

Number System Pre Class Notes

All numbers are either real or complex numbers. The real numbers can be either rational or irrational numbers.

Complex Numbers

A Complex Numbers is a combination of a real number and an imaginary number in the form $a + bi$. The real part is a , and b is called the imaginary part.

Examples include $4 + 6i$, $2 + (-5)i$, (often written as $2 - 5i$), $3.2 + 0i$, and $0 + 2i$.

Imaginary Numbers

These are all based on the imaginary number i . This imaginary number is equal to the square root of negative one. Any real number times i is an imaginary number.

Examples include i , $3i$, $-9.3i$, and (πi)

Real Numbers:-

This group is made up of all the Rational and Irrational Numbers.eg- $+8.7$, -1.3 , -256.69

Rational Numbers:-

This is any number that can be expressed as a ratio of two integers.eg- $\frac{x}{y}$. These have terminating or recurring decimal representation.

Irrational Numbers:-

This is any number that can not be express as an integer divided by an integer.

These numbers have decimals that never terminate and never repeat with a pattern.

Examples include **π** , **e** , and the **square root of two**.

Natural Numbers:-

This group of numbers starts at 1. It includes 1, 2, 3, 4, 5, and so on. Zero is not in this group. It has no negative numbers. There are no numbers with decimals.

Whole Numbers:-

This group has all of the Natural Numbers in it plus the number 0. Fractions & negative numbers are not whole number

Integers:-

This group has all the Whole Numbers in it and their opposites.

Eg- $(\dots -3, -2, -1, 0, 1, 2, 3, \dots n)$ are called integers

All integers are divisible by themselves & by 1

Even Numbers:-

The Numbers which are divisible by 2 are called Even numbers. Eg- $2, 4, 6, \dots$

Odd Numbers:-

The Numbers which are not divisible by 2 are called odd numbers. Eg- $1, 3, 5, \dots$

Prime Numbers:-

Number System Pre Class Notes

If a number has no other divisor apart from 1 & itself, then it is called a prime number. Eg - 2,3,5,7...

Composite Numbers:-

The numbers except 1 which are not prime are called Composite Numbers. Eg- 4,6,8,9.....

Facts about Numbers:-

- Odd Number + Odd Number = Even Number
- Odd Number + Even Number = Odd Number
- Even Number + Even Number = Even Number
- Odd Number \times Odd Number = Odd Number
- Odd Number \times Even Number = Even Number
- Even Number \times Even Number = Even Number

Divisibility Test:-

A Number is said to be divisible by another number if the remainder is zero.

- A number is said to be divisible by 2, when its unit digit is Even or 0
- A number is divisible by 3, when the sum of its digits is divisible by 3
- A number is divisible by 4 when the number formed by the last two digits is divisible by 4, or the last two digit are 0
- A number is divisible by 5 when its unit's digit is 5 or 0
- A number is divisible by 6 when it is divisible by 2 & 3 both
- A Number is divisible by 8, when the number formed by the last three right-hand digit is divisible by 8, or when the last three digit is 0.
- A number is divisible by 9 when the sum of its digit is divisible by 9
- A number is divisible by 11 when the difference between the sum of the digits in the odd & the even places is 0, or a multiple of 11. Eg- If a number is abcd, then $[(a+c)-(b+d)]=k$ where $k = 0$ or k is the multiple of 11.
- A number is divisible by 12 when it is divisible by 3 & 4 both.

Factors & Multiples:

If a is divisible by b , then b is a **factor** of a , and a is a **multiple** of b .

For example, $30 = 3 \times 10$, so 3 and 10 are factors of 30 and 30 is a multiple of 3 and 10.

1 is a factor of every number.

Prime Factors:

A factor which is a prime number is called a **prime factor**.

For example, the **prime factorization** of 180 is $2 \times 2 \times 3 \times 3 \times 5$

Highest Common Factor or Greatest Common Factor (HCF or GCF):-

Number System Pre Class Notes

HCF of two or more number is the greatest number that perfectly divides each of them. Eg- 5 is the HCF of 15 & 20.

Lowest Common Multiple:-

LCM of two or more numbers is the least number which is perfectly divisible by each of them. Eg- 57 is a common multiple of 3 & 19.

Common Multiple:-

A common multiple of two or more numbers is a number which is perfectly divisible by each of them. Eg – 45 is a common multiple of 3,5 & 15.

Note-LCM of two Number \times HCF of two numbers = Product of the two Numbers.

LCM of Fractions: $\frac{LCM\ of\ numerator}{HCF\ of\ denominator}$

HCF of fraction: $\frac{HCF\ of\ Numerator}{LCM\ of\ denominator}$

Points to Remember:

- $a^m \times a^n = a^{m+n}$ [Product Law], eg $2^5 \times 2^3 = 2^8$
- $a^m \div a^n = a^{m-n}$ [Quotient Law], eg $2^5 \div 2^3 = 2^2$
- $(a^m)^n = a^{mn}$ [Power Law] eg $(2^5)^3 = 2^{15}$
- $(ab)^m = a^m \cdot b^m$, eg- $(ab)^3 = a^3 \cdot b^3$
- $a^m / n = (a^m)^{1/n} = \sqrt[n]{a^m}$
- $a^0 = 1$
- $a^{-1} = 1/a$

Rules:

- $(x^n + y^n)$ is divisible by $(x + y)$ when n is odd.
- $(x^n - y^n)$ is divisible by $(x + y)$ when n is even & by $(x - y)$. always
- $(x^n - x)$ is divisible by n , if n is prime
- Divisor = $\left(\frac{Divident - Remainder}{Quotient} \right)$
- Factor Test:** To find all of the factors of a number n , test only those natural numbers that are no greater than the square root of the number,
- If a number is divisible by 2 factors, it is also divisible by the **product** of these factors.
Eg-Number 18 is divisible by 2 and 3, so it must be divisible by $2 \times 3 = 6$.