

1. NUMBER SYSTEM

- ↪ **Natural numbers** : While counting things we need help of numbers 1,2,3, these numbers are called natural numbers.

$$N = \{1,2,3,4,\dots\}$$

- ↪ The next number of any natural number is called its successor and the number just before a number is called predecessor.

Ex. : Successor of 9 is 10 and the predecessor of 9 is 8.

- ↪ In natural numbers 1 has no predecessor.
- ↪ **Whole numbers** : The natural numbers along with the zero form the collection of whole numbers.

$$\text{Whole numbers (W)} = \{0,1,2,3,\dots\}$$

- è Smallest whole number is 0
- è All natural numbers are whole numbers but all whole numbers are not natural numbers.
- è Every whole number has a successor. Every whole number except zero has a predecessor.
- è Whole numbers are closed under addition and multiplication.
- è Division by zero is not define.
 $a \div 0$ not defined.

- ↪ **Integers** :

The collection of Negative numbers and whole numbers together we get a bigger collection of numbers called Integers.

$$\text{Integers (Z)} = \{\dots, -3, -2, 1, 0, 1, 2, 3, \dots\}$$

- è Zero is an integer neither positive nor negative.
- ↪ The product of two negative integers is a positive integer.
Ex : $-3 \times -6 = 18$
- ↪ The product of two positive integers is a positive integer.
- ↪ The product of one positive integer and one negative integer is negative integer.
- ↪ The number of negative integers being multiplied is even then the product is a positive integer.
- ↪ The number of negative integers being multiplied is odd then the product is a negative integer.
- ↪ If we divide a negative integer by a negative integer, we get positive number as the Quotient.

$$\text{Ex : } (-15) \div (-3) = 5$$

→ For any integer a , $a \div 0$ is not defined but $0 \div a = 0$ for $a \neq 0$.

→ For any integer a $a \div 1 = a$; $a \div -1 = -a$; $a \div a = 1$.

Properties

→ **Closure Property** :

If $a, b \in p$ then $a \odot b \in p$ then p are closed under operation $\odot$

Ex.: If $1, 3 \in \mathbb{N}$ then $1+3=4 \in \mathbb{N}$

Natural numbers are closed under addition.

ii) If $2, 5 \in \mathbb{W}$ then $2-5=-3 \notin \mathbb{W}$

Therefore whole numbers are not closed under subtraction.

[$\odot$ read as - dot circle]

→ **Commutative Property** :

If $a, b \in p$ then $a \odot b = b \odot a$ then p are commutative under operation $\odot$

Ex. : i) $-3, -2 \in \mathbb{Z}$ then $(-3)+(-2) = (-2)+(-3)$

Therefore integers are commutative under addition.

ii) $5, 10 \in \mathbb{Z}$ then $5 \div 10 = \frac{1}{2}$

$$10 \div 5 = 2$$

$$5 \div 10 \neq 10 \div 5$$

Therefore integers are not commutative under division.

→ **Associative Property** :

If $a, b, c \in p$ then $(a \odot b) \odot c = a \odot (b \odot c)$ then p are satisfied associative property under operation $\odot$

Ex. : Let $2, 3, 4 \in \mathbb{N}$

$$\text{Now } (2+3)+4 = 5+4 = 9$$

$$2+(3+4) = 2+7 = 9$$

Therefore natural numbers satisfies associative property under addition.

→ **Identity Property** :

If $a, b \in p$ then $a \odot b = a$ then p are satisfied identity property under operation $\odot$

Ex. : $a+0 = a$

Therefore 0 is additive identity

$$a \times 1 = a$$

1 is the multiplicative identity

Note : Natural numbers have no additive identity.

→ **Inverse Property :**

If $a, b \in p$ then $a \odot b = e$ inverse then p satisfied inverse property under operation

⊙

Ex. : $a + (-a) = 0$

∴ $-a$ is the additive identity of a

$$a \times \frac{1}{a} = 1$$

∴ $\frac{1}{a}$ is the multiplicative inverse of a .

Note : 1. Natural numbers and whole numbers have no additive inverse.
2. N and W does not satisfies inverse property with respect to addition.
3. Only rational numbers except zero satisfied multiplication inverse property.

Distributive of Multiplication over Addition

If $a, b, c \in p$ and $a \times (b + c) = a \times b + a \times c$

Properties of whole numbers

Property	Addition	Subtraction	Multiplication	Division
Closure	✓	✗	✓	✗
Commutative	✓	✗	✓	✗
Associative	✓	✗	✓	✗
Identity	✓	-	✓	-
Inverse	✗	-	✗	-

Properties of Integers

Property	Addition	Subtraction	Multiplication	Division
Closure	✓	✓	✓	✗
Commutative	✓	✗	✓	✗
Associative	✓	✗	✓	✗
Identity	✓	-	✓	-
Inverse	✓	-	✗	-

- Fractions : A fraction is a number representing a part of a whole.
- Ex. : $\frac{5}{12}$ is a fraction we read is as five-twelfths. Here 5 is called the numerator and 12 is called the denominator.
- Proper fraction : A fraction whose numerator is less than the denominator is called a proper fraction.
- Ex. : $\frac{2}{5}, \frac{5}{7}, \frac{6}{13}, \frac{21}{109}$ are proper fractions.
- Improper fraction : A fraction whose numerator is greater than or equal to its denominator is called an improper fraction.
- Ex. : $\frac{16}{9}, \frac{25}{8}, \frac{36}{36}$ etc are improper fractions.
- Mixed fraction : A number which can be expressed as the sum of a whole number and a proper fraction is called a mixed fraction.
- Ex. : $1\frac{2}{3}, 3\frac{4}{7}, 7\frac{3}{11}$ etc.
- Decimal fraction : A fraction whose denominator is 10, 100, 1000 etc is called a decimal fraction.
- Ex. : $\frac{3}{10}, \frac{7}{100}, \frac{24}{1000}$ etc.
- Vulgar fraction : A fraction whose denominator is an integer other than 10, 100, 1000 etc is called a vulgar fraction (or) common fraction (or) simple fraction.
- Ex. : $\frac{3}{4}, \frac{5}{7}, \frac{6}{13}$ etc.
- Like fraction : Fractions having the same denominators are called like fractions.
- Ex. : $\frac{4}{11}, \frac{3}{11}, \frac{7}{11}, \frac{10}{11}$ etc. are like fractions.
- Unlike fractions : Fractions having the different denominators are called unlike fractions.
- Ex. : $\frac{3}{5}, \frac{3}{7}, \frac{11}{12}, \frac{19}{40}$ etc. are unlike fractions.
- Unit fractions : Fractions with 1 as numerator are known as unit fractions.
- Ex. : $\frac{1}{2}, \frac{1}{3}, \frac{1}{7}, \frac{1}{23}$ etc. are unit fractions.
- Equivalent fractions : Two (or) more fractions representing the same part of a whole are called equivalent fractions.

Ex. : $\frac{2}{3}, \frac{4}{6}, \frac{6}{9}, \dots$ etc.

→ Multiplication of Fractions = $\frac{\text{Product of Numerators}}{\text{Product of denominators}}$

→ The product of two proper fractions is less than each of the fractions that they are multiplied.

$$\text{Ex. : } \frac{2}{3} \times \frac{5}{7} = \frac{10}{21}$$

$$\text{Here } \frac{10}{21} < \frac{2}{3} \text{ and } \frac{10}{21} < \frac{5}{7}$$

→ A reciprocal of a fraction is obtained by inverting the numerator and denominator

$$\text{Ex. : Reciprocal of } \frac{3}{5} \text{ is } \frac{5}{3}$$

$$\text{Reciprocal of } 2 \text{ is } \frac{1}{2}$$

→ While dividing a whole number with a fraction we multiply the whole number with the reciprocal of that fraction.

$$\text{Ex. : } 5 \div \frac{7}{3} = 5 \times \frac{3}{7} = \frac{15}{7}$$

→ While dividing one fraction by another fraction we multiply the first fraction with the reciprocal of the second.

$$\text{Ex. : } \frac{3}{4} \div \frac{5}{7} = \frac{3}{4} \times \frac{7}{5} = \frac{21}{20}$$

→ Fraction in lowest terms : A fraction is in its lowest terms if its numerator and denominator have no common factor other than 1.

→ If a fraction is in its lowest form H.C.F. of its Numerator and denominator is 1.

Decimals : Decimals can be considered as fractions whose denominators are 10,100,1000 etc. The numbers expressed in decimal forms are called decimals.

Ex. : 17.235, 0.149, 125.005 etc.

each decimal has two parts. : (i) whole number part (ii) decimal part

Multiplication of a decimal number by 10,100,1000 etc.

If we multiplied a decimal number by 10,100,1000 then the decimal point in the products shifts to the right by as many zeroes as in 10,100,1000 etc. ...

$$\text{Ex. : } 2.35 \times 10 = 23.5$$

$$12.356 \times 100 = 1235.6$$

Division of a decimal number by 10,100,1000 etc.

If we divide a decimal number by 10,100,1000 then the decimal point in the product shifts to the left by as many zeroes as in 10,100,1000 etc.....

$$\text{Ex. : } 132.7 \div 10 = 13.27$$

$$17.36 \div 100 = 0.1736$$

Rational numbers :

Rational numbers are a bigger collection of numbers which includes all integers, positive fractional numbers and all negative fractional numbers.

(or)

The numbers in the form of $\frac{p}{q}$, where p and q are integers and $q \neq 0$ are called as Rational numbers. $Q = \left\{ \frac{p}{q} / q \neq 0 \right\}$

→ $a(b+c) = ab+ac$ this property is called the distributive law of multiplication over addition.

→ $a(b-c) = ab-ac$ this property is called the distributive law of multiplication over subtraction.

Properties of Rational Numbers

Property	Addition	Subtraction	Multiplication	Division
Closure	✓	✓	✓	✓ (Except 0)
Commutative	✓	✗	✓	✗
Associative	✓	✗	✓	✗
Identity	✓	-	✓ (Except 0)	-
Inverse	✓	-	✓	-

→ Rational Numbers except zero satisfies inverse property under multiplication.

→ If a,b are any two rational numbers then $\frac{a+b}{2}$ is a rational number between them.

→ There are infinite rational numbers between any two rational numbers (Density property)

→ Decimal representation of Rational numbers

Rational numbers can be represent as

- (i) terminating decimals
- (ii) non terminating but reccuring (or) repeating decimals

Terminating Decimals :

The number of digits in decimal part are finite those are terminating decimals.

$$\text{Ex. : } \frac{1}{2} = 0.5; \quad \frac{3}{8} = 0.375; \quad \frac{13}{25} = 0.52$$

If the denominators of simplest rational numbers has no prime divisors other than 2 and 5 they are expressed as terminating decimals.

Non terminating recurring decimals :

If we observe that the division never ends, no matter how long it is carried on and a digit or a set of digits repeat continuously such decimals are called non terminating recurring decimals.

$$\text{Ex. : } \frac{1}{3} = 0.3333..... = 0.\overline{3}$$

$$\frac{5}{3} = 1.666..... = 1.\overline{6}$$

$$\frac{11}{9} = 1.222..... = 1.\overline{2}$$

→ The set of digits which repeats in non-terminating recurring decimal is called period. Number of digits in a period is called periodicity.

$$\text{Ex. : } 0.12\overline{75}$$

$$\text{Period} = 75$$

$$\text{Periodicity} = 2$$

SQUARE ROOTS & CUBE ROOTS

SYNOPSIS

- ★ Square of a number and square numbers.

The square of a number is that number raised to the power 2.

$$\therefore a^2 = a \times a$$

That is the square of a number is obtained by multiplying itself. If $a \times a = b$ then b is the square of a.

- ★ Perfect Square : A natural number n is called a perfect square if there exists a natural number m such that $n=m^2$.

$$\text{Ex. : } 36=6^2; 49=7^2$$

- ★ Square Root : The square root of a number a is that number which when multiplied by it self gives a as the product.

$$\therefore b \times b = a \text{ (or) } b^2 = a$$

Therefore b is the square root of a.

$$\text{Ex. : } 5 \times 5 = 25 \text{ then 5 is the square root of 25.}$$

- ★ Properties of square numbers :

→ 1) Perfect squares does not end with the digits 2,3,7 or 8.

Ex. : 152, 7693, 14357 are not perfect squares.

→ 2) The number of zeroes at the end of a perfect square is always even.

Ex. : 15000, 2700000 are never perfect squares.

→ 3) Squares of even numbers are always even and squares of odd numbers are always odd.

$$\text{Ex. : } 12^2 = 144 \text{ even number}$$

$$17^2 = 289 \text{ odd number.}$$

→ 4) Units digit of the number Units digit of the square of the number

0	-	0
1 or 9	-	1
2 or 8	-	4
3 or 7	-	9
4 or 6	-	4
5	-	5

- ★ If a number contains n digit then its square contains $2n$ or $2n-1$ digits.

Ex. : A 10 digit number contains 19 or 20 digits in its square.

- ★ For every natural number n, $(n+1)^2 - n^2 = 2n+1$

The difference of squares of two consecutive numbers is sum of the numbers.

Ex. : $11^2 - 10^2 = 11 + 10 = 21$

Ex. : $347^2 - 346^2 = 347 + 346 = 693$

- ★ There are $2n$ non perfect square numbers between two consecutive square numbers n^2 and $(n+1)^2$

Ex. : Non-perfect square numbers between 20^2 and 21^2 are $2(20) = 40$.

- ★ The square of a natural number n is equal to the sum of first n odd natural numbers.

Ex. : $5^2 = 1 + 3 + 5 + 7 + 9 = 25$

$\therefore 1 + 3 + 5 + \dots + 2n - 1 = n^2$

- ★ Pythagorean Triplets :

A triplet (a, b, c) of three natural numbers is called a pythagorean triplet if $a^2 + b^2 = c^2$

Ex. : $(3, 4, 5)$, $(5, 12, 13)$, $(8, 15, 17)$, $(7, 24, 25)$ are pythagorean triplets.

Note : For any natural number n greater than 1, $(2n, n^2 - 1, n^2 + 1)$ is a pythagorean triplet.

- ★ The sum of two consecutive triangular numbers is a square number.
triangular number are 1, 3, 6, 10, 15, 21, etc.
- ★ If 1 is added to the product of two consecutive odd natural numbers it is equal to the square of the only even natural number between them.

Ex. : $1 \times 3 + 1 = 2^2$

$5 \times 7 + 1 = 6^2$

$(2n - 1) \times (2n + 1) + 1 = (2n)^2$

- ★ If 1 is added to the product of two consecutive even natural numbers it is equal to the square of the only odd natural number between them

$2 \times 4 + 1 = 3^2$

$6 \times 8 + 1 = 7^2$

$2n \times (2n + 2) + 1 = (2n + 1)^2$

- ★ $n^2 + (n+1)^2 + (n^2 + n)^2 = (n^2 + n + 1)^2$

Ex. : $5^2 + 6^2 + 30^2 = 31^2$

$7^2 + 8^2 + 56^2 = 57^2$

Cube: The cube of a number is raised to the power 3.

$\therefore a^3 = a \times a \times a$

Perfect Cube : A natural number is said to be a perfect cube if it is the cube of some natural number.

★ $1^3 + 2^3 + 3^3 + \dots + n^3 = (1 + 2 + 3 + \dots + n)^2$

Cube root : A number m is the cube root of a number n if $n = m^3$

$$\therefore n = m^3 \text{ then } \sqrt[3]{n} = m$$

- ★ From 1 to 100 there are 4 perfect cubes, and between 1 and 500 there are 7 perfect cubes, between 500 and 1000 there are only 2 perfect cubes.

Playing with numbers

Place value of a number and Expanded form of numbers.

- ★ $645 = 600 + 40 + 5 = 6 \times 100 + 4 \times 10 + 5 \times 1$
- ★ In 7894 place value of 7 is 7000 and face value of 7 is 7.
- ★ $ab = 10a + b$
- ★ $abc = 100a + 10b + c$
- ★ In abcde place value of c is 100 c.

Factors and multiple of numbers

A number which is exactly divisible by numbers are called factors of that number.

Factors of 36 are 1,2,3,4,6,9,12,18 and 36.

- ★ Every factor is less than or equal to the given number.
- ★ Every number is a factor of itself and 1 is factor of all numbers.
- ★ Greatest factor of a non-zero number is the number itself.
- ★ If a natural number other than 1 has no factors except 1 and itself then they are called prime numbers.

Ex. : 2,3,5,7,11,13, etc.

★ **Composite number :**

A number which has factors besides other than 1 and itself is called a composite number.

- 1 is neither prime nor composite
- 2 is the only even prime number

★ **Number of factors**

If a number can be written as product of primes $N = 2^a \times 3^b \times 5^c \times \dots$

Number of factors of $N = (a+1)(b+1)(c+1) \dots$

Ex. : Find the number of factors of 36

$$36 = 2^2 \times 3^2$$

$$\text{Number of factors} = (2+1)(2+1) = 3 \times 3 = 9$$

Divisibility Rules :

Divisibility by 2 : If the unit's digit of the number is 0 or 2 or 4 or 6 or 8 (even number) then it is divisible by 2 otherwise it is not divisible by 2.

Ex. : 23468

digit in unit's place is 8 so it is divisible by 2.

★ If we take three digit number abc it can be written as

$$abc = 100a + 10b + c$$

$$= \frac{2(50a + 5b)}{\text{Multiple of 2}} + C$$

If abc is divisible by 2 then c = 0 or 2 or 4 or 6 or 8.

Divisibility by 3 : The sum of all digits in a number is divisible by 3 then the number is divisible by 3.

Ex. : 378

$$\text{Sum of all digits} = 3+7+8 = 18 \text{ (Multiple of 3)}$$

∴ 378 is divisible by 3

→ If we take three digit number abc,

$$abc = 100a + 10b + c = 99a + 9b + a + b + c$$

$$= \frac{3(33a+3b)}{\text{Multiple of 3}} + a+b+c$$

If abc is divisible by 3 then a+b+c is divisible by 3.

Ex. : If 24c is divisible by 3 then least value of c =

$$\text{sum of digits} = 2+4+c = 6+c$$

possible values of c are 0 or 3 or 6 or 9

least value of c = 0

★ Product of three consecutive numbers is divisible by 3

Divisibility by 4 : In a given number if the number formed by last two digits is divisible by 4 or last two digits are '0' then the number is divisible by 4.

Ex. : 378416

Last two digits 16 divisible by 4 therefore 378416 is divisible by 4.

★ If abcd is a 4 digits number

$$abcd = 1000a + 100b + 10c + d$$

$$= \frac{4(250a + 25b)}{\text{multiple of 4}} + 10c + d$$

The given number is divisible by 4 only if 10c + d is divisible by 4

Ex. : 1. Find the least value of a 94689a6 is divisible by 4.

Sol. Last two digits in given number = a6

multiples of 4 which having 6 in units place are

16,36,56,76,96 least value of a is 1.

2. If 378 A 3460 is divisible by 4 then least value of A = 0

and greatest value of A = 9

Divisibility by 5 : If the units digit of a number is 0 or 5 then it is divisible by 5.

Ex. : 1. 347895

The digit in units place is 5 therefore it is divisible by 5

2. If 45678 A is divisible by 5 least value of A is 0
3. The least number must be added to 346786 is divisible by 5 is 4.
4. If 4B is divisible by 5 then the remainder is 1, then possible values of B are 1 or 6.
5. If 76c is divisible by 5 then the remainder is 2 then maximum value of c is 7.

Divisibility by 6 : If a number is divisible by 2 and 3 then it is divisible by 6.

Ex. : 1. 378642

digit in units place is 2 so it is divisible by 2.

sum of all the digits = $3+7+8+6+4+2=30$ is divisible by 3

$\therefore$ 378642 is divisible by 6.

2. If a three digit number ABC is divisible by 6 the least value of $A+B+C$ is 3.

Divisibility by 7 : * ABC is a three digit number

$$ABC = 100A + 10B + C$$

$$= 7(14A + B) + 2A + 3B + C$$

If ABC is divisible by 7 only when $2A + 3B + C$ is divisible by 7.

Ex. : 1. 343

$$2A+3B+C = 2 \times 3 + 3 \times 4 + 3 = 6 + 12 + 3 = 21 \text{ (divisible by 7)}$$

Therefore 343 is divisible by 7.

2. Find the least value of C is 99c is divisible by 7.

Sol. Comparing 99c with ABC

$$A=9, B=9, C=c$$

$$\begin{aligned} \text{Now } 2A+3B+C &= 2(9)+3(9)+c = 18+27+c \\ &= 45 + c \end{aligned}$$

Nearest multiple of 7 to 45 is 49

$$\therefore 45 + c = 49$$

$$c = 4.$$

Divisibility by 8 : In a given number if the number formed by last three digits are divisible by 8 or last 3 digits are '0's then that number is divisible by 8.

Ex. : 1. 3786436

Last three digits are 436

$\therefore$ 436 is not divisible by 8

therefore 3786436 is not divisible by 8.

Note : If ABCD is a four digit number then $4B+2C+D$ is divisible

by

8 therefore ABCD is divisible by 8.

Ex. : 1. 7752

$$4B+2C+D=4(7)+2(5)+2= 28+10+2 = 40 \text{ (divisible by 8)}$$

8)

$\therefore$ 7752 is divisible by 8

2. If 36874A is divisible by 8 then A value

$$4B+2C+D = 4(7)+2(4)+A = 28+8+A = 36 + A$$

Nearest multiple of 8 to 36 is 40

$$\therefore 36+A = 40$$

$$A = 40-36 = 4$$

Divisibility by 9 : The sum of the digits of a number is multiple of 9 then the number is divisible by 9.

Ex. : 1. 8378649

$$\text{Sum of the digits} = 8+3+7+8+6+4+9=45 \text{ (multiple of 9)}$$

Therefore 8378649 is divisible by 9.

2. If 34A is divisible by 9 then maximum value of A is

$$3+4+A = 7+A = 9$$

$$A = 2$$

Divisibility by 10 : If the unit digit of a number is '0' then it is divisible by 10.

Divisibility by 11 : If the difference between the sum of digits in odd places and sum of digits in even places of a number is multiple of 11 or equal to zero then the number is divisible by 11.

Ex. : 61809

$$\text{Sum of the digits at odd places} = 6+8+9 = 23$$

$$\text{Sum of the digits at even places} = 1+0 = 1$$

$$\text{Their difference} = 22 \text{ (multiple of 11)}$$

$\therefore$ 61809 is divisible by 11.

★ The palindrome numbers are always divisible by 11.

★ If we write a three digit number even number of times is divisible by 11.

Ex. : 789789 divisible 11

348348348348 is divisible by 11.

★ $a^{2n}-1$ ($\forall n \in N$) number is always divisible by 9 and 11.

Ex. : $10^{2n}-1 = 10^{10}-1$ ($n=5$)

$$= 10000000000 - 1$$

$$= 9999999999 \text{ (It is divisible by 9 and 11)}$$

★ a^n+b^n is divisible by $a+b$ when ever n is a odd number.

- ★ $a^n - b^n$ is divisible by $a - b$ for all values of n .
- ★ $a^{2n+1} + b^{2n+1}$ is always divisible by $(a + b)$
- ★ If a number a is divisible by another number b then it is divisible by each of the factors of that number b .
Ex. : Suppose 24 is divisible by 12 then 24 is also divisible by the factors of 12 are 1, 2, 3, 4, 6, 12.

b

- ★ If a, b are divisible by c then their sum $a + b$ and difference $a - b$ are divisible by c .
- ★ Any two digit number three times to make a 6-digit number it is divisible by 3.
Ex. : 474747 is divisible by 3.
- ★ any three digit number write it two times to make a 6-digit number is divisible by 7, 11 and 13 also.

$$\begin{aligned}\rightarrow \quad abcabc &= abc (1001) \\ &= abc \times 7 \times 11 \times 13\end{aligned}$$

- ★ Sum of first n natural numbers $\frac{n(n+1)}{2}$

$$1+2+3+\dots+n = \frac{n(n+1)}{2}$$

- ★ Sum of first n even natural numbers $= n(n+1)$
- ★ Sum of first n odd even natural numbers n^2 .

$$1+3+5+7+9 = 5^2 = 25$$

$$1+3+5+7+\dots+99 = 50^2 = 2500$$

$$2+4+6+8+10 = 5(6) = 30$$

$$2+4+6+\dots+100 = 50(51) = 2550$$

- ★ The sum of Integers from 1 to 100 which are divisible by 5.

$$5+10+15+\dots+100 = 5 [1+2+3+\dots+20]$$

$$= \frac{5[20(20+1)]}{2} = 5 \times 10 \times 21 = 1050$$

- ★ Find the sum of integers which are divisible by 5 from 50 to 85.

$$50+55+60+65+70+75+80+85$$

$$= [5+10+15+\dots+85] - [5+10+\dots+45]$$

$$= 5 [1+2+3+\dots+17] - 5 [1+2+\dots+9]$$

$$= \left(5 \times \frac{17 \times 18}{2}\right) - \left(5 \times \frac{9 \times 10}{2}\right) = 5 \times 9 (17-5)$$

$$= 5 \times 9 \times 12$$

$$= 540$$

Worked Examples

1. The sum of two rational numbers is $\frac{-3}{5}$. If one of the number is $\frac{-9}{20}$ find the other.

Sol. It is given that

sum of the numbers = $\frac{-3}{5}$, one of the numbers = $\frac{-9}{20}$

suppose the other rational number is x

$$\therefore x + \left(\frac{-9}{20}\right) = \frac{-3}{5}$$

$$x = \frac{-3}{5} - \left(\frac{-9}{20}\right)$$

$$x = \frac{-3}{5} + \frac{9}{20} = \frac{-12+9}{20} = \frac{-3}{20}$$

2. By what number should we multiply $\frac{3}{-14}$ so that the product may be $\frac{5}{12}$.

Sol. $\frac{3}{-14} \times x = \frac{5}{12}$

$$x = \frac{5}{12} \times \frac{-14}{3} = \frac{-35}{18}$$

3. Find the greatest 5-digit perfect square.

Sol. Let us first work out the process of finding the square root by the division method.

3	99999	316
	9	
61	99	
	61	
626	3899	
	3756	
	143	

$$\text{Required number} = 99999 - 143 = 99856$$

4. What is the smallest number by which 1600 is to be divided so that the quotient is a perfect cube.

Sol. Resolving 1600 into prime factors, we get

$$1600 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 5 \times 5$$

$$\text{The smallest number which is to be divided} = 5 \times 5 = 25$$

5. Find the reciprocal of $\frac{-3}{8} \times \frac{-7}{13}$

Sol. We have $\frac{-3}{8} \times \frac{-7}{13} = \frac{(-3) \times (-7)}{8 \times 13} = \frac{21}{104}$

Reciprocal of $\frac{-3}{8} \times \frac{-7}{13} = \frac{104}{21}$

6. Is $\frac{23}{2^5 \times 5^7}$ terminating decimal or not ?

Sol. In a fraction in its lowest form if denominator is not having any prime numbers except 2 and 5 then it is terminating decimal.

$\therefore \frac{23}{2^5 \times 5^7}$ is terminating decimal.

7. In a class there are 60 students one third of them are girls. How many boys are there in the class.

Sol. No. of girls = $\frac{1}{3}$ of students = $\frac{1}{3} \times 60 = 20$

No. of boys = $60 - 20 = 40$

8. Convert (i) $5.\bar{2}$ (ii) $6.\bar{28}$ (iii) $0.\bar{375}$ as rational numbers.

Sol. (i) $5.\bar{2} = \frac{52-5}{9} = \frac{47}{9}$

(ii) $6.\bar{28} = \frac{628-6}{99} = \frac{622}{99}$

(iii) $0.\bar{375} = \frac{375-3}{990} = \frac{372}{990}$

9. Simplify $\left(1-\frac{1}{2}\right)\left(1-\frac{1}{3}\right)\left(1-\frac{1}{4}\right) \dots \left(1-\frac{1}{n}\right)$

Sol. $\left(1-\frac{1}{2}\right)\left(1-\frac{1}{3}\right)\left(1-\frac{1}{4}\right) \dots \left(1-\frac{1}{n}\right)$

$= \frac{1}{2} \cdot \frac{2}{3} \cdot \frac{3}{4} \dots \frac{n-1}{n} = \frac{1}{n}$

10. Find no. of digits in $4^{24} \cdot 25^{24}$

Sol. $4^{24} \cdot 25^{24} = (4 \cdot 25)^{24} = (100)^{24} = (10^2)^{24} = 10^{48}$

There are 49 digits in given number

11. If $\sqrt{576} = 24$ then find $\sqrt{5.76} + \sqrt{0.0576}$

Sol. $\sqrt{5.76} + \sqrt{0.0576} = 2.4 + 0.24 = 2.64$

12. Find the last digit of 3^{1997}

Sol. $3^1 = 3$

$3^2 = 9$

$3^3 = 27$

$3^4 = 81$

$3^5 = 243$

Power of 3 has recurring degree 4.

$3^{1997} = 3^{4 \times (499) + 1}$

Last digit of 3^{1997} is 3.

13. Simplify $2\frac{1}{2} + 3\frac{5}{7} \times \frac{3}{13} - \frac{1}{2} \div 4$ is

Sol.
$$\begin{aligned} 2\frac{1}{2} + 3\frac{5}{7} \times \frac{3}{13} - \frac{1}{2} \div 4 &= \frac{5}{2} + \frac{26}{7} \times \frac{3}{13} - \frac{1}{2} \times \frac{1}{4} \\ &= \frac{5}{2} + \frac{6}{7} - \frac{1}{8} \\ &= \frac{140 + 48 - 7}{56} = \frac{188 - 7}{56} = \frac{181}{56} = 3\frac{13}{56} \end{aligned}$$

14. If $x = \frac{1}{2}$ then find the value of $x + \frac{1}{1 + \frac{1}{1 + \frac{1}{x}}}$

Sol.
$$\begin{aligned} x + \frac{1}{1 + \frac{1}{1 + \frac{1}{x}}} &= \frac{1}{2} + \frac{1}{1 + \frac{1}{1 + 2}} = \frac{1}{2} + \frac{1}{1 + \frac{1}{3}} \\ &= \frac{1}{2} + \frac{1}{\frac{4}{3}} \\ &= \frac{1}{2} + \frac{3}{4} = \frac{5}{4} \end{aligned}$$

15. Find H.C.F. of $\frac{4}{5}, \frac{5}{6}, \frac{9}{10}$

Sol. H.C.F. of fractions = $\frac{\text{H.C.F. of numerators}}{\text{L.C.M. of denominators}}$

$$= \frac{\text{H.C.F. of } 4, 5, 9}{\text{L.C.M. of } 5, 6, 10} = \frac{1}{30}$$

16. If $a(b+c)=119, b(c+a)=128, c(a+b)=135$ then find abc

given $a(b+c)=119, b(c+a)=128, c(a+b)=135$

$$a(b+c)+b(c+a)+c(a+b)=119+128+135$$

$$ab+ac+bc+ba+ca+bc=382$$

$$2ab+2bc+2ca=382$$

$$2(ab+bc+ca)=382$$

$$ab+bc+ca=\frac{382}{2}=191$$

Now $ab=(ab+bc+ca)-c(a+b)=191-135=56$

$$bc=(ab+bc+ca)-a(b+c)=191-119=72$$

$$ca=(ab+bc+ca)-b(c+a)=191-128=63$$

$$ab.bc.ca=56 \times 72 \times 63$$

$$(abc)^2=7 \times 8 \times 9 \times 8 \times 9 \times 7$$

$$(abc)^2=(7 \times 8 \times 9)^2=(504)^2$$

$$\therefore abc=504$$

17. $\frac{1}{1.2} + \frac{1}{2.3} + \frac{1}{3.4} + \dots + \frac{1}{n(n+1)}$

Sol: $1 - \frac{1}{2} + \frac{1}{2} - \frac{1}{3} + \frac{1}{3} - \frac{1}{4} + \dots + \frac{1}{n} - \frac{1}{n+1}$

$$=1 - \frac{1}{n+1} = \frac{n+1-1}{n+1} = \frac{n}{n+1}$$

18. If $\sqrt{x-2}=y$ and $\sqrt{y-3}=z; \sqrt{z-4}=3$ then find x value

$$\sqrt{z-4}=3 \Rightarrow z-4=9$$

$$z=13$$

$$\sqrt{y-3}=z \Rightarrow \sqrt{y-3}=13$$

$$y-3=169$$

$$y=172$$

$$\sqrt{x-2}=y \Rightarrow \sqrt{x-2}=172$$

$$x-2=29584$$

$$x=29586$$

19. Find the greatest prime number that divide $5^{52} + 5^{53} + 5^{54} + 5^{55}$

$$5^{52} + 5^{53} + 5^{54} + 5^{55} = 5^{52}(1 + 5 + 5^2 + 5^3)$$

$$= 5^{52} (2^2 \times 3 \times 13)$$

$$\begin{aligned}\text{Divident} &= \text{Diviser} \times \text{Quotient} + \text{Remainder} \\ &= 272 \times 34 + 16 \\ &= 9264\end{aligned}$$

7. A certain freezing process requires that room temperature be lowered from 50°C at the rate of 3°C every hour. What will be the room temperature $\frac{3}{4}$ day after the process begins ? []
- a) 14°C b) -4°C c) -22°C d) -12°C
8. In a class test containing 8 questions , 5 marks are awarded for every correct answer and (-2) mark is for every incorrect answer and 0 for questions not attempted. If Ravi attempts all the questions and of them 3 are wrong. How many marks did he get ? []
- a) 25 b) 5 c) 19 d) 17
9. An elevator descends into a mine shaft at the rate of 5 meters per minute. If the descent starts from 50m above the ground level how long will it take to reach -255m ? []
- a) 51 b) 53 c) 55 d) 61
10. If $a = (-1 \times (-1) \times (-1) \dots\dots 100$ times, and $b = (-1) \times (-1) \times (-1) \times \dots\dots 99$ times. Then $a+b = \dots\dots$ []
- a) -1 b) -2 c) 0 d) 1
11. By what number $9\frac{4}{5}$ be multiplied to get 42. []
- a) $\frac{30}{7}$ b) $\frac{7}{30}$ c) $4\frac{1}{7}$ d) $4\frac{3}{7}$
12. A bucket contains $24\frac{3}{4}$ litres of water. How many $\frac{3}{4}$ litre jugs can be filled from the bucket to get it emptied? []
- a) 35 b) 33 c) 37 d) 29
13. The product of two numbers is $20\frac{5}{7}$. If one of the numbers $6\frac{2}{3}$ then the other is []
- a) $3\frac{5}{28}$ b) $3\frac{7}{28}$ c) $3\frac{3}{28}$ d) $2\frac{3}{28}$
14. Which of the following statement is incorrect ? []
- a) All Natural numbers are Rational numbers
b) All Integers are whole numbers
c) All whole numbers are Rational numbers
d) All whole numbers are not natural numbers
15. A car runs 16km using 1 litre of petrol. How much distance will it cover using $2\frac{3}{4}$ litres of petrol ? []
- a) 55km b) 45 km c) 48 km d) 44 km
16. By selling oranges at the rate of Rs. $5\frac{1}{4}$ per orange, a fruit seller gets Rs. 630. How many dozens of oranges does he sell ? []
- a) 10 b) 12 c) 14 d) 8
17. A set of whole numbers satisfy proper under multiplication []

- a) Closed b) Commutative c) Associative d) All the above
18. The value of $-1+2-3+4-5+6 \dots\dots -2017+2018$ is equal to []
 a) 4036 b) 1009 c) -1008 d) 0
19. Which of the following is true ? []
 a) $130 \div 0 = 0$ b) $150 \div 1 = 50$ c) $0 \times 130 = 0$ d) $150 \times 1 = 151$
20. A fan rotates on its shaft around 5 times in a second. How many times does the fan rotate in a day if there was no electricity for 2 hours ? []
 a) 396000 b) 39600 c) 395000 d) 398000
21. The area of a Rectangle whose length is 5.7 cm and breadth is 3.5 cm ? []
 a) 19.25 cm^2 b) 19.95 cm^2 c) 18.95 cm^2 d) 17.95 cm^2
22. A car covers a distance of 89.1/km in 2.2 hours. What is the average distance covered by the car in 1 hour ? []
 a) 38.5 b) 27.5 c) 40.5 d) 44.5
23. When 0.48 is written in the simplest form of its terms, the sum of its numerator and denominator is []
 a) 148 b) 74 c) 37 d) 147
24. If $\frac{-3}{7} = \frac{x}{35}$ then $x = \dots\dots$ []
 a) 15 b) 21 c) -15 d) -21
25. What should be added to $\frac{-5}{8}$ So as to get $\frac{5}{9}$? []
 a) $\frac{85}{72}$ b) $\frac{72}{75}$ c) $\frac{-82}{75}$ d) $\frac{12}{85}$
26. Find $(x+y) \div (x-y)$ if $x = \frac{2}{3}, y = \frac{3}{2}$ []
 a) $\frac{12}{5}$ b) $\frac{17}{5}$ c) $\frac{-12}{5}$ d) $\frac{-13}{5}$
27. The sum of two numbers is $\frac{-4}{3}$. If one of the number is -5. Then the other is []
 a) $\frac{20}{3}$ b) $\frac{11}{3}$ c) $\frac{14}{3}$ d) $\frac{16}{3}$
28. What should be subtracted from $\left(\frac{3}{4} - \frac{2}{3}\right)$ to get $\frac{-1}{6}$? []
 a) $\frac{1}{2}$ b) $\frac{1}{3}$ c) $\frac{1}{4}$ d) $\frac{1}{6}$
29. Divide the sum of $\frac{-13}{5}$ and $\frac{12}{7}$ by the product of $\frac{-31}{7}$ and $\frac{-1}{2}$ []
 a) $\frac{-2}{5}$ b) $\frac{-7}{5}$ c) $\frac{12}{5}$ d) $\frac{-20}{3}$
30. $0.\overline{2} + 0.\overline{23} = \dots\dots$ []

- a) $0.\overline{43}$ b) $0.\overline{45}$ c) $0.4\overline{3}$ d) $0.4\overline{5}$
31. Which of the following are terminating ? []
- a) $\frac{5}{3}$ b) $\frac{17}{6}$ c) $\frac{54}{99}$ d) $\frac{37}{5}$
32. Find the perimeter of the rectangle whose length and breadth are $8\frac{3}{5}$ and $8\frac{2}{3}$?
- a) $32\frac{6}{15}$ b) $30\frac{4}{15}$ c) $34\frac{8}{15}$ d) $36\frac{8}{15}$ []
33. If we write $0.454545 \dots$ in $\frac{p}{q}$ form then $p+q = \dots$ []
- a) 15 b) 16 c) 13 d) 17
34. The smallest of the fractions $\frac{2}{3}$, $\frac{4}{7}$, $\frac{8}{11}$ and $\frac{5}{9}$ is []
- a) $\frac{2}{3}$ b) $\frac{4}{7}$ c) $\frac{8}{11}$ d) $\frac{5}{9}$
35. If $x = (-23) + 22 + (-23) + 22 \dots$ (40 terms) and $y = 11 + (-10) + 11 + (-10) \dots$ (20 terms) then $y-x = \dots$ []
- a) 40 b) 10 c) 20 d) 30
36. If $x = (-1)^{2018}$, $y = (+1)^{2018}$ and $x+y = z$ then $x+y+z = \dots$ []
- a) 0 b) 2 c) 4 d) 3
37. Water level increased at a dam 4ft per day and decreased 3ft per day then after 10 days water level in dam is when 3ft water is already there []
- a) 10 ft b) 13 ft c) 6ft d) 14ft
38. $\frac{1}{2} + \frac{3}{4} + \frac{5}{6} + \frac{7}{8} + \frac{9}{10} = \dots$ []
- a) $\frac{463}{110}$ b) $\frac{462}{119}$ c) $\frac{463}{120}$ d) $\frac{463}{119}$
39. If $\frac{x}{2} = \frac{y}{3}$ then $\left[\frac{4}{5} + \frac{y-x}{y+x} \right]$ equals []
- a) $\frac{3}{5}$ b) $\frac{4}{5}$ c) 1 d) $\frac{6}{5}$
40. Guru read $\frac{3}{5}$ of a book. He finds that there are still 80 pages left to read. Total number of pages in book are []
- a) 100 b) 200 c) 400 d) 300
41. By what number should $\frac{-3}{4}$ be multiplied in order to produce $\frac{2}{3}$ []
- a) $\frac{-3}{2}$ b) $\frac{2}{3}$ c) $\frac{-4}{9}$ d) $\frac{-8}{9}$
42. The property involved in $(2 \times x) + (2 \times 6) = 2 \times (x+6)$ []
- a) Associative property b) Commutative property
c) Distributive property d) Identity property
43. The property involved in $(-2) \times (3 \times 4) = (-2 \times 3) \times 4$ []

- a) Multiplicative associative in whole numbers
 b) Commutative under multiplication in Integers
 c) Associative under multiplication in Rational numbers
 d) Associative under multiplication in natural numbers
44. The period of $0.\overline{54} + 4.\overline{7}$ is []
 a) 32 b) 61 d) 47 d) 27
45. If $\frac{2}{5}$ of a number exceeds $\frac{1}{7}$ of the same number by 36 then the number is
 a) 156 b) 140 c) 132 d) 144 []
46. Which of the following is non-terminating decimal ? []
 a) $\frac{1}{4}$ b) $\frac{4}{7}$ c) $\frac{3.66}{6}$ d) $\frac{5}{32}$
47. Choose the rational number does not lie between rational numbers $\frac{-2}{5}$ and $\frac{-1}{5}$
 a) $\frac{-1}{4}$ b) $\frac{-3}{10}$ c) $\frac{-5}{10}$ d) $\frac{-7}{20}$
48. The numbers and are having their own reciprocals. []
 a) 0,1 b) 5,1 c) -1,1 d) 0,-1
49. A man spends $\frac{1}{4}$ of his salary on the rent of his house, $\frac{1}{3}$ of the remaining on food and Rs. 3000 on the education of his children. If his salary is Rs. 24,000 find the sum of money still left with him.
 []
 a) 900 b) 3000 c) 9000 d) 90000
50. Arrange the fractions in descending order : $\frac{5}{12}, \frac{3}{8}, \frac{7}{16}$ []
 a) $\frac{7}{16}, \frac{3}{8}, \frac{5}{12}$ b) $\frac{5}{12}, \frac{7}{16}, \frac{3}{8}$ c) $\frac{7}{16}, \frac{5}{12}, \frac{3}{8}$ d) $\frac{3}{8}, \frac{5}{12}, \frac{7}{16}$
51. The highest score in an inning was $\frac{3}{11}$ of the total and the next highest was $\frac{3}{11}$ of the remaining. If the scores differed by 63. Find the total score ? []
 a) 836 b) 850 c) 847 d) 900
52. The reciprocal of $\frac{3}{4} \div 3$ will be []
 a) 4 b) $\frac{1}{4}$ c) $\frac{9}{4}$ d) $\frac{4}{9}$
53. If $a+b = 7$, $b+c = 10$, $c+a = 11$ then a value = ... []
 a) 7 b) 4 c) 3 d) 5
54. Which one of the following will divide $(3^{25} + 3^{26} + 3^{27} + 3^{28})$ completely ? []
 a) 11 b) 16 c) 25 d) 30
55. If the unit digit in $(549 \times 56 \times 28 \times 684)$ be 8, then what digit will be there in place of * []
 a) 4 b) 3 c) 2 d) 1

56. The difference between the local value of face value of 6 in the numeral 586723 is []
 a) 723 b) 6717 c) 5994 d) None of these
57. The periodicity of $\frac{5}{13}$ is []
 a) 2 b) 4 c) 6 d) 8
58. If $x=0.\overline{7}$ and $y=0.\overline{23}$ then rational number between $(x+y)$ and $(x-y)$ is []
 a) $\frac{4}{11}$ b) $\frac{5}{11}$ c) $\frac{53}{55}$ d) $\frac{12}{11}$
59. The cost of $2\frac{1}{3}$ metres of cloth is Rs. $75\frac{1}{4}$ find the cost of cloth per meter ? []
 a) 35.25 b) 41.75 c) 32.25 d) 37.75
60. A real number $\frac{2^2 \times 3^2 \times 7^2}{2^5 \times 5^3 \times 3^2 \times 7}$ will have []
 a) Terminating decimal b) Non-terminating decimal
 c) Non-terminating and non-repeating decimal
 d) Terminating repeating decimal
61. Which of the following is not a perfect square ? []
 a) 6400 b) 8400 c) 90000 d) 10000
62. Number of non perfect squares numbers between 2017^2 and 2018^2 are []
 a) 2018 b) 2017 c) 4035 d) 4034
63. $\sqrt{1296}=36$ then $\sqrt{0.001296}=.....$ []
 a) 0.36 b) 0.036 c) 0.0036 d) 3.60
64. Number of perfect cubes from 1 to 1000 []
 a) 7 b) 8 c) 9 d) 10
65. Which of the following is not a pythagorean triplet ? []
 a) (6,8,10) b) (12,16,20) c) (6,4,10) d) (16,30,34)
66. No. of Integers between 2018^2 and 2020^2 []
 a) 8034 b) 8074 c) 8075 d) 8077
67. For what values of n, n^2+96 is a perfect square ? []
 a) 23,10,5,2 b) 25,12,4,3 c) 28,14,6,7 d) None
68. $\sqrt{mn}=8$ then possible least value of $m+n$ is []
 a) 16 b) 20 c) 25 d) 30
69. The least four digit perfect square is []
 a) 1024 b) 9801 c) 1056 d) 1225
70. Which is greater among the following ? []
 a) 2^{2^2} b) $\left(\left(2^2\right)^2\right)^2$ c) 2222 d) 222^2

71. The smallest number by which 3645 must be multiplied to get a perfect square is
 a) 5 b) 3 c) 7 d) 11 []
72. The product of two numbers is 1296. If one number is 16 times the other then the sum of two numbers is []
 a) 144 b) 153 c) 162 d) 81
73. The least number must be subtracted from 4000 to make it perfect square []
 a) 39 b) 43 c) 34 d) 31
74. The smallest prime number dividing the sum $3^{11} + 5^{13}$ is []
 a) 2 b) 3 c) 5 d) 7
75. The smallest number should be multiplied to 7803 so that product becomes a perfect cube []
 a) 11 b) 13 c) 17 d) 23
76. Ravi made a cuboid of plasticine of dimensions 12cm, 8cm and 3cm. How many minimum number of such cuboids will be needed to form a cube []
 a) 288 b) 144 c) 256 d) 128
77. Which of the following two digit number which is square number and also a cubic number ? []
 a) 16 b) 27 c) 64 d) 81
78. The least number must be added to 6412 to make it a perfect square []
 a) 147 b) 149 c) 163 d) 167
79. What is the smallest number by which 1600 is to be divided so that the quotient is a perfect cube ? []
 a) 5 b) 4 c) 25 d) 2
80. $2\sqrt{18} + \sqrt{32}$ []
 a) $40\sqrt{2}$ b) $30\sqrt{2}$ c) $20\sqrt{2}$ d) $10\sqrt{2}$
81. Find the greatest number of six digits which is a perfect square ? []
 a) 998011 b) 988001 c) 998001 d) 988801
82. If $5\sqrt{x} + 12\sqrt{x} = 13\sqrt{x}$ then x = []
 a) 1 b) 2 c) 3 d) 4
83. Area of a circular field is 6.16m^2 then its circumference []
 a) 7.6 b) 5.6 c) 6.6 d) 8.8
84. $\sqrt{41 - \sqrt{21 + \sqrt{19 - \sqrt{9}}}}$ = []
 a) 5 b) 6 c) 7 d) 8

85. $3\sqrt[3]{\frac{0.027}{0.008}} \div \sqrt{\frac{0.09}{0.04}} - 1$ []
 a) 0 b) 1 c) 1.4 d) 2.1
86. $\sqrt{19.36} + \sqrt{0.1936} + \sqrt{0.001936}$ is []
 a) 488.4 b) 48.84 c) 4.884 d) 0.4884
87. Between which two consecutive whole numbers $\sqrt{1000}$ lies []
 a) 29 and 39 b) 30 and 31 c) 31 and 32 d) 32 and 33
88. Find the greatest 4-digit number which is a perfect square ? []
 a) 9901 b) 9801 c) 9081 d) 9999
89. Which of the following contains digit 3 in its unit place ? []
 a) 123^3 b) 198^3 c) 206^3 d) 157^3
90. The length and breadth of a rectangular field are in the ratio 4:3 its area is 6.75 hectares then its perimeter is in sq. meters []
 a) 1050 b) 1450 c) 525 d) 725
91. If a number 34A is divided by 2 and 5 leaves remainders 0 and 1 then A value []
 a) 0 b) 2 c) 1 d) 5
92. If 2A8 is divisible by 2 then number of possible values of A are []
 a) 9 b) 99 c) Infinity d) 10
93. No. of factors of 32 []
 a) 5 b) 6 c) 36 d) 16
94. If 345A7 is divisible by 3 then A value []
 a) 2 b) 5 c) 8 d) All the above
95. Which of the following is not divisible by 11 ? []
 a) 12344321 b) 234554320 c) 12345678 d) 87655678
96. Sum of all the even numbers from 1 to 120 is []
 a) 3660 b) 7260 c) 3600 d) 240
97. If $5A1 - 23A = 325$ then A value []
 a) 2 b) 3 c) 6 d) 1
98. $Y+Y+Y = MY$ then M,Y values are []
 a) 1,5 b) 5,1 c) 5,5 d) 1,1
99. $10^{2n} - 1$ is divisible by which of the following []
 a) 9 b) 11 c) 3 d) All the above
100. $1^{11} + 2^{11} + 3^{11} + 4^{11}$ is divisible by []
 a) 2 b) 4 c) 5 d) 7
101. $8A5 + 94A = 1A33$ then A value []
]

- a) 6 b) 7 c) 8 d) 9
102. $AB \times 2 = BO2$ then A,B values are []
- a) 5,1 b) 1,5 c) 1,1 d) 5,5
103. Condition for $10^n - 1$ is divisible by 11 is []
- a) n is any natural number b) n is any even number
c) n is any odd number d) n is a multiple of 11
104. Which of the following is exactly divisible by 7, 11 and 13 ? []
- a) 123321 b) 121312 c) 123123 d) 132123
105. Which of the following is factor of 311131113111 ? []
- a) 8 b) 3 c) 4 d) 2
106. No. of factors of 7^{2007} []
- a) 2006 b) 2007 c) 2008 d) 2009
107. If $x^2 + x + 11$ is a prime number then x value []
- a) 1 b) 2 c) 3 d) All the above
108. $a = 4b + 26$, b is a positive integer then which of the following exactly divides a ? []
- a) 2 b) 5 c) 4 d) 6
109. If a, b, c, d are consecutive multiples of 5 then $(a - c) (d - b) = \dots\dots$ []
- a) 100 b) -100 c) 25 d) -25
110. $1^{2007} + 2^{2007} + 3^{2007} + \dots\dots + (2006)^{2007}$ is divisible by the following []
- a) 2007 b) 2006 c) 2005 d) 2008

LEVEL - 1
ANSWERS

1. C	23. C	45. B	67. D	89. D
2. C	24. C	46. B	68. A	90. A
3. B	25. A	47. C	69. A	91. C
4. A	26. D	48. C	70. D	92. D
5. D	27. B	49. C	71. A	93. B
6. A	28. C	50. C	72. B	94. D
7. B	29. A	51. C	73. D	95. C
8. C	30. B	52. A	74. A	96. A
9. D	31. D	53. B	75. C	97. C
10. C	32. C	54. D	76. A	98. A
11. A	33. B	55. B	77. C	99. D
12. B	34. D	56. C	78. B	100. C
13. C	35. D	57. C	79. C	101. C
14. B	36. C	58. C	80. A	102. A
15. D	37. B	59. C	81. C	103. B
16. A	38. C	60. A	82. D	104. C
17. D	39. C	61. B	83. D	105. B
18. B	40. B	62. D	84. B	106. C
19. C	41. D	63. B	85. A	107. D
20. A	42. C	64. D	86. C	108. A
21. B	43. C	65. C	87. C	109. B
22. C	44. A	66. C	88. B	110. A

LEVEL - 2

PRACTICE BITS

1. If $a+b = 2018$ then the value of $(-1)^a + (-1)^b$ []
a) 2 b) -2 c) 2 or -2 d) 0
2. Find the least value of K for which $2005+K$ is the sum of first n odd natural numbers []
a) 20 b) 25 c) 15 d) 45
3. The sum of two digit number and the number formed by reversing the digits is a perfect square. How many such two digit numbers are there []
a) 6 b) 8 c) 7 d) 10
4. How many perfect cubes are there in the sequence $1^1, 2^2, 3^3, 4^4, \dots, 2018^{2018}$ []
a) 714 b) 762 c) 568 d) 680
5. The number $2^{55} + 1$ is divisible by []
a) 2 b) 5 c) 11 d) 13
6. Number of digits in $8^{20} \cdot 25^{25}$ []
a) 52 b) 54 c) 62 d) 55
7. What is the 2018th digit in the sequence 12345678910111213 ? []
a) 7 b) 0 c) 8 d) 9
8. If we add 329 to the three digit number 2×4 we get 573 divisible by 3. The greatest possible value of x []
a) 2 b) 3 c) 4 d) 7
9. The sum of two numbers is 52 and their L.C.M. is 168 then the numbers are
a) 20,32 b) 24,26 c) 12,40 d) 24,28
10. $\frac{1}{3 \times 5} + \frac{1}{5 \times 7} + \frac{1}{7 \times 9} + \frac{1}{9 \times 11} + \dots + \frac{1}{2017 \times 2018}$ []
a) $\frac{1}{4}$ b) $\frac{1}{3}$ c) $\frac{2017}{2019}$ d) $\frac{1}{2}$
11. $\left[1 - \frac{1}{2^2}\right] \left[1 - \frac{1}{3^2}\right] \left[1 - \frac{1}{4^2}\right] \dots \left[1 - \frac{1}{2018^2}\right]$ []
a) $\frac{2018}{4036}$ b) $\frac{2019}{4036}$ c) $\frac{1}{2}$ d) $\frac{2017}{2018}$
12. Find $x^2 + y^2$ if x and y are positive integers such that $xy + x + y = 71$ and $x^2y + xy^2 = 880$ []
a) 136 b) 146 c) 176 d) 156
13. If $a(b+c) = 152$, $b(c+a) = 162$, $c(a+b) = 170$ then $abc =$ []
a) 620 b) 712 c) 720 d) 634

14. The last digit of the sum $2002^{2005} + 2003^{2006} + 2007^{2007}$ is []
a) 3 b) 5 c) 6 d) 4
15. The unit digit of $1 + 9 + 9^2 + 9^3 + \dots + 9^{2018}$ is []
a) 1 b) 9 c) 0 d) 8
16. The sum of all the digits of the result of subtraction $10^{99} - 99$ []
a) 865 b) 845 c) 874 d) 883
17. Which one of the following will divide $4^{61} + 4^{62} + 4^{63} + 4^{64}$ completely ? []
a) 3 b) 10 c) 11 d) 13
18. $\frac{1}{2} + \frac{1}{6} + \frac{1}{12} + \frac{1}{20} + \frac{1}{30} + \dots + \frac{1}{n(n+1)} = \dots$ []
a) $\frac{1}{n}$ b) $\frac{1}{n+1}$ c) $\frac{2(n+1)}{n}$ d) $\frac{n}{n+1}$
19. $\frac{1}{1.2} + \frac{1}{2.3} + \frac{1}{3.4} + \dots + \frac{1}{2018.2019} = \dots$ []
a) $\frac{2017}{2018}$ b) $\frac{2018}{2017}$ c) $\frac{2018}{2019}$ d) $\frac{2}{2019}$
20. The simplified value of $\left(1 - \frac{1}{3}\right)\left(1 - \frac{1}{4}\right)\left(1 - \frac{1}{5}\right)\left(1 - \frac{1}{6}\right) \dots \left(1 - \frac{1}{100}\right)$ []
a) $\frac{2}{99}$ b) $\frac{1}{25}$ c) $\frac{1}{50}$ d) $\frac{1}{100}$
21. If $ab + a + b = 524$, $bc + b + c = 146$, $cd + c + d = 104$ then $a - b = \dots$ []
a) 4 b) 6 c) 8 d) 10
22. If $a^2 + 6b = -14$, $b^2 + 8c + 23 = 0$, $c^2 + 4a - 8 = 0$ then $ab + bc + ca = \dots$ []
a) 26 b) 32 c) 16 d) 25
23. 30, 72 and x are three positive integers such that product of any two of them of divisible by third then least value of $x = \dots$ []
a) 60 b) 48 c) 96 d) 84
24. On dividing a certain number by 357, the remainder is 39 on dividing the same number by 17 what will be the remainder ? []
a) 0 b) 3 c) 5 d) 11
25. In a division problem the divisor is ten times the quotient and five times the remainder. If the remainder is 46, the dividend is []
a) 4236 b) 4306 c) 4336 d) 5336
26. $1^3 + 2^3 + 3^3 + 4^3 + \dots + 10^3 = \dots$ []
a) $(55)^2$ b) $(55)^3$ c) 5555 d) 5505

27. Which of the following is a perfect square and cube ? []
 a) $(2018)^2$ b) $(2018)^3$ c) $(2018)^6$ d) $(2018)^8$
28. $\left(\frac{2019^2-1}{2}\right) + \left(\frac{2019^2+1}{2}\right) = \dots\dots$ []
 a) 2018 b) 4036 c) $(2019)^2$ d) $(4038)^2$
29. $1=1^3$; $3+5=2^3$; $7+9+11=3^3$; $13+15+17+19=4^3$ then 10^3 is equal to []
 a) $89+91+93 + \dots\dots + 107$ b) $91+93+ \dots\dots + 109$
 c) $91+92+93+ \dots\dots + 100$ d) $95+97+99+ \dots\dots + 103$
30. Which of the following is not a perfect square ? []
 a) 80371225 b) 80389156 c) 80407089 d) 80425023
31. $a^3 + (a+1)^3 + (a+2)^3 + (a+3)^3 = 100$ then $a^3 = \dots\dots$ []
 a) 4 b) 3 c) 2 d) 1
32. $\sqrt{x-3} = y$ and $\sqrt{y-4} = z$, $\sqrt{z-5} = 2$ then x value []
 a) 6129 b) 6565 c) 7103 d) 7228
33. $2^{11} + 2^8 + 2^n$ is a perfect square then least value of n []
 a) 11 b) 12 c) 13 d) 14
34. $1^2 - 2^2 + 3^2 - 4^2 + 5^2 - 6^2 + \dots\dots + 2017^2 - 2018^2 = \dots\dots$ []
 a) -1009×2009 b) 1008×2018 c) -1009×2018 d) -1008×2018
35. The digit in unit place of $(5+1)(5^2+1)(5^3+1)\dots\dots(5^{2018}+1)$ []
 a) 1 b) 6 c) 5 d) 4
36. $\frac{\sqrt{59.29} - \sqrt{5.29}}{\sqrt{59.29} + \sqrt{5.29}} = \dots\dots$ []
 a) 0.54 b) 0.45 c) 0.56 d) 0.65
37. The area of a square field is $101\frac{1}{400}$ sq.m. Find the length of one side of the field.
 a) $9\frac{11}{20}$ b) $9\frac{9}{20}$ c) $9\frac{19}{20}$ d) $10\frac{1}{20}$ []
38. Three numbers are to one another 2:3:4 the sum of their cubes is 33957. Find the biggest number []
 a) 24 b) 48 c) 28 d) 64
39. $\sqrt[3]{0.125} + \sqrt[3]{0.729} = n \times 0.7$ then n = []
 a) 4 b) 3 c) 2 d) 1

40. If $x^2 + y^2 = 47$ and $xy = \frac{19}{2}$ then the value of $3(x+y)^2 + (x-y)^2$ is []
- a) 170 b) 270 c) 226 d) 86

LEVEL - 2
ANSWERS

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