

# B right Career Science A cademy

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Chapter < 1 > **Rational Number:** A number which can be written in the form  $\frac{p}{q}$  where  $p, q \in Z$  and  $q \neq 0$  is called rational number. Example:  $5, \frac{7}{3}$  &  $-\frac{17}{4}$ .

**Irrational Number:** A number which cannot be written in the form  $\frac{p}{q}$  where  $p, q \in Z$  and  $q \neq 0$  is called irrational number. Example:  $\sqrt{5}, \sqrt{7}, \sqrt{12}$  &  $\sqrt{\frac{5}{6}}$ .

**Real Number:** A number that is either rational or irrational is called a real number. i.e.  $R = Q \cup Q'$

**Terminating Decimal:** A decimal that contain finite number of digits in its decimal part is called terminating decimal.

Example:  $0.5, -0.7$  &  $5.373$

**Recurring Decimal:** A decimal having an infinitely repeating digit or group of digits is called recurring decimal.

Example:  $0.\bar{3} = 0.33333\dots$  &  $0.\overline{67} = 0.676767\dots$

**Complex Number:** A Complex number is defined as  $C = \{z = a + bi \wedge a, b \in R\}$  where  $i = \sqrt{-1}$ .

Chapter < 2 > **SET:** Any collection of well define different objects is called set.

**Empty or Null Set:** A set contains no element is called null or empty set. It is denoted by  $\{ \} = \phi$ .

**Order of a set:** The number of elements in a set is called Order of a set.

**Singleton set:** A set having only one element is called singleton set.

**Induction:** A result on the basis of personal experience is called induction.

**Deduction:** A result on the basis of well-known facts is called deduction.

**Proposition:** Any statement which is either true or false but not both is called proposition.

**Tautology:** A statement which is necessarily true for all the cases is called a tautology.

**Absurdity or Contradiction:** A statement which is necessarily false for all cases is called contradiction or absurdity.

**Relation:** Let  $A$  and  $B$  be two non-empty sets then any subset of Cartesian product  $A \times B$  is called relation.

**Function:** A function is rule relating two sets in such a way that each element in the first set corresponds to one and only one element in the second set.

**One-One or Injective function:** A function in which the second elements of the order pair are different is called the One-one or injective function.

**Into function:** If a function  $f: A \rightarrow B$  such that  $Ran(f) \neq B$  then  $f$  is called into function.

**Onto or Surjective function:** If a function  $f: A \rightarrow B$  such that  $Ran(f) = B$  then  $f$  is called onto or surjective function.

**Bijjective Function:** The function which is One-one and onto is called bijjective function.

**Groupoid:** A non-empty set  $G$  in which closure law holds under the binary operation  $*$  is called groupoid.

**Semi group:** A non-empty set  $G$  in which closure and associative laws holds under the binary operation  $*$  is called semi group.

**Monoid:** A non-empty set  $G$  in which closure, associative and identity properties holds under the binary operation  $*$  is called monoid.

**Group:** A non-empty set  $G$  in which closure, associative, identity and inverse properties holds under the binary operation  $*$  is called group.



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**Abelian group:** A non-empty set  $G$  in which closure, associative, identity, inverse and commutative properties holds under the binary operation  $*$  is called Abelian group.

**Finite group:** A group having finite number of elements is called finite group.

**Infinite group:** A group having infinite number of elements is called infinite group.

**Residue classes modulo  $n$ :** When the natural numbers greater or equal to  $n$  are divided by  $n$ , then the remainders are called the Residue classes modulo  $n$ .

Chapter < 3 > **Matrix:** A rectangular array of number enclosed by a pair of bracket is called matrix.

**Row Matrix / vector:** A matrix which has only one row is called row matrix.

**Column Matrix / Vector:** A matrix which has only one column is called column matrix.

**Rectangular Matrix:** A matrix in which the number of row is not equal to the number of columns is called rectangular matrix.

**Square Matrix:** A matrix in which the number of rows is equal to number of columns is called square matrix.

**Diagonal Matrix:** A matrix in which each non-diagonal element is zero is called diagonal matrix.

**Scalar Matrix:** A matrix in which each diagonal element is same constant while the remaining all of its elements are zero is called the scalar matrix.

**Identity or Unit Matrix:** A square matrix in which each diagonal element is 1 (one) while the remaining all of its elements are zero is called unit or identity matrix. It is denoted by  $I$ .

**Null or Zero Matrix:** A matrix in which every element is zero is called zero or null matrix.

**Order of Matrix:** If a matrix has  $m$  rows and  $n$  columns then  $m \times n$  is said to be it's order.

**Transpose of a Matrix:** The transpose of a matrix  $A$  is another matrix obtained by interchanging the rows and columns of  $A$ . it is denoted by  $A^t$ .

**Rank of a Matrix:** The rank of a matrix is equal to number of non-zero rows in it's echelon form.

**Upper Triangular Matrix:** A square matrix  $A$  is said to be an upper triangular matrix if each of it's element below the diagonal is zero.

**Lower Triangular Matrix:** A square matrix  $A$  is said to be an lower triangular matrix if each of its element above the diagonal is zero.

**Consistent:** A system of linear equation is said to be consistent if the system has a unique solution or it has infinitely many solutions.

**Inconsistent:** A system of liner equation is said to be inconsistent if the system has no solution.

**Trivial Solution:** The solution  $(0, 0, 0) = (x_1, x_2, x_3)$  is called trivial solution.

**Non Trivial Solution:** Any solution other then trivial solution is called non-trivial solution.

**Symmetric Matrix:** A square matrix  $A$  is called symmetric if  $A^t = A$ .

**Skew Symmetric Matrix:** A square matrix  $A$  is called skew symmetric if  $A^t = -A$ .

**Hermitian Matrix:** A square matrix  $A$  is called hermitian if  $(\bar{A})^t = A$ .

**Skew Hermitian Matrix:** A Square Matrix  $A$  is called skew hermitian if  $(\bar{A})^t = -A$ .

**Singular Matrix:** A Square Matrix  $A$  is called singular if  $|A| = 0$ .

**Non Singular Matrix:** A Square Matrix  $A$  is called non-singular if  $|A| \neq 0$ .



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Chapter < 4 > **Factor theorem (Statement):** The polynomial  $x - a$  is factor of the polynomial  $f(x)$  if and only if  $f(a) = 0$ .

**Remainder theorem (Statement):** If a polynomial  $f(x)$  of degree  $n$  is divided by  $x - a$  till no  $x$  term exists in the remainder, then  $f(a)$  is the remainder.

Chapter < 5 > **Equation:** A relation in which the equality holds for particular values of variable is called equation. **Examples:**  $x^2 + 7x + 12 = 0$  ,  $x^2 - 9 = 0$ .

**Identity:** A relation in which the equality holds for all values of variable is called identity.

Examples:  $(x+3)(x+4) = x^2 + 7x + 12 = 0$  ,  $x^2 - 9 = (x+3)(x-3)$ .



**Rational Fraction:** The quotient of two polynomials  $\frac{P(x)}{Q(x)}$  where  $Q(x) \neq 0$  with no common factor is called a

rational fraction. **Examples:**  $\frac{x^4}{1-x^4}$  ,  $\frac{1}{1-x^2}$  ,  $\frac{3x^2}{x-2}$ .

**Proper Rational Fraction:** The rational fraction  $\frac{P(x)}{Q(x)}$  is called proper rational fraction if the degree of  $P(x)$  is less

than the degree of  $Q(x)$ . Examples:  $\frac{3}{1-x}$  ,  $\frac{2x-5}{x^2+4}$  ,  $\frac{9x^2}{x^3-1}$ .

**Improper Rational Fraction:** The rational fraction  $\frac{P(x)}{Q(x)}$  is called improper rational fraction if the degree of  $P(x)$  is

equal to or greater than the degree of  $Q(x)$ . Examples:  $\frac{x^4}{1-x^4}$  ,  $\frac{x^2-3}{3x+1}$  ,  $\frac{x^3-x^2+x+1}{x^2+5}$ .

**Partial Fractions:** A rational fraction can be written as a sum of two or more single rational fraction is called partial

fractions. Example:  $\frac{7x+25}{(x+3)(x+4)} = \frac{4}{x+3} + \frac{3}{x+4}$ .

Chapter < 6 > **Sequence:** A sequence is a function whose domain is a subset of natural number.

**Arithmetic Progression or Sequence (A.P.):** A sequence  $\{a_n\}$  is an arithmetic sequence if  $a_n - a_{n-1}$  is same for all terms. Where  $n \in N$  and  $n > 1$ .

**Series:** The sum of the terms of a sequence is called series.

**Geometric Progression or Sequence (G.P.):** A sequence  $\{a_n\}$  is a geometric sequence if  $\frac{a_n}{a_{n-1}}$  is same for all terms.

Where  $n \in N$  and  $n > 1$ .

**Harmonic Progression or Sequence (H.P.):** A sequence of numbers whose reciprocals form an A.P. is called Harmonic progression or sequence.

Chapter < 7 > **Circular Permutation:** The permutation of things which can be represented by the points on a circle are called circular permutation.

**Combinations:** An arrangement of  $n$  different objects taken  $r$  at a time without any order is called a combination of "  $n$  " things taken "  $r$  " at a time. It is denoted by  ${}^n C_r$  or  $\binom{n}{r}$ .

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**Sample Space:** The collection of all possible outcomes of an experiment is called a sample space. It is denoted by  $S$ .

**Event:** A particular outcome of an experiment is called an event. It is denoted by  $E$ .

**Probability:** Probability is the numerical evaluation of a chance that a particular event occur. It is denoted by  $P(E)$  and its value is  $0 \leq P(E) \leq 1$ .

Chapter < 8 > **State “Principle of mathematical induction”:**

If a statement  $S(n)$  satisfies the following conditions:

- (1)  $S(n)$  is true for  $n = 1$ .
- (2)  $S(n)$  is true for  $n = k$  implies that  $S(n)$  is true for  $n = k + 1$ . Then  $S(n)$  is true for all positive integral value of  $n$ .



**Difference between Binomial Theorem and Binomial Series:** The Binomial theorem has finite terms and exponent  $n$  is non-negative integer while the Binomial series has infinite terms and the exponent  $n$  is a negative or fraction.

Chapters < 9 to 14 > **Radian:** Radian is the measure of angle subtended at the center of circle by an arc, whose length is equal to the radius of the circle.

**Fundamental law of the trigonometry:** Let  $\alpha$  and  $\beta$  any two angles then

$\cos(\alpha - \beta) = \cos \alpha \cos \beta + \sin \alpha \sin \beta$  is called Fundamental law of the trigonometry.

**Allied Angles:** The basic angle  $\theta$  associated with right angle or its multiple is called an allied angle.

**Examples:**  $90^\circ \pm \theta$ ,  $180^\circ \pm \theta$ ,  $270^\circ \pm \theta$ ,  $360^\circ \pm \theta$  are allied angles.

**Period:** Period of a trigonometric function is smallest positive number such that the value of the trigonometric function remains unchanged when we add the period to original angle.

**Angle of Elevation:** When an object is at higher level form the observer’s eye then the angle made by the observer’s eye is called an angle of elevation.

**Angle of Depression:** When an object is at lower level form the observer’s eye then the angle made by the observer’s eye is called an angle of depression.

**In-Circle:** The circle inside a triangle touching its three sides is called inscribed circle or in-circle. Its center is called in-center and its radius is called in-radius.

**Escribed Circle:** A circle which touches one side of the triangle externally and the outer two produced sides is called an escribed or ex-circle or e-circle.

**Trigonometric Equation:** The equations containing at least one trigonometric function are called trigonometric equations. Example  $\cos x - 1 = 0$ .

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