.**

**Sol.** $72 = 2^3 \times 3^2$, $288 = 2^5 \times 3^2$, $1080 = 2^3 \times 3^3 \times 5$.

The prime factors common to all the given numbers are 2 and 3. The lowest indices of 2 and 3 in the given numbers are 3 and 2 respectively. Hence, HCF = $2^3 \times 3^2 = 72$.

**(ii) Division Method**

To find the HCF of two numbers by division method, we divide the larger number by the smaller number. Then we divide the smaller number by the first remainder, then first remainder by the second remainder and so on, till the remainder becomes 0. The last divisor is the required HCF.

**Example 2. Find the HCF of 288 and 1080 by the division method.**

**Sol.**

$$\begin{array}{r|l|l} 288 & 1080 & 3 \\ & 864 & \\ \hline 216 & 288 & 1 \\ & 216 & \\ \hline 72 & 216 & 3 \\ & 216 & \\ \hline & 0 & \end{array}$$

The last divisor 72 is the HCF of 288 and 1080.

**Note**

To find the HCF of any number of given numbers, first find the difference between two nearest given numbers. Then find all factors (or divisors) of this difference. Highest factor which divides all the given numbers is the HCF.

**Example 3. Find the HCF of 12, 20 and 32.**

**Sol.** Difference of nearest two numbers

12 and 20 = 20 – 12 = 8

All factors (or divisor) of 8 are 1, 2, 4 and 8.

1, 2 and 4 divides each of the three given numbers 12, 20 and 32. Out of 1, 2 and 4; 4 is the highest number. Hence, HCF = 4.

### LEAST COMMON MULTIPLE (LCM)

The least common multiple (LCM) of two or more numbers is the lowest number which is divisible by all the given numbers.

#### Methods to Find the LCM

There are two methods to find the LCM.

**(i) Prime Factorization Method**

After performing the prime factorization of all the given numbers, we find the highest index of all the prime factors among the given numbers. The LCM is the product of all these prime factors with their respective highest indices because LCM must be divisible by all of the given numbers.

**Example 4. Find the LCM of 72, 288 and 1080.**

**Sol.** $72 = {}^3 \times 3^2$

$288 = 2^5 \times 3^2$

$1080 = 2^3 \times 3^3 \times 5$

Hence, LCM = $2^5 \times 3^3 \times 5^1 = 4320$

**(ii) Division Method**

This method can be easily understood by the following example.

To find the LCM of 5, 72, 196 and 240, we use the division method in the following way:

Check whether any prime number that divides at least two of all the given numbers. If there is no such prime number, then the product of all these numbers is the required LCM, otherwise

write all the given numbers in a row separating them by putting the comma ',' in between the numbers and find the smallest prime number that divides at least two of the given numbers. Here, we see that smallest prime number that divides at least two given numbers is 2.

Divide those numbers out of the given numbers by 2 which are divisible by 2 and write the quotient below it. The given number(s) that are not divisible by 2 write as it is below it and repeat this step till you do not find at least two numbers that are not divisible by any prime number.

| | |
|---|---|
| 2 | 5, 72, 196, 240 |
| 2 | 5, 36, 98, 120 |
| 2 | 5, 18, 49, 60 |
| 3 | 5, 9, 49, 30 |
| 5 | 5, 3, 49, 10 |
| | 1, 3, 49, 2 |

After that find the product of all divisors and the quotient left at the end of the division. This product is the required LCM.

Hence, LCM of the given numbers = product of all divisors and the quotient left at the end.

$= 2 \times 2 \times 2 \times 3 \times 5 \times 3 \times 49 \times 2 = 35280$

**Remember...**

Using idea of co-prime, you can find the LCM by the following shortcut method:

LCM of 9, 10, 15 and 36 can be written directly as $9 \times 10 \times 2$.

**The logical thinking that behind it is as follows:**

**Step 1:** If you can see a set of 2 or more co-prime numbers in the set of numbers of which you are finding the LCM, write them down by multiply them.

In the above situation, since we see that 9 and 10 are co-prime to each other, we start off writing the LCM by writing $9 \times 10$ as the first step.

**Step 2:** For each of the other numbers, consider what prime factor(s) of it is/are not present in the LCM (if factorised into primes) taken in step 1. In case you see some prime factors of each of the other given numbers separately are not present in the LCM (if factorised into primes) taken in step 1, such prime factors will be multiplied in the LCM taken in step 1.

Prime factorisation of $9 \times 10 = 3 \times 3 \times 2 \times 5$

Prime factorisation of $15 = 3 \times 5$

Prime factorisation of $36 = 2 \times 2 \times 3 \times 3$

Here we see that both prime factors of 15 are present in the prime factorisation of $9 \times 10$ but one prime factor 2 of 36 is not present in the LCM taken in step 1. So to find the LCM of 9, 10, 15 and 36; we multiply the LCM taken in step 1 by 2.

Thus required LCM $= 9 \times 10 \times 2 = 180$

## RULE FOR FINDING HCF AND LCM OF FRACTIONS

**(I)** HCF of two or more fractions

$$= \frac{\text{HCF of numerator of all fractions}}{\text{LCM of denominator of all fractions}}$$

**(II)** LCM of two or more fractions

$$= \frac{\text{LCM of numerator of all fractions}}{\text{HCF of denominator of all fractions}}$$

**Example 5. Find the HCF and LCM of $\frac{4}{5}$, $\frac{6}{11}$ and $\frac{3}{5}$.**

**Sol.** $\text{HCF} = \frac{\text{HCF of 4, 6, 3}}{\text{LCM of 5, 11, 5}} = \frac{1}{55}$

$$\text{LCM} = \frac{\text{LCM of 4, 6, 3}}{\text{HCF of 5, 11, 5}} = \frac{12}{1} = 12$$

The product of the H.C.F and L.C.M of any two numbers is always equal to the product of these two numbers. However the same pattern is not applicable to three or more numbers.

Thus, for any two numbers $a$ and $b$.

$a \times b$ = H.C.F. × L.C.M.

# SIMPLIFICATION

## FUNDAMENTAL OPERATIONS

### 1. Addition

(a) Sum of two positive numbers is a positive number.
For example : $(+5) + (+2) = +7$

(b) Sum of two negative numbers is a negative number.
For example : $(-5) + (-3) = -8$

(c) Sum of a positive and a negative number is the difference between their magnitudes with the sign of the number with greater magnitude.

***For example :*** $(-3) + (+5) = 2$ and $(-7) + (+2) = -5$

### 2. Subtractions

Subtraction of two numbers is same as the sum of a positive and a negative number.

***For Example :*** $(+9) - (+2) = (+9) + (-2) = 7$

$(-3) - (-5) = (-3) + 5 = +2.$

### 3. Multiplication

(a) Product of two positive numbers is positive.

(b) Product of two negative numbers is positive.

(c) Product of a positive number and a negative number is negative.

(d) Product of more than two numbers is positive or negative depending upon the presence of negative quantities.

If the number of negative numbers is even then product is positive and if the number of negative numbers is odd then product is negative.

*For Example :* $(-3) \times (+2) = -6$
$(-5) \times (-7) = +35$
$(-2) \times (-3) \times (-5) = -30$
$(-2) \times (-3) \times (+5) = +30$

### 4. Division

(a) If both the dividend and the divisor are of same sign, then quotient is always positive.

(b) If the dividend and the divisor are of different sign, then quotient is negative,

*For Example :* $(-36) \div (+9) = -4$
$(-35) \div (-7) = +5$

### 5. Brackets

**Types of brackets are :**

(i) Vinculum or bar : '‾'

(ii) Parenthesis or small or common brackets : ( )

(iii) Curly or middle brackets : { }

(iv) Rectangular or big brackets : [ ]

The order for removal of brackets is : ( ), { }, [ ]

**Note**

If there is a minus (–) sign before the bracket then while removing bracket, sign of each term will change + to – and – to +.

### 6. 'BODMAS' Rule

Now a days BODMAS becomes 'VBODMAS' where,

'V' stands for "Vinculum" or Bar

'B' stands for "Bracket" order of operation of bracket is ( ), { }, [ ].

'O' stands for "Of" (Calculation is done the same as multiplication)

'D' stands for "Division"

'M' stands for "Multiplication"

'A' stands for "Addition"

'S' stands for "Subtraction"

A given series of calculations or operations is done in a specific order as each letter of VBODMAS in order represent.

So, first of all we solve vinculum then the inner most brackets moving outwards. Then we perform 'of' which means multiplication, then division, addition and subtraction.

- Addition and subtraction can be done together or separately as required.
- Between any two brackets if there is not any sign of addition, subtraction and division it means we have to do multiplication

$(20 \div 5)(7 + 3 \times 2) + 8 = 4(7 + 6) + 8$
$= 4 \times 13 + 8 = 52 + 8 = 60$

**Example 6. Simplify $6 + 5 - 3 \times 2$ of $5 - (15 \div \overline{7-2})$**

**Sol.** $6 + 5 - 3 \times 2$ of $5 - (15 \div \overline{7-2})$
$= 6 + 5 - 3 \times 2$ of $5 - (15 \div 5)$ {Remove vinculum}
$= 6 + 5 - 3 \times 2$ of $5 - 3$ {Remove common bracket}
$= 6 + 5 - 3 \times 10 - 3$ {'Of' is done}
$= 6 + 5 - 30 - 3$ {Multiplication is done}
$= 11 - 33$ {Addition is done}
$= -22$ {Subtraction is done}.

To simplify an expression, add all the positive numbers together and all the negative numbers separately and add or subtract the resulting numbers as the case will.

**Example 7. Simplify : $7 - 2 + 13 - 5 - 2 + 1$**

**Sol.** $7 - 2 + 13 - 5 - 2 + 1$
$= 7 + 13 + 1 - 2 - 5 - 2 = 21 - 9 = 12$
$[7 + 13 + 1 = 21$ and $-2 - 5 - 2 = -9]$

**Example 8.** $\dfrac{11 \times 11 - 21}{9 \times 6 - (2)^2} =$

**(a) 0 (b) $\frac{11}{52}$ (c) 2 (d) 40**

**Sol. (c)** $\dfrac{11 \times 11 - 21}{9 \times 6 - (2)^2} = \dfrac{121 - 21}{54 - 4} = \dfrac{100}{50} = 2$

**Example 9.** $\dfrac{1 + 1 \times 1 - 1 \times 1 + 1}{1 + 1 \div 1 + (1 + 1) \times (1 + 1)}$

**(a) 1/2 (b) 1/5 (c) 2/5 (d) 1/3**

**Sol. (d)** $\dfrac{1 + 1 - 1 + 1}{1 + 1 + 2 \times 2} = \dfrac{3 - 1}{2 + 4} = \dfrac{2}{6} = \dfrac{1}{3}$

**Example 10. What is the missing figure in the expression given below?**

$$\frac{16}{7} \times \frac{16}{7} - \frac{*}{7} \times \frac{9}{7} + \frac{9}{7} \times \frac{9}{7} = 1$$

**(a) 1 (b) 7 (c) 4.57 (d) 32**

**Sol. (d)** Let the missing figure in the expression be $x$. Then

$$\frac{16}{7} \times \frac{16}{7} - \frac{x}{7} \times \frac{9}{7} + \frac{9}{7} \times \frac{9}{7} = 1$$
$$\Rightarrow 16 \times 16 - 9x + 9 \times 9 = 7 \times 7$$
$$\Rightarrow 9x = 16 \times 16 + 9 \times 9 - 7 \times 7$$
$$= 256 + 81 - 49 = 288$$
$$\Rightarrow x = \frac{288}{9} = 32$$

## APPROXIMATION

To calculate the value of complex mathematical expression a lot of time is consumed in the examination hall. To save time, we use approximation method. In this method we calculate the nearest (round off) value of the given expression. Value obtained by this method is not equal to the exact result, but it is very close to the exact result (either a little less or little more).

### Basic Rules of Approximation

**(i)** Take the nearest round off value of the numbers given in the expression.

***For example:*** 2899.27 can be approximated as 2900.

**(ii)** To multiply larger numbers, some numbers are increased to its nearest round off value and others are decreased to its nearest round off value accordingly, so that the calculation becomes easy.

***For example:*** 898 × 463 is approximated as 900 × 460.

**(iii)** When we divide one number by other, then we can increase or decrease both the numbers accordingly.

***For example:*** 541032 ÷ 20134 can be approximated as 540000 ÷ 20000

**Example 11. Find the approximate value of**

**$234 \div 17 + 15.3 \times 18 - 13 \times 3.7$**

**(a) 250 (b) 220**

**(c) 245 (d) 235**

**Sol. (d)** $234 \div 17 + 15.3 \times 18 - 13 \times 3.7$

$= 225 \div 15 + 15 \times 18 - 13 \times 4$

$= 15 + 270 - 52 = 15 + 270 - 50 = 235.$

**Example 12. What approximate value should come in place of the question mark?**

**$11^3 + 0.8^3 + 12^3 + 1.1^3 + 1.2^3 = ?$**

**(a) 3063 (b) 3060**

**(c) 3066 (d) 3068**

**Sol. (a)** $11^3 + 0.8^3 + 12^3 + 1.1^3 + 1.2^3$

$= 1331 + 1 + 1728 + 1.331 + 1.728$

$= 1332 + 1728 + 1 + 2 = 3063.$

**Example 13. What approximate value should come in place of the question mark (?) in the following question?**

$$\frac{256}{\sqrt{17}} + \frac{190}{16} = ?$$

**(a) 68 (b) 76 (c) 78 (d) $\frac{446}{16}$**

**Sol. (b)** $\frac{256}{\sqrt{17}} + \frac{190}{16} = \frac{256}{4} + 12 = 64 + 12 = 76.$

## ALGEBRAIC IDENTITIES

### Standard Identities

(i) $(a + b)^2 = a^2 + 2ab + b^2$

(ii) $(a - b)^2 = a^2 - 2ab + b^2$

(iii) $a^2 - b^2 = (a + b)(a - b)$

(iv) $(x + a)(x + b) = x^2 + (a + b)x + ab$

(v) $(a + b + c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ca$

### Some More Identities

We have dealt with identities involving squares. Now we will see how to handle identities involving cubes.

(i) $(a + b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$

$\Rightarrow (a + b)^3 = a^3 + 3ab(a + b) + b^3$

(ii) $(a - b)^3 = a^3 - 3a^2b + 3ab^2 - b^3$

$\Rightarrow (a - b)^3 = a^3 - 3ab(a - b) - b^3$

(iii) $a^3 + b^3 = (a + b)(a^2 - ab + b^2)$

(iv) $a^3 - b^3 = (a - b)(a^2 + ab + b^2)$

(v) $a^3 + b^3 + c^3 - 3abc$

$= (a + b + c)(a^2 + b^2 + c^2 - ab - bc - ca)$

If $a + b + c = 0$ then $a^3 + b^3 + c^3 = 3abc$

## SHORTCUTS

### Shortcut Approach – 1

Least number which is exactly divisible by $x$, $y$ and $z$ = LCM of $x$, $y$ and $z$

**Example 14. How many numbers are there between 4000 and 6000 which are exactly divisible by 32, 40, 48 and 60?**

**(a) 1 (b) 2 (c) 3 (d) 4**

**Sol. (d)** $32 = 2^5$

$40 = 2^3 \times 5$

$48 = 2^4 \times 3$

$60 = 2^2 \times 3 \times 5$

$\therefore$ LCM $= 2^5 \times 3 \times 5 = 480$

The numbers divisible by 480 between 4000 and 6000 are 4320, 4800, 5280 and 5760.

$\therefore$ Required number of numbers = 4

**Example 15. Find the least number which is exactly divisible by 12, 15, 90, 108, 135 and 150.**

**(a) 1500 (b) 3000 (c) 2700 (d) 2250**

**Sol. (c)** $12 = 2^2 \times 3$

$15 = 3 \times 5$

$90 = 2 \times 3^2 \times 5$

$108 = 2^2 \times 3^3$

$135 = 3^3 \times 5$

$150 = 5^2 \times 3 \times 2$

$\therefore$ LCM $= 2^2 \times 3^3 \times 5^2 = 2700$

### Shortcut Approach – 2

Least number which when divided by $x$, $y$ and $z$ leaves the same remainder '$r$' in each case = (LCM of $x$, $y$ and $z$) + $r$

**Example 16. The least number which when divided by 12, 16 and 18 leaves 5 as remainder in each case. Find the number.**

**(a) 139 (b) 149 (c) 159 (d) 169**

**Sol. (b)** Here, $x = 12$, $y = 16$, $z = 18$, $r = 5$

$\therefore$ Required least number = (LCM of $x$, $y$ and $z$) + $r$

= (LCM of 12, 16, 18) + 5

| | |
|---|---|
| 2 | 12, 16, 18 |
| 2 | 6, 8, 9 |
| 3 | 3, 4, 9 |
| | 1, 4, 3 |

$\therefore$ LCM $= 2 \times 2 \times 3 \times 3 \times 4 = 144$

Hence, required least number = 144 + 5 = 149

**Example** **17. What is the least number which when diminished by 7, is divisible by each one of 21, 28, 36 and 45?**

**(a) 1267** **(b) 1157**
**(c) 1077** **(d) 1347**

**Sol. (a)**

| | |
|---|---|
| 2 | 21, 28, 36, 45 |
| 2 | 21, 14, 18, 45 |
| 3 | 21, 7, 9, 45 |
| 3 | 7, 7, 3, 15 |
| 7 | 7, 7, 1, 5 |
| 5 | 1, 1, 1, 5 |

$\therefore$ LCM = $2 \times 2 \times 3 \times 3 \times 7 \times 5 = 1260$
Hence, required number = 1260 + 7 = 1267

### Shortcut Approach – 3

To find the smallest $n$-digits number divisible by $x$, $y$ and $z$; follow the steps :

Step (i) : Find the LCM of $x$, $y$ and $z$.
Let LCM of $x$, $y$ and $z = L$.

Step (ii): Find the remainder by dividing $n$-digits smallest number by $L$.
Let the remainder = $R$.

Step (iii): Required number = $n$-digits smallest number + $(L - R)$

**Example** **18. Find that smallest 6-digit number which when divided by 9, 12, 21 and 25 leaves no remainder**

**(a) 100005** **(b) 100225**
**(c) 100800** **(d) 100100**

**Sol. (c)** Smallest 6-digits number = 100000
LCM of 9, 12, 21, 25 = 6300
On dividing 100000 by 6300, we get 5500 as remainder.
$\therefore$ Required number
= 100000 + (6300 – 5500) = 100800

### Shortcut Approach – 4

To find smallest $n$-digits number which, when divided by $x$, $y$ and $z$ leaves $K$ in each case; follow the steps :

Step (i) : Find the LCM of $x$, $y$ and $z$.
Let LCM of $x$, $y$ and $z = L$.

Step (ii): Find the remainder by dividing $n$-digits smallest number by $L$.
Let the remainder = $R$.

Step (iii): Required $n$-digits smallest number
= $n$-digits smallest number + $(L - R) + K$.

**Example** **19. Find the least possible 5-digit number, which when divided by 10, 12, 16 and 18 leaves remainder 27.**

**(a) 10107** **(b) 10100**
**(c) 10027** **(d) 10507**

**Sol. (a)** LCM of 10, 12, 16, 18 = 720
Smallest 5 – digit number = 10000
On dividing 10000 by 720, we get 640 as remainder.
$\therefore$ Required number
= 10000 + (720 – 640) + 27
= 10107

### Shortcut Approach – 5

Least number which when divided by $x_1$, $x_2$ and $x_3$ leaves the remainder $a_1$, $a_2$ and $a_3$ respectively
= (LCM of $x_1, x_2, x_3$) – $(x_1 - a_1)$ or $(x_2 - a_2)$ or $(x_3 - a_3)$
Note that here, $x_1 - a_1 = x_2 - a_2 = x_3 - a_3$

**Example** **20. Find that smallest number which when divided by 16, 24 and 30 leaves remainder as 6, 14 and 20 respectively.**

**(a) 116** **(b) 224**
**(c) 300** **(d) 230**

**Sol. (d)** Here, 16 – 6 = 24 – 14 = 30 – 20 = 10
$\therefore$ LCM of 16, 24 and 30 = 240
Hence, required number = 240 – 10 = 230

### Shortcut Approach – 6

To compare two fractions $\frac{a}{b}$ and $\frac{c}{d}$, follow as

$\frac{a}{b}$ $\quad$ $\frac{c}{d}$

$ad$ $\quad$ $bc$ [Write the product $ad$ and $bc$ on their numerator side $a$ and $c$ respectively]

If $ad > bc$, then $\frac{a}{b} > \frac{c}{d}$

If $ad < bc$, then $\frac{a}{b} < \frac{c}{d}$

**Example** **21. If $a = \frac{15}{16}$, $b = \frac{8}{9}$ then which is true**

**(a) $a > b$** **(b) $a < b$**
**(c) $a = b$** **(d) can't be determine**

**Sol. (a)** $15 \times 9 = 135$, $16 \times 8 = 128$
Here 135 > 128
$\therefore$ $a > b$

# EXERCISE

**1.** $\dfrac{0.125+0.027}{0.25-0.15+0.09}$ is equal to

(a) 0.3 (b) 0.5 (c) 0.8 (d) 0.9

**2.** If $x=\dfrac{1}{\sqrt{2}+1}$ then $(x+1)$ equals to

(a) 2 (b) $\sqrt{2}-1$ (c) $\sqrt{2}+1$ (d) $\sqrt{2}$

**3.** $\sqrt{\dfrac{0.009\times0.036\times0.016\times0.08}{0.002\times0.0008\times0.0002}}$ is equal to

(a) 34 (b) 36 (c) 38 (d) 39

**4.** By what least number should 675 be multiplied so as to obtain a perfect cube number ?

(a) 3 (b) 5 (c) 24 (d) 40

**5.** $\left(1\frac{1}{2}+11\frac{1}{2}+111\frac{1}{2}+1111\frac{1}{2}\right)$ is equal to

(a) 1236 (b) $1234\frac{1}{2}$ (c) 618 (d) 617

**6.** $\dfrac{256\times256-144\times144}{112}$ is equal to

(a) 420 (b) 400 (c) 360 (d) 320

**7.** $\left(1-\frac{1}{3}\right)\left(1-\frac{1}{4}\right)\left(1-\frac{1}{5}\right)...\left(1-\frac{1}{25}\right)$ is equal to

(a) $\frac{2}{25}$ (b) $\frac{1}{25}$ (c) $1\frac{19}{25}$ (d) $\frac{1}{325}$

**8.** Simplified form of $\left[\left(\sqrt[5]{x^{\frac{-3}{5}}}\right)^{-5/3}\right]^5$ is

(a) $x^5$ (b) $x^{-5}$ (c) $x$ (d) $\frac{1}{x}$

**9.** The value of $\dfrac{2\frac{1}{3}-1\frac{2}{11}}{3+\dfrac{1}{3+\dfrac{1}{3+\frac{1}{3}}}}$ is

(a) $\frac{38}{109}$ (b) $\frac{109}{38}$ (c) 1 (d) $\frac{116}{109}$

**10.** The value of $\dfrac{3\sqrt{2}}{\sqrt{3}+\sqrt{6}}-\dfrac{4\sqrt{3}}{\sqrt{6}+\sqrt{2}}+\dfrac{\sqrt{6}}{\sqrt{3}+\sqrt{2}}$ is

(a) 4 (b) 0 (c) $\sqrt{2}$ (d) $3\sqrt{6}$

**11.** If $9\sqrt{x}=\sqrt{12}+\sqrt{147}$, then $x=?$

(a) 2 (b) 3 (c) 4 (d) 5

**12.** If $\dfrac{4\sqrt{3}+5\sqrt{2}}{\sqrt{48}+\sqrt{18}}=a+b\sqrt{6}$, then the values of $a$ and $b$ are respectively

(a) $\frac{9}{15},-\frac{4}{15}$ (b) $\frac{3}{11},\frac{4}{33}$ (c) $\frac{9}{10},\frac{2}{5}$ (d) $\frac{3}{5},\frac{4}{15}$

**13.** The value of $3+\dfrac{1}{\sqrt{3}}+\dfrac{1}{3+\sqrt{3}}+\dfrac{1}{\sqrt{3}-3}$ is

(a) $3+\sqrt{3}$ (b) 3 (c) 1 (d) 0

**14.** $\sqrt{6+\sqrt{6+\sqrt{6+...}}}=?$

(a) 2.3 (b) 3 (c) 6 (d) 6.3

**15.** $3-\dfrac{3+\sqrt{5}}{4}-\dfrac{1}{3+\sqrt{5}}$ is equal to

(a) 0 (b) $\frac{3}{2}$ (c) $\frac{\sqrt{5}}{2}$ (d) $\sqrt{5}$

**16.** If $2\sqrt{x}=\dfrac{\sqrt{5}+\sqrt{3}}{\sqrt{5}-\sqrt{3}}-\dfrac{\sqrt{5}-\sqrt{3}}{\sqrt{5}+\sqrt{3}}$, then the value of $x$ is:

(a) 6 (b) 30 (c) $\sqrt{15}$ (d) 15

**17.** The simplest value of $\dfrac{1}{\sqrt{2}+\sqrt{3}}+\dfrac{1}{\sqrt{3}+\sqrt{4}}+\dfrac{1}{\sqrt{4}+\sqrt{5}}+\dfrac{1}{\sqrt{5}+\sqrt{6}}$ is

(a) $\sqrt{3}\left(\sqrt{2}-1\right)$ (b) $\sqrt{2}(\sqrt{3}-1)$

(c) $\sqrt{3}-1$ (d) $\sqrt{2}-1$

**18.** The simplified value of $\dfrac{\sqrt{32}+\sqrt{48}}{\sqrt{8}+\sqrt{12}}$ is

(a) 4 (b) 3 (c) 2 (d) 6

**19.** $\sqrt{\dfrac{9.5\times0.085}{0.0017\times0.19}}$ equals

(a) 5 (b) 50 (c) 500 (d) 0.05

**20.** The greatest among the following numbers $(3)^{\frac{1}{3}},(2)^{\frac{1}{2}},1,(6)^{\frac{1}{6}}$ is:

(a) $(2)^{\frac{1}{2}}$ (b) 1 (c) $(6)^{\frac{1}{6}}$ (d) $(3)^{\frac{1}{3}}$

**21.** Number of digits in the square root of 62478078 is:

(a) 3 (b) 4 (c) 5 (d) 6

**22.** If $x^2=y+z$, $y^2=z+x$ and $z^2=x+y$, then the value of $\dfrac{1}{1+x}+\dfrac{1}{1+y}+\dfrac{1}{1+z}$ is

(a) 2 (b) 0 (c) $-1$ (d) 1

**23.** The greatest 4 digit member which is a perfect square, is
(a) 9999 (b) 9909 (c) 9801 (d) 9081

**24.** The value of $\frac{4+3\sqrt{3}}{7+4\sqrt{3}}$ is
(a) $5\sqrt{3}-8$ (b) $5\sqrt{3}+8$ (c) $8\sqrt{3}+5$ (d) $8\sqrt{3}-5$

**25.** If $(2^3)^2 = 4^x$ then $3^x$ is equal to
(a) 3 (b) 6 (c) 9 (d) 27

**26.** The value of $3 \div \left[(8-5) \div \left\{(4-2) \div \left(2+\frac{8}{13}\right)\right\}\right]$ is
(a) $\frac{15}{17}$ (b) $\frac{13}{17}$ (c) $\frac{15}{19}$ (d) $\frac{13}{19}$

**27.** The simplified value of
$\left(\sqrt{6}+\sqrt{10}-\sqrt{21}-\sqrt{35}\right)\left(\sqrt{6}-\sqrt{10}+\sqrt{21}-\sqrt{35}\right)$ is
(a) 13 (b) 12 (c) 11 (d) 10

**28.** Which one of the following is true ?
(a) $\sqrt{5}+\sqrt{3} > \sqrt{6}+\sqrt{2}$ (b) $\sqrt{5}+\sqrt{3} < \sqrt{6}+\sqrt{2}$
(c) $\sqrt{5}+\sqrt{3} = \sqrt{6}+\sqrt{2}$ (d) $(\sqrt{5}+\sqrt{3})(\sqrt{6}+\sqrt{2}) = 1$

**29.** Arrange the following in ascending order $3^{34}$, $2^{51}$, $7^{17}$, we get
(a) $3^{34} > 2^{51} > 7^{17}$ (b) $7^{17} > 2^{51} > 3^{34}$
(c) $3^{34} > 7^{17} > 2^{51}$ (d) $2^{51} > 3^{34} > 7^{17}$

**30.** The simplified value of
$\frac{(0.0539-0.002)\times 0.4+0.56\times 0.07}{0.04\times 0.25}$ is:
(a) 59.96 (b) 599.6 (c) 0.5996 (d) 5.996

**31.** If $3^{2x-y} = 3^{x+y} = \sqrt{27}$, then the value of $3^{x-y}$ will be :
(a) $\frac{1}{\sqrt{3}}$ (b) $\frac{1}{\sqrt{27}}$ (c) $\sqrt{3}$ (d) 3

**32.** The simplified value of following is :
$\left(\frac{3}{15}a^5b^6c^3 \times \frac{5}{9}ab^5c^4\right) \div \frac{10}{27}a^2bc^3$
(a) $\frac{9}{10}a^2bc^4$ (b) $\frac{1}{10}a^4b^4c^{10}$
(c) $\frac{3}{10}a^4b^{10}c^4$ (d) $\frac{3}{10}ab^4c^3$

**33.** The smallest five digit number which is divisible by 12, 18 and 21 is:
(a) 10080 (b) 30256 (c) 10224 (d) 50321

**34.** The H.C.F. and L.C.M. of two numbers are 8 and 48 respectively. If one of the numbers is 24, then the other number is
(a) 48 (b) 36 (c) 24 (d) 16

**35.** The greatest number, which when subtracted from 5834, gives a number exactly divisible by each of 20, 28, 32 and 35, is
(a) 1120 (b) 4714 (c) 5200 (d) 5600

**36.** The H.C.F. and L.C.M. of two numbers are 12 and 336 respectively. If one of the numbers is 84, the other is
(a) 36 (b) 48 (c) 72 (d) 96

**37.** The traffic lights at three different road crossings change after 24 seconds, 36 seconds and 54 seconds respectively. If they all change simultaneously at 10 : 15 :00 AM, then at what time will they again change simultaneously?
(a) 10 : 16 : 54 AM (b) 10 : 18 : 36 AM
(c) 10 : 17 : 02 AM (d) 10 : 22 : 12 AM

**38.** Four runners started running simultaneously from a point on a circular track. They took 200 seconds, 300 seconds, 360 seconds and 450 seconds to complete one round. After how much time they meet at the starting point for the first time?
(a) 1800 seconds (b) 3600 seconds
(c) 2400 seconds (d) 4800 seconds

**39.** L.C.M. of $\frac{2}{3}, \frac{4}{9}, \frac{5}{6}$ is
(a) $\frac{8}{27}$ (b) $\frac{20}{3}$ (c) $\frac{10}{3}$ (d) $\frac{20}{27}$

**40.** Amit, Sucheta and Neeti start running around a circular track and complete one round in 18, 24 and 32 seconds respectively. In how many seconds will the three meet again at the starting point if they all have started running at the same time?
(a) 196 sec. (b) 288 sec.
(c) 324 sec. (d) Cannot be determined
(e) None of these

**41.** The L.C.M. of $\frac{1}{3}, \frac{5}{6}, \frac{2}{9}, \frac{4}{27}$ is
(a) $\frac{1}{54}$ (b) $\frac{10}{27}$ (c) $\frac{20}{3}$ (d) $\frac{27}{3}$

**42.** HCF of two numbers each of 4 digits is 103 and their LCM is 19261. Sum of the numbers is
(a) 2884 (b) 2488 (c) 4288 (d) 4882

**43.** $\frac{5}{8}$ of $\frac{4}{9}$ of $\frac{3}{5}$ of 222 = ?
(a) 42 (b) 43 (c) 39 (d) 37
(e) None of these

**44.** 56% of 450 + ? = 300
(a) 52 (b) 48 (c) 42 (d) 56
(e) None of these

**45.** $27^{1.5} \times 27^{3.5} = 27^{?}$
(a) 5 (b) 7 (c) 3 (d) 2
(e) None of these

**46.** $27.06 \times 25 - ? = 600$
(a) 27.3 (b) 76.7 (c) 76.5 (d) 76.2
(e) None of these

**47.** $4\frac{7}{8} \times 2\frac{4}{13} = ?$ ***(IBPS Clerk – 2016)***
(a) $11\frac{1}{3}$ (b) $11\frac{1}{13}$ (c) $11\frac{4}{13}$ (d) $11\frac{3}{8}$
(e) None of these

**48.** $74156 - ? - 321 - 20 + 520 = 69894$ ***(IBPS Clerk – 2017)***
(a) 3451 (b) 4441 (c) 5401 (d) 4531
(e) None of these

**49.** $6\frac{2}{3} + 3\frac{3}{5} + 3\frac{5}{6} = ?$
(a) 15 (b) $15\frac{11}{20}$ (c) $14\frac{1}{10}$ (d) 14
(e) None of these

**50.** $[(165)^2 \div 75 \times 12] \div 36 = (?)^2$
(a) 13 (b) 169 (c) 121 (d) 11
(e) None of these

**51.** $\sqrt{\sqrt{44944} + \sqrt{52441}} = ?$ ***(IBPS PO Pre – 2018)***
(a) 312 (b) 441 (c) 485 (d) 17
(e) None of these

**52.** $348 + 25 \times 0.80 - 11 = ?$ ***(IBPS Clerk – 2017)***
(a) 354 (b) 666 (c) 324 (d) 600
(e) None of these

**53.** (24.8% of 1338) – (15.5% of 945) = ?
(a) 187.349 (b) 185.349
(c) 183.349 (d) 171.349
(e) None of these

**54.** $(76.32)^2 - (28.82)^2 = ?$
(a) 5014.25 (b) 4975
(c) 4994.15 (d) 5000
(e) None of these

**55.** $\frac{1}{2} + \frac{1}{4} + \frac{3}{4} + \frac{2}{3} = ?$
(a) $2\frac{1}{5}$ (b) $\frac{1}{16}$ (c) $2\frac{1}{16}$ (d) $2\frac{1}{6}$
(e) None of these

**56.** $(4)^? = 1024$
(a) 1 (b) 2 (c) 3 (d) 4
(e) None of these

**57.** $22.5 \times 0.05$ ?
(a) 11.25 (b) 1.125
(c) 22.55 (d) 112.5
(e) None of these

**58.** $999 + 111 \times 0.5 = ?$
(a) 555 (b) 500
(c) 1054.5 (d) 1110.5
(e) None of these

**59.** 40% of 250 = 50% of ? ***(IBPS RRB PO Pre – 2018)***
(a) 200 (b) 100 (c) 150 (d) 400
(e) None of these

**60.** $8451 + 793 + 620 - ? = 6065 + 713$ ***(IBPS PO Pre – 2019)***
(a) 4912 (b) 4712 (c) 4312 (d) 4512
(e) None of these

**61.** Let $x$ be the least number, which when divided by 5, 6, 7 and 8 leaves a remainder 3 in each case but when divided by 9 leaves remainder 0. The sum of digits of $x$ is
(a) 24 (b) 21 (c) 22 (d) 18

**62.** The LCM of four consecutive numbers is 60. The sum of the first two numbers is equal to the fourth number. What is the sum of four numbers?
(a) 17 (b) 14 (c) 21 (d) 24

**63.** The least number which when divided by 48, 64, 90, 120 will leave the remainders 38, 54, 80, 110 respectively, is
(a) 2870 (b) 2860
(c) 2890 (d) 2880

**64.** $(47 \times 588) \div (28 \times 120) = ?$
(a) 6.284 (b) 7.625
(c) 8.225 (d) 8.285
(e) None of these

**65.** 45% of 224 × ?% of 120 = 8104.32 ***(IBPS PO Pre – 2019)***
(a) 67 (b) 62 (c) 59 (d) 71
(e) None of these

**66.** $\sqrt{7921} \times 51 + 374 = (?)^3$
(a) 16 (b) 19 (c) 15 (d) 21
(e) None of these

**67.** ?% of 762 + 44% of 568 = 524.24
(a) 24 (b) 36 (c) 48 (d) 60
(e) None of these

**68.** $\{(45)^3 + (65)^2\} \div ? = 1907$
(a) 80 (b) 70 (c) 60 (d) 50
(e) None of these

**69.** $8^{0.4} \times 4^{1.6} \times 2^{1.6} = ?$
(a) 52 (b) 48 (c) 64 (d) 76
(e) None of these

**70.** $8^7 \times 2^6 \div 8^{2.4} = 8^?$
(a) 10.6 (b) 9.6 (c) 8.6 (d) 6.6
(e) None of these

**71.** If $289 = 17^{\frac{x}{5}}$, then $x = ?$
(a) 16 (b) 8 (c) 32 (d) 24
(e) None of these

**72.** $0.01 \times 0.1 - 0.001 \div 10 + 0.01 = ?$ ***(IBPS Clerk Pre – 2019)***
(a) 0.01009 (b) 0.0101
(c) 0.19 (d) 0.109
(e) 0.0109

**73.** If $x$% of 500 = $y$% of 300 and $x$% of $y$% of 200 = 60, then $x = ?$ ***(SBI Clerk Pre – 2019)***
(a) $10\sqrt{2}$ (b) $20\sqrt{2}$ (c) $15\sqrt{2}$ (d) $30\sqrt{2}$
(e) None of these

**74.** $\frac{1}{2}$ of 3842 + 15% of ? = 2449
(a) 3520 (b) 3250 (c) 3350 (d) 3540
(e) None of these

**75.** 40% of 859 + 86.01 ÷ 7.99 = ? ***(IBPS Clerk Pre – 2019)***
(a) 398 (b) 286 (c) 412 (d) 215
(e) 355

**76.** 59.94% of (? × 8.03) – $\sqrt{4227}$ = 6.92 ***(IBPS RRB PO Pre – 2019)***

(a) 8 (b) 10 (c) 15 (d) 28
(e) 22

**77.** Three numbers which are co-prime to one another are such that the product of the first two is 551 and that of the last two is 1073. The sum of the three numbers is:

(a) 75 (b) 81
(c) 85 (d) 89

**78.** If $A$ and $B$ are the HCF and LCM respectively of two algebraic expressions $x$ and $y$, and $A + B = x + y$, then the value of $A^3 + B^3$ is

(a) $x^3 - y^3$ (b) $x^3$
(c) $y^3$ (d) $x^3 + y^3$

**79.** A milk vendor has 21 litres of cow milk, 42 litres of toned milk and 63 litres of double toned milk. If he wants to pack them in cans so that each can contains same litres of milk and does not want to mix any two kinds of milk in a can, then the least number of cans required is:

(a) 3 (b) 6
(c) 9 (d) 12

**80.** The LCM of two positive integers is twice the larger number. The difference of the smaller number and the GCD of the two numbers is 4. The smaller number is:

(a) 12 (b) 6
(c) 8 (d) 10

**81.** The ratio of HCF of LCM of two numbers $a$ and $b$ is 1 : 30 and the difference between the HCF and LCM is 493. Find the possible number of pairs of a and b.

(a) One (b) Two
(c) Four (d) Five

**82.** If $x$ is a prime number, LCM of $x$ and its successive number would be ***(RRB NTPC – 2016)***

(a) $x$ (b) $x + 1$
(c) $x(x + 1)$ (d) $\frac{x}{x+1}$

**83.** Find the least number which should be added to 1456 so that is divisible by 6, 5 and 4 without leaving a remainder. ***(RRB NTPC – 2017)***

(a) 61 (b) 6
(c) 16 (d) 44

**84.** The least number which when divided by 6, 9, 12, 15, 18 leaves the same remainder 2 in each case is: ***(SSC CGL 2nd Sit. 2015)***

(a) 178 (b) 182
(c) 176 (d) 180

**85.** What is the LCM (least common multiple) of 57 and 93? ***(SSC CHSL 2017)***

(a) 1767 (b) 1567
(c) 1576 (d) 1919

**86.** Two numbers are in the ratio 4 : 7. If their HCF is 26, then the sum of these two numbers will be: ***(SSC Sub. Ins. 2018 )***

(a) 364 (b) 286
(c) 338 (d) 312

**87.** Which among the following numbers is exactly divisible by 11.13 and 7? ***(SSC CHSL-2018)***

(a) 259237 (b) 259248
(c) 259270 (d) 259259

**88.** $\frac{5.75\times5.75\times5.75+3.25\times3.25\times3.25}{57.5\times57.5+32.5\times32.5-57.5\times32.5}$ is equal to: ***(SSC Sub. Ins. 2018)***

(a) 0.0009 (b) 0.9
(c) 0.009 (d) 0.09

**89.** If the numbers $\sqrt[3]{9}$, $\sqrt[4]{20}$, $\sqrt[6]{25}$ are arranged in ascending order, then the right arrangement is ***(SSC CGL 2016)***

(a) $\sqrt[6]{25} < \sqrt[4]{20} < \sqrt[3]{9}$ (b) $\sqrt[3]{9} < \sqrt[4]{20} < \sqrt[6]{25}$
(c) $\sqrt[4]{20} < \sqrt[6]{25} < \sqrt[3]{9}$ (d) $\sqrt[6]{25} < \sqrt[3]{9} < \sqrt[4]{20}$

**90.** The LCM of 112, 72 and 90 is?

(a) 7560 (b) 5040
(c) 2520 (d) 3780 ***(RRB Group.D-2018)***

**91.** The LCM of the prime numbers between 1 to 12 is ____. ***(RRB Group D-2018)***

(a) 1010 (b) 1000
(c) 2310 (d) 2020

**92.** If $7 \times 7 + 3 \times 7 \times x + 3 \times 3 = -5$, then find the value of $x$? ***[AFCAT 2021-II]***

(a) 4 (b) 3 (c) – 3 (d) – 5

**93.** 10 siblings out of which A′s pocket money 30% of total and he spends 20% of it and saves Rs. 144. What is B's savings if he spends 50% and his pocket money is 20% of total? ***[AFCAT 2021-I]***

(a) Rs. 60 (b) Rs. 50
(c) Rs. 120 (d) Rs. 80

**94.** 60% of the total students are girls. 85% of boys get scholarship and 92.5% girls get scholarship. Number of students who don't get scholarship are 525. Find half of the total students who get the scholarship. ***[AFCAT 2021-I]***

(a) 2250 (b) 1860
(c) 2500 (d) 2850

**95.** If X and Y are two fractions and X is thrice of Y and multiplication of X and Y is 25/12, then Y is:

(a) 5/6 (b) 6/5 ***[AFCAT 2021-I]***
(c) 5/8 (d) None of these

**DIRECTIONS (Qs. 96-100) :** *What should come in place of question mark (?) in the following questions ?* ***(RBI Assistant Prelim-2020)***

**96.** 205% of 3850 – 105% of 2640 = ?

(a) 4218.5 (b) 5120.5 (c) 4448.5 (d) 4628.5
(e) 6120.5

**97.** 4527 + 785 + 968 – ? = 4560

(a) 1,720 (b) 1,700 (c) 1,675 (d) 1,800
(e) 1,520

**98.** $27.4 \times 3 + 5.4 - 57.6 = ? + 14.8$
(a) 15.7 (b) 12.6 (c) 14.8 (d) 15.2
(e) 13.2

**99.** $7.53 + 6.32 + 0.54 + 41.47 + 345 = ?$
(a) 397.27 (b) 419.57 (c) 400.86 (d) 406.67
(e) 500.86

**100.** $\sqrt{7396} \times 3375 = 225 \times ?$
(a) 1,250 (b) 1,290 (c) 1,270 (d) 1,300
(e) 1,450

**DIRECTIONS (Qs. 101-109) :** *What should come in place of question mark (?) in following questions?*

***(IBPS RRB Asst. Pre 2020)***

**101.** $(24\% \text{ of } 500) \div 0.6 = ?$
(a) 600 (b) None of these
(c) 40 (d) 500
(e) 200

**102.** $\dfrac{3^3 + (17)^2}{9^2 + 25 - 27} = ?$
(a) 1 (b) 5 (c) 4 (d) 6
(e) 3

**103.** $(5)^{?} \times 3 = \dfrac{(15)^2}{\sqrt[4]{81}}$
(a) 5 (b) 2 (c) 4 (d) 1
(e) None of these

**104.** $7 \times (53 - ?) = 7^3$
(a) 6 (b) 9 (c) 4 (d) 4
(e) None of these

**105.** $? + 385 - 225 = 433$
(a) 384 (b) 234 (c) 224 (d) 276
(e) 273

**106.** $15 \times 8 + (?)^2 = (13)^2$
(a) 7 (b) 12 (c) 5 (d) 6
(e) None of these

**107.** $(30\% \text{ of } 500 + ?\% \text{ of } 400 = 250)$
(a) 22 (b) 36 (c) 35 (d) 25
(e) 20

**108.** $\sqrt{576} \div 8 = ? - 270$
(a) 284 (b) 273 (c) 287 (d) 283
(e) 285

**109.** $\sqrt{441} - \sqrt{169} + \sqrt{784} = 34 + ?$
(a) 1 (b) 4
(c) 5 (d) 7
(e) 2

**DIRECTIONS (Qs. 110-113) :** *Simplify the following given equations.*

***(IBPS RRB Asst. Main 2020)***

**110.** $\sqrt[3]{(126 + 392 \div 7 - 162 + 14^2)} = ?$
(a) 2 (b) 5
(c) 6 (d) 11
(e) None of these

**111.** $140\% \text{ of } 200 + \dfrac{16^2 - 12^2}{2} - 7 = ?$
(a) 496 (b) 376
(c) 281 (d) 329
(e) None of these

**112.** $\dfrac{63}{7 \times 3} \times \sqrt{576} - \sqrt{729} = \sqrt{?}$
(a) 4016 (b) 2025
(c) 2861 (d) 2179
(e) None of these

**113.** $3\dfrac{1}{6} + 7\dfrac{2}{3} - 4\dfrac{1}{4} = ? + 2\dfrac{1}{6}$
(a) $5\dfrac{4}{11}$ (b) $7\dfrac{3}{10}$ (c) $6\dfrac{5}{12}$ (d) $8\dfrac{7}{15}$
(e) None of these

**DIRECTIONS (Qs. 114-118) :** *What should come in place of question mark (?) in the following questions?*

***(IBPS RRB Scale-1 Main 2020)***

**114.** 711, 719, 735, 767, 831, ?
(a) 1063 (b) 1045 (c) 1105 (d) 959
(e) 1055

**115.** 245, 384, 567, ?, 1089, 1440
(a) 1230 (b) 735 (c) 800 (d) 885
(e) 805

**116.** 2755, 2629, 2479, ?, 2099, 1865
(a) 2400 (b) 2207 (c) 2197 (d) 2387
(e) 2303

**117.** 29, 38, –26, –1, –217, ?
(a) –168 (b) –257 (c) +168 (d) 1
(e) –278

**118.** 632, 582, 534, 488, 444, ?
(a) 420 (b) 415 (c) 415 (d) 402
(e) 404

**DIRECTIONS (Qs. 119-123):** *What will come in the place of question (?) mark in following questions.*

***(IBPS Clerk Prelim 2021)***

**119.** $38\% \text{ of } 250 + 36 \div 2 \times ? = 257$
(a) 9 (b) 10
(c) 11 (d) 8
(e) 7

**120.** $\sqrt{4900}\% \text{ of } 160 + \dfrac{4}{5} \text{ of } 380 - ? = 456$
(a) –36 (b) –44 (c) –40 (d) 50
(e) 54

**121.** $120 \times 182 \div 14 - ? = 18^2$
(a) 1235 (b) 1236 (c) 1234 (d) 1344
(e) 1444

**122.** $\left(5\dfrac{3}{4} + 1\dfrac{1}{2}\right) \times 50\% \text{ of } 280 = ?$
(a) 1010 (b) 1012 (c) 1015 (d) 1016
(e) None of these

**123.** $\frac{1}{5}\times\frac{128\times5}{2\times16}+7^3=3379$

(a) 12 (b) 13 (c) 14 (d) 15
(e) 11

**DIRECTIONS (Qs. 124-126):** *What approximate value should come in place of question mark (?) in the following questions?*

***(RBI Asst. Main 2020)***

**124.** $\frac{\left(\frac{12\times50}{99.98}\right)}{53.79}\times100=\frac{5.88}{54}\times100.01\times?$

(a) 3 (b) 6 (c) 4 (d) 1
(e) 5

**125.** $(1903.76+2040.12)-\frac{?}{100}\times66299=2618.11$

(a) 5 (b) 2 (c) 4 (d) 6
(e) 1

**126.** $850\left(\frac{6}{5}\times14.92+\frac{5}{4}\times19.98\right)=?$

(a) 27400 (b) 32400 (c) 36550 (d) 42300
(e) 45300

**DIRECTIONS (127–131) :** *What approximate value will come in place of question mark (?) in the following questions.*

***(IBPS RRB Clerk Main 2021)***

**127.** $\frac{98}{7.98}\times72.01+\frac{99}{10.95}\times120.89-\sqrt{24.99}=\sqrt{?}$

(a) 169 (b) 225 (c) 196 (d) 289
(e) None of these

**128.** $\sqrt{325}\times\sqrt{24.99}-17\times1.99^{1.99}=\sqrt{?}$

(a) 576 (b) 400 (c) 484 (d) 361
(e) None of these

**129.** 21.06 × 5.99 + 9 of 20.01 % of 59.98 = ?
(a) 234 (b) 227 (c) 239 (d) 218
(e) None of these

**130.** $?=((30.99^{1.99}-12.09^{2.02})+24.12)^{0.51}$
(a) 27 (b) 28.5 (c) 29 (d) 33
(e) None of these

**131.** 448.09 ÷ 16.06 × 5.05 – 131.17 = $\sqrt{?}$
(a) 74 (b) 77 (c) 79 (d) 80
(e) None of these

**132.** If '+' means '–', '–' means '+', '×' means '÷' and '÷' means, '×', then the value of $\frac{42-12\times3+8\div2+15}{8\times2-4+9\div3}$ is :

***(SSC CGL 2019-20)***

(a) $\frac{15}{19}$ (b) $-\frac{5}{3}$ (c) $-\frac{15}{19}$ (d) $\frac{5}{3}$

**133.** What is the value of 32 × 4 of 2 × 3 + $\left[5\text{ of }6-\{7\text{ of }8(10+6\text{ of }\frac{5}{6}\times5-1)\div80\}\right]-7\times3\div2$?

***(SSC MTS 2019-20)***

(a) 7.5 (b) 17.5 (c) 12.5 (d) 24.5

**134.** What is the value of
$\frac{72\div9+3-6-(2\times3)+5\text{ of }3-(1+5\times2-2)}{8\div4+2-(6\times8\div2)+(7\times4-2\times2)}$ ?

***(SSC MTS 2019-20)***

(a) $\frac{11}{4}$ (b) $\frac{5}{4}$ (c) 0 (d) $\frac{15}{4}$

**135.** If $\frac{a}{b}=\frac{3}{4},\frac{b}{c}=\frac{4}{3}$ and $\frac{c}{d}=\frac{5}{6}$, then the sum of the numerator and the denominator (which are coprimes) of $\left(\frac{a}{d}\right)^{10}$ is :

***(SSC MTS 2019-20)***

(a) 1025 (b) 4097 (c) 2049 (d) 513

**136.** The value of 90 ÷ 20 of 6 × [11 ÷ 4 of {3 × 2 – (3 – 8)}] ÷ (9 ÷ 3 × 2) is: ***(SSC CGL 2020-21)***

(a) $\frac{9}{8}$ (b) $\frac{3}{8}$ (c) $\frac{1}{36}$ (d) $\frac{1}{32}$

**137.** Simplify the following expression. ***(SSC CHSL 2020-21)***

$5\frac{1}{3}\div\left[7-3\div\left(1-\frac{1}{4}\right)\times\frac{2}{3}+1\right]-3\div1+2$

(a) 15 (b) 0 (c) $-4$ (d) $\frac{1}{41}$

**138.** The value of $\frac{7}{10}\div\frac{7}{5}of\left[\frac{21}{10}+\frac{13}{5}\right]+\left[\frac{1}{10}\times\frac{10}{47}-\frac{6}{47}\right]$ is :

***(SSC MTS 2020-21)***

(a) 1 (b) 10 (c) 0 (d) 5

**139.** What is the simplified value of ***(SSC MTS 2020-21)***

$\left\{\left(4-\frac{2}{1+\frac{2}{1-\frac{1}{2+\frac{3}{4}}}}\right)\div1\frac{5}{12}\text{ of }\frac{72}{145}-(4+3\div0.5-1)\right\}$ ?

(a) 1 (b) $-4$ (c) $-2$ (d) 3

**140.** The value of $\frac{40-\frac{3}{4}\text{ of }32}{37-\frac{3}{4}\text{ of }(34-6)}$ is:

***(SSC Sub-Inspector 2020-21)***

(a) $\frac{1}{2}$ (b) 1 (c) $-\frac{1}{2}$ (d) 0

**141.** The value of $8 - 3 \div 6$ of $2 + (4 \div 4$ of $\frac{1}{4}) \div 8 + (4 \times 8 \div \frac{1}{4}) \times \frac{1}{8}$ is :

*(SSC Sub-Inspector 2020-21)*

(a) $\frac{7}{4}$ (b) $-\frac{97}{4}$ (c) $-\frac{7}{4}$ (d) $\frac{97}{4}$

**142.** The value of $\frac{6.35 \times 6.35 \times 6.35 + 3.65 \times 3.65 \times 3.65}{63.5 \times 63.5 + 36.5 \times 36.5 - 63.5 \times 36.5}$ is equal to:

*(SSC Sub-Inspector 2020-21)*

(a) 0.1 (b) 10 (c) 1 (d) 0.01

**143.** What is the HCF of $23 \times 34$ and $25 \times 32$ ?

*(SSC MTS 2019-20)*

(a) $25 \times 33$ (b) $23 \times 34$ (c) $23 \times 32$ (d) $25 \times 34$

**144.** Which is the largest number that will divide 2036 and 233 leaving remainders 12 and 13, respectively?

*(SSC MTS 2020-21)*

(a) 36 (b) 42 (c) 44 (d) 46

**145.** Two numbers are in the ratio 7 : 11. If their HCF is 28, then the difference between the two numbers is:

*(SSC Sub-Inspector 2020-21)*

(a) 28 (b) 308 (c) 112 (d) 196

**146.** Find the value of the following expression:

$372 \div 56 \times 7 - 5 + 2$ *(SSC CGL Tier-1 2022)*

**(a)** 58 (b) $-2\frac{95}{98}$ (c) $43\frac{1}{2}$ (d) $2\frac{93}{98}$

**147.** LCM of two numbers is 56 times their HCF, with the sum of their HCF and LCM being 1710. If one of the two numbers is 240, then what is the other number? *(SSC CGL Tier-1 2022)*

(a) 57 (b) 171 (c) 1680 (d) 210

# Hints & Solutions

**1. (c)** If $0.5 = a$ and $0.3 = b$ then,

$$Expression = \frac{a^3 + b^3}{a^2 - ab + b^2}$$

$$= \frac{(a+b)(a^2 - ab + b^2)}{a^2 - ab + b^2} = a + b = 0.5 + 0.3 = 0.8$$

**2. (d)** $x = \frac{1}{\sqrt{2}+1} \times \frac{\sqrt{2}-1}{\sqrt{2}-1} = \sqrt{2} - 1$

Now, $x + 1 = \sqrt{2} - 1 + 1 = \sqrt{2}$

**3. (b)** Expression

$$= \sqrt{\frac{0.009 \times 0.036 \times 0.016 \times 0.08}{0.002 \times 0.0008 \times 0.0002}} = \sqrt{\frac{9 \times 36 \times 16 \times 8}{2 \times 8 \times 2}}$$

$= 3 \times 2 \times 3 \times 2 = 36$

**4. (b)** $675 = 5 \times 5 \times 3 \times 3 \times 3$

Hence number to be multiplied is 5.

**5. (a)** $1\frac{1}{2} + 11\frac{1}{2} + 111\frac{1}{2} + 1111\frac{1}{2} = 1234 + 2 = 1236$

**6. (b)** If $256 = a$ and $144 = b$, then

$$\frac{a^2 - b^2}{a - b} \qquad [\because a - b = 256 - 144 = 112]$$

$$= \frac{(a+b)(a-b)}{(a-b)} = a + b = 256 + 144 = 400$$

**7. (a)** $\left(1 - \frac{1}{3}\right)\left(1 - \frac{1}{4}\right)\left(1 - \frac{1}{5}\right) \ldots \left(1 - \frac{1}{24}\right)\left(1 - \frac{1}{25}\right)$

$$= \frac{2}{3} \times \frac{3}{4} \times \frac{4}{5} \ldots\ldots \times \frac{23}{24} \times \frac{24}{25} = \frac{2}{25}$$

**8. (c)** $\left[\left(\sqrt[5]{x^{-3/5}}\right)^{\frac{-5}{3}}\right]^5 = \left(x^{-\frac{3}{5}}\right)^{\frac{1}{5} \times \frac{-5}{3} \times 5} = x^{-\frac{3}{5} \times \frac{-5}{3}} = x$

**9. (a)** $\frac{\frac{7}{3} - \frac{13}{11}}{3 + \frac{1}{3 + \frac{1}{\frac{10}{3}}}} = \frac{\frac{77 - 39}{33}}{3 + \frac{10}{33}} = \frac{\frac{38}{33}}{\frac{109}{33}} = \frac{38}{109}$

**10. (b)** Expression $= \frac{3\sqrt{2}}{\sqrt{3} + \sqrt{6}} - \frac{4\sqrt{3}}{\sqrt{6} + \sqrt{2}} + \frac{\sqrt{6}}{\sqrt{3} + \sqrt{2}}$

$$= \frac{3\sqrt{2}(\sqrt{6} - \sqrt{3})}{(\sqrt{6} + \sqrt{3})(\sqrt{6} - \sqrt{3})} - \frac{4\sqrt{3}(\sqrt{6} - \sqrt{2})}{(\sqrt{6} + \sqrt{2})(\sqrt{6} - \sqrt{2})} + \frac{\sqrt{6}}{(\sqrt{3} + \sqrt{2})} \times \frac{(\sqrt{3} - \sqrt{2})}{(\sqrt{3} - \sqrt{2})}$$

$$= \frac{3\sqrt{2}(\sqrt{6} - \sqrt{3})}{6 - 3} - \frac{4\sqrt{3}(\sqrt{6} - \sqrt{2})}{(6 - 2)} + \frac{\sqrt{6}(\sqrt{3} - \sqrt{2})}{3 - 2}$$

$$= \sqrt{2}(\sqrt{6} - \sqrt{3}) - \sqrt{3}(\sqrt{6} - \sqrt{2}) + \sqrt{6}(\sqrt{3} - \sqrt{2})$$

$$= \sqrt{12} - \sqrt{6} - \sqrt{18} + \sqrt{6} + \sqrt{18} - \sqrt{12} = 0$$

**11. (b)** $9\sqrt{x} = \sqrt{3 \times 2 \times 2} + \sqrt{3 \times 7 \times 7}$

$\Rightarrow \quad 9\sqrt{x} = 2\sqrt{3} + 7\sqrt{3} = 9\sqrt{3}$

$\therefore \quad x = 3$

**12. (d)** $\frac{4\sqrt{3} + 5\sqrt{2}}{\sqrt{48} + \sqrt{18}} \Rightarrow \frac{4\sqrt{3} + 5\sqrt{2}}{4\sqrt{3} + 3\sqrt{2}}$

By Rationalising

$$\frac{(4\sqrt{3}+5\sqrt{2})(4\sqrt{3}-3\sqrt{2})}{(4\sqrt{3}+3\sqrt{2})(4\sqrt{3}-3\sqrt{2})}=\frac{30-12+8\sqrt{6}}{30}$$

$$\frac{18}{30}+\frac{8}{30}\sqrt{6}=a+b\sqrt{6}$$

$$\frac{3}{5}+\frac{4}{15}\sqrt{6}=a+b\sqrt{6}$$

$$a=\frac{3}{5},\ b=\frac{4}{15}$$

**13. (b)** $3+\frac{1}{\sqrt{3}}+\left(\frac{1}{3+\sqrt{3}}-\frac{1}{3-\sqrt{3}}\right)$

$$=3+\frac{1}{\sqrt{3}}+\left(\frac{3-\sqrt{3}-3-\sqrt{3}}{(3+\sqrt{3})(3-\sqrt{3})}\right)$$

$$=3+\frac{1}{\sqrt{3}}+\frac{-2\sqrt{3}}{9-3}=3+\frac{1}{\sqrt{3}}-\frac{\sqrt{3}}{3}=3+\frac{1}{\sqrt{3}}-\frac{1}{\sqrt{3}}=3$$

**14. (b)** $\sqrt{6+\sqrt{6+\sqrt{6.....}}}=x \quad \Rightarrow \quad x^2=6+x$

$x^2-x-6=0\ ;\ (x-3)\ (x+2)=0$

$x=3,-2$

But here $x$ can not be negative

$\therefore \quad x=3$

**15. (b)** $\frac{1}{3+\sqrt{5}}=\frac{3-\sqrt{5}}{(3+\sqrt{5})(3-\sqrt{5})}=\frac{3-\sqrt{5}}{9-5}=\frac{3-\sqrt{5}}{4}$

$$\therefore \quad 3-\frac{3+\sqrt{5}}{4}-\frac{3-\sqrt{5}}{4}=\frac{12-3-\sqrt{5}-3+\sqrt{5}}{4}=\frac{6}{4}=\frac{3}{2}$$

**16. (d)** $2\sqrt{x}=\frac{\sqrt{5}+\sqrt{3}}{\sqrt{5}-\sqrt{3}}-\frac{\sqrt{5}-\sqrt{3}}{\sqrt{5}+\sqrt{3}}$

$$=\frac{(\sqrt{5}+\sqrt{3})^2-(\sqrt{5}-\sqrt{3})^2}{(\sqrt{5}-\sqrt{3})(\sqrt{5}+\sqrt{3})}=\frac{4.\sqrt{5}.\sqrt{3}}{5-3}=2\sqrt{15}$$

$\therefore \quad 2\sqrt{x}=2\sqrt{15} \Rightarrow x=15$

**17. (b)** $\frac{1}{\sqrt{2}+\sqrt{3}}$

$$=\frac{1}{\sqrt{3}+\sqrt{2}}\times\frac{\sqrt{3}-\sqrt{2}}{\sqrt{3}-\sqrt{2}}=\frac{\sqrt{3}-\sqrt{2}}{3-2}=\sqrt{3}-\sqrt{2}$$

$$\therefore \quad \frac{1}{\sqrt{4}+\sqrt{3}}=\sqrt{4}-\sqrt{3};\ \frac{1}{\sqrt{4}+\sqrt{5}}=\sqrt{5}-\sqrt{4};$$

$$\frac{1}{\sqrt{5}+\sqrt{6}}=\sqrt{6}-\sqrt{5}$$

$\therefore$ Expression

$$=\sqrt{3}-\sqrt{2}+\sqrt{4}-\sqrt{3}+\sqrt{5}-\sqrt{4}+\sqrt{6}-\sqrt{5}$$

$$=\sqrt{6}-\sqrt{2}=\sqrt{2}\left(\sqrt{3}-1\right)$$

**18. (c)** $\frac{\sqrt{32}+\sqrt{48}}{\sqrt{8}+\sqrt{12}}=\frac{\sqrt{2\times2\times2\times2\times2}+\sqrt{2\times2\times2\times2\times3}}{\sqrt{2\times2\times2}+\sqrt{2\times2\times3}}$

$$\Rightarrow \quad \frac{4\sqrt{2}+4\sqrt{3}}{2\sqrt{2}+2\sqrt{3}}=\frac{2(2\sqrt{2}+2\sqrt{3})}{(2\sqrt{2}+2\sqrt{3})}=2$$

**19. (b)** $\sqrt{\frac{9.5\times0.085}{0.0017\times0.19}}=\sqrt{\frac{95}{10}\times\frac{85}{1000}\times\frac{10000}{17}\times\frac{100}{19}}$

$$\Rightarrow \quad \sqrt{5\times5\times100}=50$$

**20. (d)** LCM of 3, 2 and 6 = 6

$$\therefore \quad (3)^{\frac{1}{3}}=(3^2)^{\frac{1}{6}}=(9)^{\frac{1}{6}}$$

$$2^{\frac{1}{2}}=(2^3)^{\frac{1}{6}}=(8)^{\frac{1}{6}}$$

$$(1)^{\frac{1}{6}}=1;(6)^{\frac{1}{6}}=(6)^{\frac{1}{6}}$$

Now, number in descending order are

$$(9)^{\frac{1}{6}},(8)^{\frac{1}{6}},(6)^{\frac{1}{6}},(1)^{\frac{1}{6}}$$

Hence, greatest number is $(3)^{\frac{1}{3}}$

**21. (b)** When no. of digit in a no. is 7 or 8 then number of digits in square root will be 4.

**22. (d)** $x^2=y+z$

$$\Rightarrow \quad x^2+x=x+y+z \quad \Rightarrow \quad x\,(x+1)=x+y+z$$

$$\Rightarrow \quad x+1=\frac{x+y+z}{x} \quad \Rightarrow \quad \frac{1}{x+1}=\frac{x}{x+y+z}$$

Similarly, $\frac{1}{y+1}=\frac{y}{x+y+z}$

$$\frac{1}{z+1}=\frac{z}{x+y+z} \quad \therefore \quad \frac{1}{1+x}+\frac{1}{1+y}+\frac{1}{1+z}$$

$$=\frac{x}{x+y+z}+\frac{y}{x+y+z}+\frac{z}{x+y+z}$$

$$=\frac{x+y+z}{x+y+z}=1$$

**23. (c)** $99\times99=9801$

**24. (a)** Expression $=\frac{4+3\sqrt{3}}{7+4\sqrt{3}}$

Rationalising the denominator.

$$=\frac{(4+3\sqrt{3})(7-4\sqrt{3})}{(7+4\sqrt{3})(7-4\sqrt{3})}=\frac{28-16\sqrt{3}+21\sqrt{3}-12\times3}{49-48}$$

$$=28+5\sqrt{3}-36=5\sqrt{3}-8$$

**25. (d)** $(2^3)^2=4^x$

$2^6=2^{2x}$

$6=2x$

$x=3$

$3^3=27$

**26. (b)** $3\div\left[(8-5)\div\left\{(4-2)\div\left(2+\frac{8}{13}\right)\right\}\right]$

$$\Rightarrow \quad 3\div\left[3\div\left\{2\div\left(\frac{34}{13}\right)\right\}\right] \quad \Rightarrow \quad 3\div\left[3\div\left\{2\times\frac{13}{34}\right\}\right]$$

$$\Rightarrow \quad 3\div\left[3\times\frac{17}{13}\right] \quad \Rightarrow \quad 3\times\frac{13}{3\times17}=\frac{13}{17}$$

**27. (d)** $\left[(\sqrt{6}-\sqrt{35})+(\sqrt{10}-\sqrt{21})\right]\left[(\sqrt{6}-\sqrt{35})-(\sqrt{10}-\sqrt{21})\right]$

$=(\sqrt{6}-\sqrt{35})^2-(\sqrt{10}-\sqrt{21})^2$

$=6+35-2\sqrt{6}.\sqrt{35}-10-21+2\sqrt{10}.\sqrt{21}$

$=10-2\sqrt{210}+2\sqrt{210}=10$

**28. (a)** $\sqrt{5}+\sqrt{3}>\sqrt{6}+\sqrt{2}$

Squaring both sides

$5+3+2\sqrt{15}>6+2+2\sqrt{12}$

$\sqrt{15}>\sqrt{12}$ which is true

**29. (a)** $3^{34}=(3^2)^{17}=9^{17}$ ; $2^{51}=(2^3)^{17}=8^{17}$

Clearly, $9^{17}>8^{17}>7^{17}$

or $9^{17}>2^{51}>3^{17}\Rightarrow 3^{34}>2^{51}>7^{17}$

**30. (d)** $0.0539-0.002=0.0519$

$0.56\times 0.07=0.0392$

$0.0519\times 0.4=0.02076$

$0.04\times 0.25=0.01$

So $\dfrac{(0.0539-0.002)\times 0.4+0.56\times 0.07}{0.04\times 0.25}$

$=\dfrac{0.0519\times 0.4+0.0392}{0.01}=\dfrac{0.02076+0.0392}{0.01}=5.996$

**31. (c)** $3^{2x-y}=3^{x+y}=\sqrt{27}=3^{\frac{3}{2}}$

$\Rightarrow \quad 2x-y=\dfrac{3}{2}$ and $x+y=\dfrac{3}{2}$

$4x-2y=3$ ..(i)

$2x+2y=3$ ...(ii)

Solving equations (i) and (ii)

$x=1 \quad y=\dfrac{1}{2} \quad \Rightarrow \quad 3^{1-\frac{1}{2}}=3^{\frac{1}{2}}=\sqrt{3}$

**32. (c)** $\left(\dfrac{3}{15}a^5\ b^6\ c^3\times\dfrac{5}{9}a\ b^5c^4\right)\div\dfrac{10}{27}\ a^2\ b\ c^3$

$=\dfrac{1}{9}a^6\ b^{11}\ c^7\div\dfrac{10}{27}\ a^2\ b\ c^3$

$=\dfrac{1}{9}a^6\ b^{11}\ c^7\times\dfrac{27}{10}\ a^{-2}\ b^{-1}\ c^{-3}=\dfrac{3}{10}a^{6-2}\ b^{11-1}\ c^{7-3}$

$=\dfrac{3}{10}a^4\ b^{10}\ c^4$

**33. (a)** Lowest 5 digit number = 10,000

The number which is divisible by 12, 18 and 21 is LCM of 12, 18, 21 which is 252.

$\dfrac{10000}{252}$ gives 172 as remainder

So, 252 – 172 = 80

10,000 + 80 = 10080

If 10080 when divided by 12, 18 and 21 gives 0 as remainder

So, 10080 is the least 5–digit number.

**34. (d)** $p\times q=$ HCF × LCM

$\therefore$ Second number $=\dfrac{8\times 48}{24}=16$

**35. (b)** LCM of 20, 28, 32, 35 is 1120

$\therefore$ Required number = 5834 – 1120 = 4714

**36. (b)** First number × second number = HCF × LCM

$q=\dfrac{12\times 336}{84}=48$

**37. (b)** LCM of 24, 36 and 54 seconds = 216 seconds

= 3 minutes 36 seconds

$\therefore$ Required time

= 10 : 15 : 00 + 3 minutes 36 seconds

= 10 : 18 : 36 A.M.

**38. (a)** Required time = LCM of 200, 300, 360 and 450 seconds = 1800 seconds.

**39. (b)** LCM of $\dfrac{2}{3},\dfrac{4}{9},\dfrac{5}{6}$

$\dfrac{\text{LCM of }(2,4,5)}{\text{HCF of }(3,9,6)}=\dfrac{20}{3}$

**40. (b)** Required time = LCM of 18, 24 and 32 seconds.

= 288 seconds

**41. (c)** LCM $=\dfrac{\text{LCM of }1,\ 5,\ 2,\ 4}{\text{HCF of }3,\ 6,\ 9,\ 27}=\dfrac{20}{3}$

**42. (a)** Let the numbers be $103x$ and $103y$ where $x$ and $y$ are prime to each other.

$\therefore$ LCM = $103xy \quad \Rightarrow \quad 103xy=19261$

$\Rightarrow \quad xy=\dfrac{19261}{103}=187 \Rightarrow \quad x=11$ or $17$

$y=17$ or $11$

$\therefore$ Numbers = 103 × 11 = 1133

and 103 × 17 = 1751 and Sum = 1751 + 1133 = 2884

**43. (d)** $?=\dfrac{5}{8}$ of $\dfrac{4}{9}$ of $\dfrac{3}{5}$ of $222=\dfrac{5}{8}\times\dfrac{4}{9}\times\dfrac{3}{5}\times 222=37$

**44. (b)** 56% of 450 + ? = 300

$\Rightarrow \quad \dfrac{56\times 450}{100}+?=300$

$\Rightarrow \quad 252+?=300 \Rightarrow \quad ?=300-252=48$

**45. (a)** $27^{?}=27^{1.5}\times 27^{3.5}$

$\Rightarrow \quad 27^{?}=27^{1.5+3.5} \quad \Rightarrow 27^{?}=27^5 \Rightarrow \quad ?=5$

**46. (c)** $27.06\times 25-?=600$

$\Rightarrow \quad 676.5-?=600$

$\Rightarrow \quad ?=676.5-600=76.5$

**47. (e)** $?=4\dfrac{7}{8}\times 2\dfrac{4}{13}=\dfrac{39}{8}\times\dfrac{30}{13}=\dfrac{45}{4}=11\dfrac{1}{4}$

**48. (b)** $74156-?+179=69894$

$\Rightarrow \quad 74335-?=69894$

$\Rightarrow \quad ?=74335-69894=4441$

**49. (c)** $?=6+\dfrac{2}{3}+3+\dfrac{3}{5}+3+\dfrac{5}{6}$

$=(6+3+3)+\left(\dfrac{2}{3}+\dfrac{3}{5}+\dfrac{5}{6}\right)=12+\left(\dfrac{20+18+25}{30}\right)$

$=12+\dfrac{63}{30}=12+2\dfrac{3}{30}=14\dfrac{1}{10}$

**50. (d)** $(?)^2 = [(165)^2 \div 75 \times 12] \div 36$

$= \left[\frac{(165)^2}{75} \times 12\right] \div 36 = \frac{165 \times 165 \times 12}{75 \times 36} = 121$

$\Rightarrow ? = \sqrt{121} = 11$

**51. (e)** $? = \sqrt{\sqrt{44944} + \sqrt{52441}} = \sqrt{212 + 229} = \sqrt{441} = 21$

**52. (e)** $? = 348 + 25 \times 0.80 - 11 = 348 + 20 - 11 = 357$

**53. (b)** $? = \frac{1338 \times 24.8}{100} - \frac{945 \times 15.5}{100}$

$= 331.824 - 146.475 = 185.349$

**54. (c)** $? = (76.32)^2 - (28.82)^2$

$= (76.32 + 28.82)(76.32 - 28.82)$

$= 105.14 \times 47.5 = 4994.15$

**55. (d)** $? = \frac{1}{2} + \frac{1}{4} + \frac{3}{4} + \frac{2}{3} = \frac{6+3+9+8}{12} = \frac{26}{12} = \frac{13}{6} = 2\frac{1}{6}$

**56. (e)** $(4)^? = 1024 = (4)^5 \Rightarrow ? = 5$

**57. (b)** $? = 22.5 \times 0.05 = 1.125$

**58. (c)** $? = 999 + 111 \times 0.5 = 999 + 55.5 = 1054.5$

**59. (a)** $\frac{250 \times 40}{100} = ? \times \frac{50}{100} \Rightarrow ? \times 50 = 250 \times 40$

$\Rightarrow ? = \frac{250 \times 40}{50} = 200$

**60. (e)** $8451 + 793 + 620 - ? = 6054 + 713$

$\Rightarrow 9864 - ? = 6778 \Rightarrow ? = 9864 - 6778 = 3086$

**61. (d)** LCM of 5, 6, 7 & 8 = 840

$\frac{840n + 3}{9} \Rightarrow \frac{3n + 3}{9}$

$\Rightarrow$ Take $n = 2 \Rightarrow 3(2) + 3$

$\Rightarrow \frac{9}{9}$ = Remainder = 0

$\therefore$ Number is $= 840n + 3$

$\Rightarrow 840(2) + 3$ $(n = 2) \Rightarrow 1683$

Sum of digits = 18

**62. (b)** Numbers $= x, x + 1, x + 2, x + 3$

$I^{st} + II^{nd} = IV^{th}$

$x + x + 1 = x + 3$

$\therefore x = 2$

$\therefore$ Numbers are 2, 3, 4, 5

$\therefore$ Sum of four numbers $= 2 + 3 + 4 + 5 = 14$.

**63. (a)** Here, $(48 - 38) = 10$, $(64 - 54) = 10$, $(90 - 80) = 10$ and $(120 - 110) = 10$.

$\therefore$ Required number

= (L.C.M of 48, 64, 90 and 120) – 10 = 2870

**64. (c)** $? = (47 \times 588) \div (28 \times 120) = \frac{47 \times 588}{28 \times 120} = 8.225$

**65. (a)** $\left(224 \times \frac{45}{100}\right) \times \left(120 \times \frac{?}{100}\right) = 8104.32$

$\Rightarrow 100.80 \times (1.20 \times ?) = 8104.32$

$\Rightarrow ? = \frac{8104.32}{100.80 \times 1.20} = 67$

**66. (e)** $(?)^3 = \sqrt{7921} \times 51 + 374$

$= 89 \times 51 + 374 = 4539 + 374 = 4913$

$\therefore ? = \sqrt[3]{4913} = \sqrt[3]{17 \times 17 \times 17} = 17$

**67. (b)** $\frac{762 \times ?}{100} + \frac{568 \times 44}{100} = 524.24$

$\Rightarrow 762 \times ? + 24992 = 52424$

$\Rightarrow 762 \times ? = 52424 - 24992 = 27432$

$\Rightarrow ? = \frac{27432}{762} = 36$

**68. (d)** $\{(45)^3 + (65)^2\} \div ? = 1907$

$\Rightarrow \frac{(91125 + 4225)}{?} = 1907 \Rightarrow \frac{95350}{?} = 1907$

$\Rightarrow ? = \frac{95350}{1907} = 50$

**69. (c)** $? = 8^{0.4} \times 4^{1.6} \times 2^{1.6} = (2^3)^{0.4} \times (2^2)^{1.6} \times 2^{1.6}$

$= 2^{1.2} \times 2^{3.2} \times 2^{1.6} = (2)^{1.2 + 3.2 + 1.6} = 2^6 = 64$

**70. (d)** $8^? = \frac{8^7 \times 2^6}{8^{2.4}} = \frac{8^7 \times 8^2}{8^{2.4}}$

$\Rightarrow 8^? = 8^{7+2-2.4} = 8^{6.6}$

$? = 6.6$

**71. (e)** $17^2 = 17^{\frac{x}{5}} \Rightarrow \frac{x}{5} = 2 \Rightarrow x = 2 \times 5 = 10$

**72. (e)** $? = 0.001 - 0.001 \times \frac{1}{10} + 0.01$

$= 0.001 - 0.0001 + 0.01 = 0.0109$

**73. (d)** $\frac{x \times 500}{100} = \frac{y \times 300}{100} \Rightarrow 5x = 3y$

$\Rightarrow y = \frac{5}{3}x$ ...(i)

Again, $\frac{xy \times 200}{100 \times 100} = 60$

$\Rightarrow xy = 3000 \Rightarrow x \times \frac{5}{3}x = 3000$

$\Rightarrow x^2 = \frac{3000 \times 3}{5} = 1800$

$\Rightarrow x = \sqrt{1800} = \sqrt{2 \times 3 \times 3 \times 10 \times 10} = 30\sqrt{2}$

**74. (a)** $3842 \times \frac{1}{2} + \frac{? \times 15}{100} = 2449$

$\Rightarrow 1921 + \frac{? \times 15}{100} = 2449$

$\Rightarrow \frac{? \times 15}{100} = 2449 - 1921 = 528$

$\Rightarrow ? = \frac{528 \times 100}{15} = 3520$

**75. (e)** $? \approx \frac{40 \times 860}{100} + 86 \div 8 \approx 344 + 11 \approx 355$

**76. (c)** $\frac{60}{100} \times ? \times 8 - \sqrt{4225} \approx 7 \Rightarrow \frac{24 \times ?}{5} - 65 \approx 7$

$\Rightarrow \quad \frac{24\times ?}{5} \approx 65+7 \approx 72 \quad \Rightarrow \quad ? \approx \frac{72\times 5}{24} \approx 15$

**77. (c)** Let numbers are $a$, $b$ and $c$.
$= a, b, c$ are co-prime numbers
HCF of co-prime numbers = 1
$\therefore$ HCF $(a, b, c) = 1$
$\therefore$ $a \times b = 551$, $b \times c = 1073$
$\Rightarrow \quad \frac{a\times b}{b\times c} = \frac{551}{1073} = \frac{19\times 29}{37\times 29} \quad \Rightarrow \quad \frac{a}{c} = \frac{19}{37}$
$\therefore$ $a = 19$, $b = 29$ $c = 37$
$\therefore$ Sum of numbers $= a + b + c = 19 + 29 + 37 = 85$

**78. (d)** HCF $= A$ (given)
LCM $= B$
Given numbers are $x$ & $y$ respectively.
$\Rightarrow$ (Product of numbers is = Product of LCM × HCF)
$\Rightarrow \quad xy = AB$
Now $\Rightarrow \quad A + B = x + y$ (given)
Take cube on both sides
$(A+B)^3 = (x+y)^3$
$\Rightarrow \quad A^3 + B^3 + 3AB\,(A+B) = x^3 + y^3 + 3xy\,(x+y)$
$\Rightarrow \quad A^3 + B^3 + 3xy\,(x+y) = x^3 + y^3 + 3xy\,(x+y)$
$\therefore \quad A^3 + B^3 = x^3 + y^3$

**79. (b)** For least or minimum number of canes we should have maximum capacity canes for required quantity
$\Rightarrow$ For this we take HCF of given quantities.
HCF (21, 42, 63) = 21
$\therefore$ Maximum capacity of a cane = 21 litres
$\therefore$ Number of canes of cow milk $= \frac{21}{21} = 1$
$\therefore$ Number of canes of toned milk $= \frac{42}{21} = 2$
$\therefore$ Number of canes of double toned milk $= \frac{63}{21} = 3$
$\therefore$ Total number of canes = 1 + 2 + 3 = 6

**80. (c)** Let G.C.D. = $a$
$\therefore$ Let number are $ax$ and $ay$ $(ax > ay)$
LCM = $axy$
$\Rightarrow$ LCM = 2 × larger number
$\therefore \quad axy = 2 \times ax \quad \therefore \quad y = 2$
Also given that
$\Rightarrow$ Smaller number – G.C.D = 4
$\Rightarrow \quad ay - a = 4$
$2a - a = 4$
$a = 4$
G.C.D. $= a = 4$
$y = 2$
$\therefore$ Smaller number $= ay \Rightarrow 2 \times 4 = 8$

**81. (c)** $\frac{\text{H.C.F.}}{\text{L.C.M.}} = \frac{1}{30} \Rightarrow \begin{matrix}\text{H.C.F.} = x\text{(Let)} \\ \text{L.C.M.} = 30x\end{matrix}$
L.C.M. – H.C.F. = 493
$30x - x = 493$
$29x = 493$
$x = 17$
H.C.F. = 17
L.C.M. = 510
So, No. = $17a$, $17b$
L.C.M. × H.C.F. = I$^{st}$ × II$^{nd}$
$510 \times 17 = 17a \times 17b$
$ab = 30$
Possible no. of pairs
$= 30$
$1 \times 30$
$2 \times 15$
$3 \times 10$
$5 \times 6$
= 4 pairs

**82. (c)** LCM of any two numbers when one being the prime no. is the product of those numbers.
$\therefore$ LCM of $x$ and $(x + 1) = x(x + 1)$

**83. (d)** LCM of (6, 5, 4) = 60
60 ) 1456 ( 24
120
256
240
16
Number to be added = (60 –16) = 44

**84. (b)** LCM of 6, 9, 12, 15 and 18

| | |
|---|---|
| 2 | 6,9,12,15,18 |
| 3 | 3,9,6,15,9 |
| 3 | 1,3,2,5,3 |
| | 1,1,2,5,1 |

LCM = 2 × 3 × 3 × 2 × 5 = 180
Least number = 180 + 2 = 182

**85. (a)** LCM of 57 and 93,

| | |
|---|---|
| 3 | 57, 93 |
| | 19, 31 |

$\Rightarrow \quad 3 \times 19 \times 31 = 1767.$
So, Required answer is 1767.

**86. (b)** Let the two numbers are $4x$ and $7x$.
H. C. F. of $4x$ and $7x = x$.
Now, $x = 26$.
So, two numbers are $4 \times 26$ and $7 \times 26$.
Sum of two numbers
$= 4 \times 26 + 7 \times 26 = 11 \times 26 = 286.$

**87. (d)** L. C. M. of 11, 13 and
$7 = 11 \times 13 \times 7 = 1001.$
Now, from given option '259259' is divisible by '1001'.
Hence, '259259' is divisible by 11, 13 and 7.

**88. (d)** $\frac{5.75\times 5.75\times 5.75 + 3.25\times 3.25\times 3.25}{57.5\times 57.5 + 32.5\times 32.5 - 57.5\times 32.5}$
$= \frac{(5.75)^3 + (3.25)^3}{100\left\{(5.75)^2 + (3.25)^2 - 5.75\times 3.25\right\}}$

This is in the form of

$$\frac{a^3+b^3}{a^2+b^2-ab}=\frac{(a+b)(a^2+b^2-ab)}{(a^2+b^2-ab)}=(a+b)$$

Here $a = 5.75$, $b = 3.25$

$$\frac{(5.75)^3+(3.25)^3}{100\left\{(5.75)^2+(3.25)^2-5.75\times3.25\right\}}$$

$$=\frac{1}{100}\times(5.75+3.25)\ =\frac{9}{100}=0.09.$$

**89. (d)** $\sqrt[3]{9}, \sqrt[4]{20}, \sqrt[6]{25}$

LCM of 3, 4, 6 = 24

$\sqrt[24]{9^8}$, $\sqrt[24]{20^6}$, $\sqrt[24]{25^4}$

$\sqrt[24]{25^4} < \sqrt[24]{9^8} < \sqrt[24]{20^6}$

i.e. $\sqrt[6]{25} < \sqrt[3]{9} < \sqrt[4]{20}$

Alternate Method:

$9^{\frac{1}{3}}, 20^{\frac{1}{4}}, 25^{\frac{1}{6}}$

L.C.M of Numbers of Powers = 12

$12\sqrt{9^4}, 12\sqrt{20^3}, 12\sqrt{25^2}$

$\sqrt[12]{6561}\ \sqrt[12]{8000}, \sqrt[12]{625}$

$\sqrt[6]{25} < \sqrt[3]{9} < \sqrt[4]{20}$

**90. (b)** $90 = 2 \times 3 \times 3 \times 5$

$72 = 2 \times 2 \times 2 \times 3 \times 3$

$112 = 2 \times 2 \times 2 \times 2 \times 7$

2 comes max 4 times, 3 comes max 2 times, 5 and 7 come max 1 time

$\therefore$ LCM $= 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 5 \times 7$

$= 5040$

**91. (c)** Prime numbers between 1 to 12 are

2, 3, 5, 7, 11

LCM $= 2 \times 3 \times 5 \times 7 \times 11 = 2310$

**92. (c)** $7 \times 7 + 3 \times 7 \times x + 3 \times 3 = -5$

$\Rightarrow \quad 49 + 21x + 9 = -5$

$\Rightarrow \quad 58 + 21x = -5$

$\Rightarrow \quad 21x = -63$

$\Rightarrow \quad x = -3.]$

**93. (a)** Let total amount money of the family is ₹$m$.

Then, $A$'s pocket money $= m\times\frac{30}{100}$

$A$'s saving $= m\times\frac{30}{100}\times\left(\frac{100-20}{100}\right)=144.$

$\therefore m = 600.$

$B$'s pocket money $= 600\times\frac{20}{100}=120.$

$\therefore$ $B$'s savings $=120\times\left(\frac{100-50}{100}\right)=$₹60.

**94. (c)** Let total number of students = $2x$.

Number of girls = $1.2x$.

Number of boys = $0.8x$.

Number of boys don't get scholarship

$$=0.8x\times\frac{100-85}{100}=0.12x.$$

Number of girls don't get scholarship

$$=1.2x\times\frac{7.5}{100}=0.09x.$$

ATQ, $0.12x + 0.09x = 525$

$$x=\frac{525}{0.21}=2500.$$

**95. (a)** $x = 3y$

and $x \cdot y = \frac{25}{12}$

$$\Rightarrow 3y\cdot y=\frac{25}{12}\Rightarrow y^2=\frac{25}{36}$$

$$\therefore y=\sqrt{\frac{25}{36}}=\frac{5}{6}.$$

**96. (b)** ? = 205 100 × 3850 – 105 100 × 2640

= 7,892.5 – 2,772 = 5120.5

**97. (a)** ? = 1720

**98. (d)** = 30 – 14.8

= 15.2

**99. (c)** ? = 400.86

**100. (b)** ? = 86 × 3375 225 = 1290

$\Rightarrow$ ? = 6

**101. (e)** $\frac{24}{100}\times500\times\frac{5}{3}=?\Rightarrow 200=?$

**102. (c)** $\frac{27+289}{81+25-27}=?\Rightarrow\frac{316}{79}=?\Rightarrow ?=4$

**103. (b)** $5^{?}\times3=\frac{225}{\sqrt[4]{81}}\Rightarrow 5^{?}\times3=75$

$5^{?}=(5)^2\Rightarrow ?=2$

**104. (c)** $53-?=\frac{343}{7}\Rightarrow 53-49=?$

? = 4

**105. (e)** ? + 385 – 225 = 433

? = 433 – 160 $\Rightarrow$ ? = 273.

**106. (a)** $(?)^2=169-120\Rightarrow(?)^2=49\Rightarrow ?=7.$

**107. (d)** $\frac{30}{100}\times500+?\%\text{ of }400=250$

$150+?\%\text{ of }400=250$

$?\%\text{ of }400 = 100 \Rightarrow ?\% = \frac{1}{4} \Rightarrow ? = 25\%.$

**108. (b)** $24 \div 8 = ? - 270$
$? = 3 + 270 \Rightarrow ? = 273.$

**109. (e)** $21 - 13 + 28 = 34 + ?$
$49 - 13 = 34 + ? \Rightarrow ? = 36 - 34 = 2.$

**110. (c)** $\sqrt[3]{(126 + 392 \div 7 - 162 + 14^2)} = ?$

$\Rightarrow \sqrt[3]{(126 + 56 - 162 + 196)} = ?$

$\Rightarrow \sqrt[3]{(378 - 162)} \Rightarrow \sqrt[3]{216} \Rightarrow ? = 6$

**111. (d)** $140\%\text{ of }200 + \frac{16^2 - 12^2}{2} - 7 = ?$

$= 280 + \frac{256 - 144}{2} - 7 = ?$
$= 280 + 56 - 7 = ?$
$\Rightarrow 336 - 7 = ?$
$\Rightarrow ? = 329.$

**112. (b)** $\frac{63}{7 \times 3} \times \sqrt{576} - \sqrt{729} = \sqrt{?}$

$\Rightarrow \sqrt{?} = \frac{63}{7 \times 3} \times 24 - 27$
$\Rightarrow \sqrt{?} = (72 - 27) \Rightarrow \sqrt{?} = 45$
$\therefore ? = (45)^2 = 2025.$

**113.** (e) $3\frac{1}{6} + 7\frac{2}{3} - 4\frac{1}{4} = ? + 2\frac{1}{6}$

$= 3\frac{1}{6} + 7\frac{2}{3} - 4\frac{1}{4} - 2\frac{1}{6} = ?$
$\Rightarrow ? = (3 + 7 - 4 - 2) + \left(\frac{1}{6} + \frac{2}{3} - \frac{1}{4} - \frac{1}{6}\right)$
$\Rightarrow ? = 4 + \frac{2 + 8 - 3 - 2}{12}$
$\therefore ? = 4 + \frac{5}{12} = 4\frac{5}{12}.$

**114. (d)** $711 + 8 = 719$
$719 + 16 = 735$
$735 + 32 = 767$
$767 + 64 = 831$
$831 + 128 = \mathbf{959}$

**115. (c)** $7^2 \times 5 = 245$
$8^2 \times 6 = 384$
$9^2 \times 7 = 567$
$10^2 \times 8 = \mathbf{800}$
$11^2 \times 9 = 1089$
$12^2 \times 10 = 1440$

**116.** (e) $2755 - 9 \times 14 = 2629$
$2629 - 10 \times 15 = 2479$
$2479 - 11 \times 16 = \mathbf{2303}$
$2303 - 12 \times 17 = 2099$
$2099 - 13 \times 18 = 1865$

**117. (a)** $29 + 3^2 = 38$
$38 - 4^3 = -26$
$-26 + 5^2 = -1$
$-1 - 6^3 = -217$
$-217 + 7^2 = -168$

**118. (d)** $25^2 + 7 = 632$
$24^2 + 6 = 582$
$23^2 + 5 = 534$
$22^2 + 4 = 488$
$21^2 + 3 = 444$
$20^2 + 2 = 402$

**119. (a)** $? = \frac{257 - 95}{18}$

$? = \frac{162}{18} = 9$

**120. (c)** $\frac{70}{100} \times 160 + 4 \times 76 - ? = 456$

$? = 112 + 304 - 456$
$? = 416 - 456$
$? = -40$

**121. (b)** $? = 1560 - 324$
$? = 1236$

**122. (c)** $\left(\frac{23}{4} + \frac{3}{2}\right) \times 140 = ?$

$\Rightarrow ? = 29 \times 35 \Rightarrow ? = 1015$

**123. (d)** $?^3 = 3379 - 4$
$?^3 = 3375$
$? = 15$

**124. (d)** $\frac{\left(\frac{12 \times 50}{100}\right)}{54} \times 100 = \frac{6}{54} \times 100 \times ? \Rightarrow ? = 1$

**125. (b)** $1904 + 2040 = ? \times 663 = 2618$
$3944 - ? \times 663 = 2618$
$? = 2$

**126. (c)** $850\left(\frac{6}{5} \times 15 + \frac{5}{4} \times 20\right) = ?$

$\Rightarrow 850(18 + 25) = ? \Rightarrow ? = 36550$

**127. (b)** $\frac{1}{8} + 72 + \frac{1}{11} \times 121 - \sqrt{25} = \sqrt{?}$

$\Rightarrow 9 + 11 - 5 = \sqrt{?}$
$\Rightarrow \sqrt{?} = 15 \Rightarrow ? = 225$

**128.** (c) $\sqrt{324} \times \sqrt{25} - 17 \times 2^2 = \sqrt{?}$

$\Rightarrow 18 \times 5 - 17 \times 4 = \sqrt{?}$
$\Rightarrow \sqrt{?} = 90 - 68 = 22 \Rightarrow ? = 484$

**129. (a)** $21 \times 6 + 9 \times \frac{20}{100} \times 60 = ?$

$\Rightarrow ? = 126 + 108$
$\Rightarrow ? = 234$

**130. (c)** $\left(\left(31^2 - 12^2\right) + 24\right)^{\frac{1}{2}} = ? \Rightarrow ? = \left(961 - 144 + 24\right)^{\frac{1}{2}}$

$\Rightarrow ? = \left(841\right)^{\frac{1}{2}} \Rightarrow ? = 29$

**131. (e)** $\frac{448}{16} \times 5 - 131 = \sqrt{?}$

$\Rightarrow \sqrt{?} = 140 - 131 = 9$

By squaring both sides
$\Rightarrow ? = 81$

**132. (c)** Here, + means –, – means +, × means ÷ and ÷ means ×.

Then, $\frac{42 - 12 \times 3 + 8 \div 2 + 15}{8 \times 2 - 4 + 9 \times 3}$

$\Rightarrow \frac{42 + 12 \div 3 - 8 \times 2 - 15}{8 \div 2 + 4 - 9 \times 3}$

$\Rightarrow \frac{42 + \frac{12}{3} - 8 \times 2 - 15}{\frac{8}{2} + 4 - 9 \times 3}$

$\Rightarrow \frac{42 + 4 - 16 - 15}{4 + 4 - 27} = \frac{-15}{19}$

**133. (a)** $12 + [\,30 - \{56\,(34) \div 80\}] - \frac{21}{2}$

$\Rightarrow 12 + [30 - 23.8 - 10.5]$
$\Rightarrow 12 + [-4.3]$
$\Rightarrow 7.7$

**134. (b)** $\frac{5 - 6 + 15 - 9}{4 - 24 + 24} \Rightarrow \frac{5}{4}$

**135. (a)** $a : b : c : d$
$3 : 4 : 5 : 6$

$\left(\frac{a}{d}\right)^{10} = \left(\frac{3}{6}\right)^{10}$

$= \frac{1}{2^{10}} = \frac{1}{1024}$

Sum = 1 + 1024 = 1025

**136. (d)** $90 \div 20$ of $6 \times [11 \div 4$ of $\{3 \times 2 - (3 - 8)\}] \div (9 \div 3 \times 2)$

$\Rightarrow 90 \div 120 \times [11 \div 4$ of $\{6 + 5\}] \div (3 \times 2)$

$\Rightarrow \frac{3}{4} \times [11 \div 4 \times 11] \div 6$

$\Rightarrow \frac{3}{4}[11 \div 44] \div 6$

$\Rightarrow \frac{3}{4} \times \frac{1}{4} \div 6$

$\Rightarrow \frac{3}{4} \times \frac{1}{24}$

$\Rightarrow \frac{1}{32}$

**137. (b)** $5\frac{1}{3} \div \left[7 - 3 \div \left(1 - \frac{1}{4}\right) \times \frac{2}{3} + 1\right] - 3 \div 1 + 2$

$= \frac{16}{3} \div \left[7 - 3 \div \left(\frac{3}{4}\right) \times \frac{2}{3} + 1\right] - 3 + 2$

$= \frac{16}{3} \div \left[7 - \frac{3}{\frac{3}{4}} \times \frac{2}{3} + 1\right] - 1$

$= \frac{16}{3} \div \left[7 - 4 \times \frac{2}{3} + 1\right] - 1$

$= \frac{16}{3} \div \left[8 - \frac{8}{3}\right] - 1$

$= \frac{16}{3} \div \left[\frac{16}{3}\right] - 1 \;= \frac{16}{3} \times \left[\frac{3}{16}\right] - 1$

$= 1 - 1 = 0$

**138. (c)** $\frac{7}{10} \div \frac{7}{5} \times \frac{21 + 26}{10} + \frac{1}{47} - \frac{6}{47}$

$= \frac{7}{10} \div \frac{7}{5} \times \frac{47}{10} + \frac{(1 - 6)}{47} = \frac{7}{10} \times \frac{50}{329} - \frac{5}{47}$

$= \frac{5}{47} - \frac{5}{47} = 0$

**139. (b)** $\left\{\left(4 - \frac{2}{1 + \frac{2}{1 - \frac{1}{2 + \frac{3}{4}}}}\right) \div 1\frac{5}{12} \text{ of } \frac{72}{145} - \left(4 + 3 \div 0.5 - 1\right)\right\}$

$$= \left\{\left(\left(4-\frac{2}{1+\frac{2}{1-\frac{4}{11}}}\right)\div\frac{17}{12}\times\frac{72}{145}-\left(4+\frac{30}{5}-1\right)\right\}$$

$$= \left\{\left(\left(4-\frac{2}{1+\frac{22}{7}}\right)\div\frac{17\times6}{145}-(9)\right\}$$

$$= \left\{\left(4-\frac{14}{29}\right)\div\frac{17\times6}{145}-9\right\} = \left\{\frac{102}{29}\times\frac{145}{17\times6}-9\right\}$$

$= 5 - 9 = -4$

**140. (b)** $\dfrac{400-\frac{3}{4}\times32}{37-\frac{3}{4}\times28} = \dfrac{40-24}{37-21} = \dfrac{16}{16} = 1$

**141. (d)** $8-3\div6\times2+(4\div4\times\frac{1}{4})\div8+(4\times8\times4)\times\frac{1}{8}$

$$\Rightarrow 8-3\div12+\frac{1}{2}+16$$

$$\Rightarrow 8-\frac{1}{4}+16+\frac{1}{2}$$

$$\Rightarrow \frac{97}{4}$$

**142. (a)** $\dfrac{(6.35)^3+(3.65)^3}{(63.5)^2+(36.5)^2-(63.5)(36.5)}$

$$\Rightarrow \frac{10\left[(6.35)^2+(3.65)^2-(6.35\times3.65)\right]}{(63.5)^2+(36.5)^2-(63.5)(36.5)}$$

$$\Rightarrow \frac{10\left[\frac{1}{10000}\right]}{\frac{1}{100}} = 0.1$$

**143. (c)** H.C.F = 23 × 32

**144. (c)** Largest number woluld be HCF of (2036 – 12) and (233 – 13) or HCF of 2024, 220

∴ HCF of 2024 and 220 :

$2024 = 2 \times 4 \times 11 \times 23$

$220 = 2 \times 2 \times 5 \times 11$

∴ HCF = 44

So, the number would be 44.

**145. (c)** Difference = (11 – 7) × 28 = 112

**146. (c)** $\dfrac{372}{56}\times7-5+2 = \dfrac{93}{2}-5+2$

$$= \frac{93-10+4}{2} = \frac{87}{2} = 43\frac{1}{2}$$

**147. (d)** L = 56 H

$\Rightarrow$ H + L = 1710

$\Rightarrow$ H + 56H = 1710

$\Rightarrow$ 57H = 1710

$\Rightarrow$ H = 30

LCM = 56 × 30 = 1680

Let other number = $x$

$240 \times x = 30 \times 1680$

$\Rightarrow x = 210$

3

CHAPTER

# Percentage

## PERCENTAGE

The word "per cent" is derived from the latin words "per centum", which means "per hundred".

It is denoted by the symbol %.

Thus 25 per cent is written as 25% and it means 25 out of 100.

This is written in the ratio form as $\frac{25}{100}$.

### Value of Percentage

Value of percentage always depends on the quantity to which it refers.

Consider the statement, "65% of the students in the class are boys". From the context, it is understood that boys form 65% of the total number of students in the class. To know the value of 65% of the students, the value of the total number of students in the class should be known.

If the total number of students in the class is 200, then, the number of boys = 65% of 200 = $\frac{200\times 65}{100} = 130$

It can also be written as (200) × (0.65) = 130.

**Note that** the expressions 6%, 63%, 72%, 155% etc. do not have any value. Their values depend on the quantities to which they refer.

**To express the fraction equivalent to % :**

Express the fraction with the denominator 100, then its numerator is the required equivalent percentage.

For example, to express the fraction $\frac{5}{20}$ to equivalent %, we have to write $\frac{5}{20}$ as $\frac{5}{20}\times\frac{5}{5}=\frac{25}{100}$, whose denominator is 100.

Then the fraction is equivalent to 25%.

**To express % equivalent to fraction :** $a\% = \frac{a}{100}$

| Fractional Equivalents of % | | | | | |
|---|---|---|---|---|---|
| (i) | $2\% = \frac{2}{100} = \frac{1}{50}$ | (iv) | $1\% = \frac{1}{100}$ | (vii) | $33\frac{1}{3}\% = \frac{33\frac{1}{3}}{100} = \frac{1}{3}$ |
| (ii) | $50\% = \frac{50}{100} = \frac{1}{2}$ | (v) | $40\% = \frac{40}{100} = \frac{2}{5}$ | (viii) | $4\% = \frac{4}{100} = \frac{1}{25}$ |
| (iii) | $100\% = \frac{100}{100} = 1$ | (vi) | $24.31\% = \frac{24.31}{100} = 0.2431$ | | |

### Percentage Increase, Decrease or Error

- $\text{Increase \% or percentage increase} = \frac{\text{Increase value}}{\text{Original value}}\times 100\%$
- $\text{Decrease \% or percentage decrease} = \frac{\text{Decrease value}}{\text{Original value}}\times 100\%$
- $\text{Error percent} = \frac{\text{Error}}{\text{Correct value}}\times 100\%$

**Note**

If the value of any thing increases, then percentage change is the percentage increase and if the value of any thing decreases, then percentage change is the percentage decrease. Thus,

Percentage change = Percentage increase, if value of the thing increases

and Percentage change = Percentage decrease, if value of the thing decreases.

### Changing a Quantity by a Given Percent

**(i)** If any quantity $x$ increased by $a$ %, then final value of $x = \left(\frac{100+a}{100}\right)x$

**(ii)** If any quantity $x$ decreased by $a$ %, then final value of $x = \left(\frac{100-a}{100}\right)x$

### Successive change in a quantity by different given percent

If any quantity $x$ increased by $a$ %, then increased by $b$ %, then decreased by $c$ %, then increased by $d$ %, ..., then final value of $x$

$$= x\left(\frac{100+a}{100}\right)\times\left(\frac{100+b}{100}\right)\times\left(\frac{100-c}{100}\right)\times\left(\frac{100+d}{100}\right)\times...$$

## POPULATION FORMULA

- If the original population of a town is $P$, and the annual increase is $r$ %, then the population after $n$ years is $P\left(1+\frac{r}{100}\right)^n$ and population before $n$ years $= \frac{P}{\left(1+\frac{r}{100}\right)^n}$.
- If the annual decrease be $r$%, then the population after $n$ years is $P\left(1-\frac{r}{100}\right)^n$ and population before $n$ years $= \frac{P}{\left(1-\frac{r}{100}\right)^n}$.

## STUDENT AND MARKS

- The percentage of passing marks in an examination is $x$%. If a candidate who scores $y$ marks fails by $z$ marks, then the maximum marks, $M = \frac{100(y+z)}{x}$.
- A candidate scoring $x$% in an examination fails by '$a$' marks, while another candidate who scores $y$% marks gets '$b$' marks more than the minimum required passing marks. Then the maximum marks, $M = \frac{100(a+b)}{y-x}$.
- In an examination $x$% and $y$% students respectively fail in two different subjects while $z$% students fail in both subjects. Then the % of student who pass in both the subjects will be $\{100-(x+y-z)\}$%.

## 2-DIMENSIONAL FIGURE AND AREA

- If the sides of a triangle, square, rectangle, rhombus or radius of a circle is increased by $a$%, its area is increased by $\frac{a(a+200)}{100}$%.
- If the side of a triangle, square, rectangle, rhombus or radius of a circle are decreased by $a$% then its area is decreased by $\frac{a(200-a)}{100}$%.
- If length and breadth of a rectangle are changed by $x$% and $y$% respectively, then % change in area = $x + y + \frac{xy}{100}$ (+/– according to increase or decrease).

## SHORTCUTS

### Shortcut Approach – 1

If the price of a commodity increases by $r$%, then the reduction in consumption so as not to increase the expenditure, is $\left(\frac{r}{100+r}\times 100\right)$%

**Example 1. The price of sugar is increased by 25%. If a family wants to keep its expenses on sugar unaltered, then the family will have to reduce the consumption of sugar by**

**(a) 20% (b) 21% (c) 22% (d) 25%**

**Sol. (a)** Required percentage

$$= \left(\frac{r}{100+r}\times 100\right)\% = \left(\frac{25}{100+25}\times 100\right)\% = 20\%$$

**Example 2. The price of cooking oil is increased by 20%. By what percent a family should reduce the consumption of cooking oil so as not to increase the expenditure on this account?**

**(a) 16.67% (b) 20% (c) 25% (d) 40%**

**Sol. (a)** Required percentage

$$= \left(\frac{20}{100+20}\times 100\right)\% = \left(\frac{20}{120}\times 100\right)\% = 16.66\%$$

**Example 3. The price of commodity rises from ₹6 per kg to ₹7.50 per kg. If the expenditure cannot increase, then percentage of reduction in consumption is :**

**(a) 15 (b) 20 (c) 25 (d) 30**

**Sol. (b)** % increase in price

$$= \left(\frac{(7.50-6)}{6}\times 100\right)\% = \left(\frac{1.50}{6}\times 100\right)\% = 25\%$$

$$\therefore \quad \text{Required percentage} = \left(\frac{25}{100+25}\times 100\right)\% = 20\%$$

### Shortcut Approach – 2

If the price of a commodity decreases by $r$ %, then, increase in consumption, so as not to decrease expenditure on this item is $\left[\frac{r}{(100-r)}\times 100\right]$%,

**Example 4. If the price of tea falls down by 6% then by how much percent must a householder increase its consumption, so as not to decrease expenditure?**

**(a) $5\frac{16}{47}$% (b) $4\frac{18}{67}$% (c) $6\frac{18}{47}$% (d) $6\frac{17}{47}$%**

**Sol. (c)** Required percentage

$$= \left(\frac{r}{100-r}\times 100\right)\% = \left(\frac{6}{100-6}\times 100\right)\% = 6\frac{18}{47}\%$$

### Shortcut Approach – 3

If the price of a commodity is decreased by $x$% and its consumption increased by $y$%, then

$$\frac{\text{New expenditure}}{\text{Initial expenditure}} = \frac{(100-x)(100+y)}{(100)^2}$$

Put $x$ as $(+x)$ and y as $(+y)$ in the case of 'increase' and $x$ as $(-x)$ and $y$ as $(-y)$ in the case of 'decrease'.

**Example** **5. The price of consumer goods increased by 50% and its consumption decreased by 25%. Find the ratio of new expenditure to initial expenditure.**

**(a) 8 : 9 (b) 9 : 8 (c) 7 : 8 (d) 11 : 8**

**Sol. (b)** Required ratio $= \frac{\text{New expenditure}}{\text{Initial expenditure}}$

$$= \frac{(100+50)(100-25)}{(100)^2} = \frac{150\times 75}{(100)^2} = \frac{9}{8} = 9:8$$

### Shortcut Approach – 4

If the value is decreased successively by $x$ % and $y$ % then the final decrease is given by $\left[x+y-\frac{xy}{100}\right]\%$,

**Example** **6. Successive discount of 50% and 50% is equivalent to**

**(a) 100% (b) 75% (c) 50% (d) 25%**

**Sol. (b)** Required equivalent single discount

$$= \left[(50+50)-\frac{(50\times 50)}{100}\right]\% = (100-25)\% = 75\%$$

### Shortcut Approach – 5

If the value is increased successively by $x$% and $y$% then the final increase is given by $\left[x+y+\frac{xy}{100}\right]\%$,

**Example** **7. A number is increased by 20% and then again by 20%. By what per cent should the increased number be reduced so as to get back the original number?**

**(a)** $30\frac{5}{9}\%$ **(b)** $19\frac{11}{13}\%$ **(c) 40% (d) 44%**

**Sol. (a)** % Increase in number

$$= \left(20+20+\frac{20\times 20}{100}\right)\% = (40+4)\% = 44\%$$

Hence, the increased number should be reduced by $\frac{44}{(100+44)}\times 100 = 30\frac{5}{9}\%$. So as to get back the original number.

**Example** **8. If the sides of a square are increased by 30%, find the percent increase in its area.**

**(a) 70% (b) 68% (c) 69% (d) 71%**

**Sol. (d)** % increase in area

$$= \left[30+30+\frac{30\times 30}{100}\right]\% = (60+9)\% = 69\%$$

### Shortcut Approach – 6

If one of the sides of a rectangle is increased by $x$% and the other is decreased by $y$%, then the increase or decrease per cent in area is given by $\left[x-y-\frac{xy}{100}\right]\%$, , according to the $+ve$ or $-ve$ sign.

**Example** **9. If the length is increased by 20% and the breadth is decreased by 25%, then what will be the effect on the area?**

**(a) 10% decrease (b) 10% increase**

**(c) 20% increase (d) 20% decrease**

**Sol. (a)** Effect on area

$$= \left(x-y-\frac{xy}{100}\right)\% = \left(20-25-\frac{20\times 25}{100}\right)\%$$

$= (-10\%) = 10\%$ decrease

### Shortcut Approach – 7

If three successive discounts of $x$ %, $y$ % and $z$ % are allowed on an amount then a single discount that equivalent to the three successive discounts will be $\left[x+y+z-\frac{xy+yz+zx}{100}+\frac{xyz}{100^2}\right]\%$.

or

Finding single discount rate equivalent to the series of two discounts

$$= 1\text{st discount} + 2\text{nd discount} - \frac{1\text{st discount}\times 2\text{nd discount}}{100}$$

**Example** **10. Find a single discount equivalent to a discount series of 10%, 20% and 25%.**

**(a) 46% (b) 56%**

**(c) 55% (d) 45%**

**Sol. (a)** Required equivalent single discount

$$= \left[(x+y+z)-\left[\frac{xy+yz+zx}{100}\right]+\frac{xyz}{(100)^2}\right]\%$$

$$= \left[(10+20+25)-\left[\frac{10\times 25+25\times 20+25\times 10}{100}\right]+\frac{10\times 20\times 25}{(100)^2}\right]\%$$

$= 55 - 9.5 + 0.5 = 46\%$

# EXERCISE

**1.** Income of *A* is 150% of the income of *B* and income of *C* is 120% of the income of *A*. If the total income of *A*, *B* and *C* together is ₹ 86,000, what is C's income?
(a) ₹ 30,000 (b) ₹ 32,000
(c) ₹ 20,000 (d) ₹ 36,000
(e) None of these

**2.** Population of a country increases every year by 10%. If the population in January 2006 was 15.8 lakhs, what was the population in January 2008?
(a) 19, 11, 800 (b) 18, 96, 000
(c) 19, 11, 600 (d) 18, 94, 000
(e) None of these

**3.** A candidate appearing for an examination has to secure 35% marks to pass. But he secured only 40 marks and failed by 30 marks. What would be the maximum marks of test? ***(IBPS PO Pre – 2016)***
(a) 280 (b) 180 (c) 200 (d) 150
(e) 210

**4.** In a test, minimum passing percentage for girls and boys is 35% and 40% respectively. A boy scored 483 marks and failed by 117 marks. What are the minimum passing marks for girls? ***(IBPS RRB PO – 2016)***
(a) 425 (b) 520 (c) 500 (d) 625
(e) None of these

**5.** Two candidates fought an election. One of them got 64% of the total votes polled and won with 992 votes. What was the total number of votes polled?
(a) 1500 (b) 1580
(c) 1550 (d) Cannot be determined
(e) None of these

**6.** In a test, minimum passing percentage for girls and boys is 30% and 45% respectively. A boy scored 280 marks and failed by 80 marks. How many more marks did a girls require to pass in the test if she scored 108 marks?
(a) 132 (b) 140 (c) 160 (d) 112
(e) None of these

**7.** Puneet scored 175 marks in a test and failed by 35 marks. If the passing percentage of the test is 35 percent, what are the maximum marks of the test?
(a) 650 (b) 700 (c) 750 (d) 600
(e) None of these

**8.** Ram scored 456 marks in an exam and Sita 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 percent, then how much more marks did Ram score than the minimum passing marks? ***(IBPS PO Pre – 2017)***
(a) 184 (b) 196 (c) 190 (d) 180
(e) None of these

**9.** Six-eleventh of a number is equal to twenty two percent 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) 107.6 (b) 131.1 (c) 115.4 (d) 143.8
(e) None of these

**10.** In order to pass in an examination, a student is required to get 342 marks out of the aggregate marks. Neha got 266 marks and was declared fail by 8 percent. What is the minimum passing percentage of the examination?
(a) 28% (b) 36% (c) 33% (d) 26%
(e) None of these

**11.** Ram and Shyam started a business in partnership by investing certain amount in the respective ratio of 3 : 5 for a fixed and equal period of time. By what per cent is the Ram's share less than that of Shayam's share in the annual profit? ***(IBPS PO Pre – 2017)***
(a) 35% (b) 20% (c) 40% (d) 42%
(e) 45%

**12.** Sumitra has an average of 56% on her first 7 examinations. How much she should make on her eighth examination to obtain an average of 60% on 8 examinations?
(a) 88% (b) 78%
(c) 98% (d) Cannot be determined
(e) None of these

**13.** The salary of an employee increases consistently by 50% every year. If his salary today is ₹ 10,000 what will be the salary after another 4 years? ***(IBPS RRB PO – 2017)***
(a) ₹ 62,500 (b) ₹ 26,500
(c) ₹ 50, 625 (d) ₹ 33,750
(e) None of these

**14.** Mr. Yadav spends 80% of his monthly salary on consumable items and 50% of the remaining on clothes and transport. He saves the remaining amount. If his savings at the end of the year are ₹ 5370 how much amount per month he would have spent on clothes and transport?
(a) ₹ 403 (b) ₹ 807
(c) ₹ 969.12 (d) ₹ 484.56
(e) None of these

**15.** Sonika spent ₹ 45,760 on the interior decoration for her home, ₹ 27896 on buying air conditioner and the remaining 28% of the total amount she had as cash with her. What was the total amount?
(a) ₹ 98540 (b) ₹ 102300
(c) ₹ 134560 (d) Cannot be determined
(e) None of these

**16.** The price of an article was increased two times successively by 10% each time. By what percent should the new price be reduced so as to restore the original price. ***(IBPS RRB PO – 2017)***
(a) 15% (b) 17.36% (c) 17% (d) 16.36%
(e) None of these

**17.** A candidate who scores 30 percent fails by 5 marks, while another candidate who scores 40 percent marks gets 10 more marks than minimum pass marks. The minimum marks required to pass are :
(a) 50 (b) 70 (c) 100 (d) 150

**18.** 90% of the students in school passed in English, 85% passed in Mathematics and 150 students passed in both the subjects. If no student failed in both the subjects, find the total number of students.
(a) 120 (b) 220 (c) 200 (d) 300

**19.** A man gives 50% of his money to his son and 30% to his daughter. 80% of the rest is donated to a trust. If he is left with 16,000 now, how much money did he have in the beginning? ***(IBPS PO Pre – 2018)***
(a) ₹ 4,00,000 (b) ₹ 40,000
(c) ₹ 90,000 (d) ₹ 80,000
(e) None of these

**20.** The value of a machine is ₹ 6,250. It decreases by 10% during the first year, 20% during the second year and 30% during the third year. What will be the value of the machine after 3 years? ***(IBPS Clerk Main – 2018)***
(a) ₹ 2,650 (b) ₹ 3,050 (c) ₹ 3,150 (d) ₹ 3,510
(e) None of these

**21.** A sample of 50 litres of glycerine is found to be adulterated to the extent of 20%. How much pure glycerine should be added to it so as to bring down the percentage of impurity to 5%? ***(IBPS RRB PO Main – 2018)***
(a) 155 litres (b) 150 litres
(c) 150.4 litres (d) 140 litres
(e) None of these

**22.** 75 gm of sugar solution has 30% sugar in it. Then the quantity of sugar that should be added to the solution to make the quantity of the sugar 70% in the solution is :
(a) 125 gm (b) 100 gm
(c) 120 gm (d) 130 gm

**23.** Ram's expenditure and savings are in the ratio 5 : 3. If his income increases by 12% and expenditure by 15%, then by how much percent does his savings increase?
(a) 12% (b) 7% (c) 8% (d) 13%

**24.** The sum of the numbers of boys and girls in a school is 150. If the number of boys is $x$, the number of girls becomes $x$% of the total number of students. The number of boys is :
(a) 90 (b) 75 (c) 25 (d) 60

**25.** The price of a school bag and a shoe are in the ratio 7 : 5. The price of the school bag is ₹ 200 more than the price of the shoe. Then the price of the shoe is :
(a) ₹ 200 (b) ₹ 700 (c) ₹ 500 (d) ₹ 1,200

**26.** The sum of two numbers is 520. If the bigger number is decreased by 4% and the smaller number is increased by 12% then the numbers obtained are equal. The smaller number is
(a) 280 (b) 240 (c) 210 (d) 300

**27.** In an office, 40% of the staff is female. 70% of the female staff and 50% of the male staff are married. The percentage of the unmarried staff in the office is
(a) 65% (b) 42% (c) 60% (d) 64%

**28.** In a college election between two candidates, one candidate got 55% of the total valid votes. 15% of the votes were invalid. If the total votes were 15,200, what is the number of valid votes the other candidate got ?
(a) 7106 (b) 6840 (c) 8360 (d) 5814
(e) None of these

**29.** The red blood cells in a blood sample grows by 10% per hour in first two hours, decreases by 10% in next one hour, remains constant in next one hour and again increases by 5% per hour in next two hours. If the original count of the red blood cells in the sample is 40000, find the approximate red blood cell count at the end of 6 hours.
(a) 40000 (b) 45025
(c) 48025 (d) 50025

**30.** Twenty five percent of Pranab's annual salary is equal to eighty percent of Surya's annual salary. Surya's monthly salary is forty percent of Dheeru's monthly salary. If Dheeru's annual salary is ₹ 6 lacs,what is Pranab's monthly salary ? (At some places annual income and in some place monthly income is given.) ***(IBPS PO Main – 2018)***
(a) ₹ 7.68 lacs (b) ₹ 56,000
(c) ₹ 8.4 lacs (d) ₹ 64,000
(e) None of these

**31.** In a big garden 60% of the trees are coconut trees, 25% of the number of coconut trees are mango trees and 20% of the number of mango trees are apple trees. If the number of apple trees in the garden is 1440. Then find the number of trees in the garden is:
(a) 48000 (b) 50000
(c) 51000 (d) 45000

**32.** Mr. $X$ spends 20% of his monthly income on household expenditure. Out of the remaining 25% he spends on children's education, 15% on transport, 15% on medicine and 10% on entertainment. He is left with ₹ 9, 800 after incurring all these expenditures. What is his monthly income? ***(IBPS Clerk – 2018)***
(a) ₹ 35,000 (b) ₹ 28,000
(c) ₹ 65, 333 (d) ₹ 48,400
(e) None of these

**33.** Aman's expense is 30% more than Vimal's expense and Vimal's expense is 10% less than Raman's expense. If the sum of their expense is ₹ 6447, then what would be the Aman's expense? ***(IBPS PO Pre – 2019)***
(a) ₹ 2, 200 (b) ₹ 2, 457
(c) ₹ 1, 890 (d) ₹ 2, 100
(e) None of these

**34.** Twenty percent of Anuj's annual salary is equal to seventy five percent of Raj's annual salary. Raj's monthly salary. Raj's monthly salary is 60% of Ravi's monthly salary. If Ravi's annual salary is ₹ 1.44 lac,s what is Anuj's monthly salary? ***(IBPS PO Pre – 2019)***
(a) ₹ 2,70,000 (b) ₹ 27,000
(c) ₹ 34,000 (d) ₹ 54,000
(e) None of these

**35.** Twelve percent of Kaushal's monthly salary is equal to sixteen percent of Nandini's monthly salary. Suresh's monthly salary is half that of Nandini's monthly salary. If Suresh's annual salary is ₹ 1.08 lacs, what is Kaushal's monthly salary? ***(IBPS Clerk Pre – 2019)***
(a) ₹ 20,000 (b) ₹ 18,000
(c) ₹ 26,000 (d) ₹ 24,000
(e) None of these

**36.** In a school there are 2000 students out of whom 36 percent are girls. Each boy's monthly fee is ₹ 480 and each girl's monthly fee is 25 percent less than a boy. What is the total of the monthly fees of girls and boys together?
(a) ₹ 8,73,400 (b) ₹ 8,67,300
(c) ₹ 8,76,300 (d) ₹ 8,73,600
(e) None of these

**37.** A sum of ₹ 731 is divided among *A*, *B* and *C*, such that '*A*' receives 25% more than '*B*' and '*B*' receives 25% less than '*C*'. What is C's share in the amount?
(a) ₹ 172 (b) ₹ 200 (c) ₹ 262 (d) ₹ 258
(e) None of these

**38.** An HR Company employs 4800 people, out of which 45 percent are males and 60 percent of the males are either 25 years or older. How many males are employed in HR Company who are younger than 25 years?
(a) 2480 (b) 2320 (c) 1278 (d) 864
(e) None of these

**39.** Dinesh's monthly income is four times Suresh's monthly income Suresh's monthly income is twenty percent more than Jyoti's monthly income. Jyoti's monthly income is ₹ 22,000. What is Dinesh's monthly income?
(a) ₹ 1,06,500 (b) ₹ 1,05,600
(c) ₹ 1,04,500 (d) ₹ 1,05,400
(e) None of these

**40.** Ruby's monthly income is three times Gayatri's monthly income. Gayatri's monthly income is fifteen percent more than Priya's monthly income, Priya's monthly income is ₹ 32,000. What is Ruby's Annual income? ***(IBPS Clerk Main – 2019)***
(a) ₹ 1,20,300 (b) ₹ 13,24,800
(c) ₹ 38,800 (d) ₹ 54,600
(e) None of these

**41.** Akash scored 73 marks in subject *A*. He scored 56% marks in subject *B* and *x* marks in subject *C*. Maximum marks in each subject were 150. The overall percentage marks obtained by Akash in all the three subjects together were 54%. How many marks did he score in subject *C*?
(a) 84 (b) 86 (c) 79 (d) 73
(e) None of these

**42.** In a company '*XYZ*', the respective ratio between the total number of under-graduate employees and the total number of graduate employees is 13 : 23. The Company has only two branches, one in Mumbai and other in Delhi. If the total number of under-graduate employees in Mumbai branch is 351, which is 30% of the total undergraduate employees in the company, what is the total number of graduate employees in the company? ***(IBPS PO Main – 2019)***
(a) 2185 (b) 1955 (c) 2070 (d) 2691
(e) None of these

**43.** In a competitive examination in state '*A*', 6% candidates got selected from the total appeared candidates. State '*B*' had an equal number of candidates appeared and 7% candidates got selected with 80 more candidates got selected than state '*A*'. What was the number of candidates appeared from each state?
(a) 8000 (b) 8400
(c) 7600 (d) Data inadequate
(e) None of these

**44.** The strength of a school increases and decreases every alternate year. It startes with increase by 10% and thereafter the percentage of increase/decrease is the same. Which of the following is **definitely true** about the strength of the school in 2000 as compared to that in 1996?
(a) Increase approximately by 2%
(b) Decrease approximately by 2%
(c) Increase approximately by 0%
(d) Decrease approximately by 0%
(e) None of these

**45.** 405 sweets were distributed equally among children in such a way that the number of sweets received by each child is 20% of the total no. of children. How many sweets did each child receive?
(a) 15 (b) 45 (c) 9 (d) 18
(e) None of these

**46.** Mr. Sarang invests 6% of his monthly salary i.e., ₹ 2,100 on insurance policies. Also he invests 8% of his monthly salary on family mediclaim policies and another 9% of his salary on NSCs. What is the total annual amount invested by Mr. Sarang?
(a) ₹ 11,400 (b) ₹ 96.600
(c) ₹ 8,050 (d) ₹ 9,050
(e) ₹ 9,500

**47.** Ms. Pooja Pushpan invests 13% of her monthly salary, i.e., ₹ 8554 in Mediclaim Policies. Later she invests 23% of her monthly salary on Child Education Policies. Also she invests another 8% of her monthly salary on Mutual Funds. What is the total annual amount invested by Ms. Pooja Pushpan?
(a) ₹ 28952 (b) ₹ 43428
(c) ₹ 347424 (d) ₹ 173712
(e) None of these

**48.** In a vessel there is 40 litres mixture of milk and water. There is 15% water in the mixture. The milkman sells 10 litres of mixture to a customer and thereafter adds 12.5 litres of water to the remaining mixture. What is the respective ratio of milk and water in the new mixture?
(a) 2 : 3 (b) 3 : 2 (c) 3 : 4 (d) 4 : 3
(e) None of these

**49.** In a 90 litres mixture of milk and water, percentage of water is only 30%. The milkman gave 18 litres of this mixture to a customer and then added 18 litres of water to the remaining mixture. What is the percentage of milk in the final mixture? ***(IBPS RRB PO – 2019)***
(a) 64 (b) 48 (c) 52 (d) 68
(e) 56