

Bright Career Science Academy Narowal

Important Definitions “Calculus & Analytic Geometry” (Math-12)

Chapter No. <1> 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.

Polynomial Function: A function of the form $P(x) = a_0x^0 + a_1x^1 + a_2x^2 + \dots + a_{n-1}x^{n-1} + a_nx^n$ is called polynomial function where $n \in \mathbb{W}$ and $a_0, a_1, a_2, \dots, a_n \in \mathbb{R}$.

Linear Function: A function of the form $f(x) = ax + b$ where $a, b \in \mathbb{R}$ and $a \neq 0$ is called linear function.

Identity Function: A function of the form $f(x) = x$ is called Identity function.

Constant Function: A function of the form $f(x) = c$ where $c \in \mathbb{R}$ is called constant function.

Rational Function: A function of the form $\frac{P(x)}{Q(x)}$ where $P(x)$ and $Q(x)$ are polynomials and $Q(x) \neq 0$ is called rational function.

Exponential Function: A function in which variable appear as power of a constant is called exponential Function. E.g. $y = 2^x$, $y = e^x$.

Logarithmic Function: The functions $f(x) = \log a^x$ and $f(x) = \log e^x$ are called general and natural logarithmic function respectively.

Explicit Function: If y is easily expressed in term of x then y is called an explicit function. E.g. $y = x^2 + 3x$, $y = \sqrt{x^2 + 1}$.

Implicit Function: If y is not expressed in term of x then y is called an implicit function. E.g. $x^2 + xy + y^2 = 4$.

Even Function: A function $f(x)$ is said to be an even function if $f(-x) = f(x)$.

Odd Function: A function $f(x)$ is said to be an odd function if $f(-x) = -f(x)$.

Parametric Function: A function in which x and y are expressed as functions of a third variable is called parametric function.

Inverse Function: Let $f(x)$ be a bijective function from A to B then its inverse is $f^{-1}(x)$ which is onto function from B to A .

Limit Of A Function: Let $f(x)$ be a function if the value of $f(x)$ tend to a fixed number “ L ” as x tends to a then “ L ” is called limit of $f(x)$ as x tends to a . It is written as $\lim_{x \rightarrow a} f(x) = L$.

Continuous Function: A function $f(x)$ is said to be continuous at $x = c$ if:

(i) $f(c)$ is defined (ii) $\lim_{x \rightarrow c} f(x)$ exists (iii) $\lim_{x \rightarrow c} f(x) = f(c)$.

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Discontinuous Function: Any function which is not continuous is called discontinuous function.

Sandwich Theorem: Let f, g and h be functions such that $f(x) \leq g(x) \leq h(x)$, If $\lim_{x \rightarrow c} f(x) = L$ and $\lim_{x \rightarrow c} h(x) = L$ then $\lim_{x \rightarrow c} g(x) = L$.

Chapter No. <2> Derivative: The rate of change of a function with respect to independent variable is called Derivative.

OR The derivative of a function $y = f(x)$ with respect to x is denoted by $\frac{dy}{dx}$ or $f'(x)$ defined as $\frac{dy}{dx} = \lim_{\delta x \rightarrow 0} \frac{\delta y}{\delta x} = \lim_{\delta x \rightarrow 0} \frac{f(x + \delta x) - f(x)}{\delta x}$.

Point Of Inflection: A point at which the function has neither maximum nor minimum value is called point of inflection.

Critical Point: If $f'(c) = 0$ or $f'(c)$ does not exist then the point $(c, f(c))$ is called critical point of $f(x)$.

Stationary Point: Those critical points of $f(x)$ at which $f'(x) = 0$ are called stationary points of $f(x)$.

Increasing Function: A function $f(x)$ is called increasing function if $f'(x) > 0$ for all $x \in (a, b)$.

Decreasing Function: A function $f(x)$ is called decreasing function if $f'(x) < 0$ for all $x \in (a, b)$.

Graphical Meaning Of Derivative: Graphical meaning of derivative is the slope of tangent line to the graph of function at given point.

Chapter No. <3> Integration or Anti-derivative: The process of finding anti derivative is called integration.

OR A function $F(x)$ is an anti-derivative of a function $f(x)$ if $F'(x) = f(x)$ and mathematically written as $\int f(x) dx = F(x) + c$ Where “ c ” is constant of integration.

Definite Integral: If $F'(x) = f(x)$ then definite integral is defined as $\int_a^b f(x) dx = \int_a^b F'(x) dx = [F(x)]_a^b = F(b) - F(a)$.

Fundamental Theorem Of Calculus: IF $f(x)$ is continuous on $[a, b]$ and $F(x)$ is anti-derivative of $f(x)$ then $\int_a^b f(x) dx = F(b) - F(a)$.

Properties Of Definite Integral: (i) $\int_a^b f(x) dx = -\int_b^a f(x) dx$ (ii) $\int_a^b f(x) dx = \int_a^b f(t) dt$.

Graphical Meaning Of Definite Integral: Graphical meaning of definite integral is area under the curve.

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Chapter No. <4> Median: Line segment joining one vertex of a triangle to the mid point of an opposite side of triangle is called median.

Isosceles Triangle: A triangle having two sides are equal is called isosceles triangle.

Equilateral Triangle: A triangle having all sides are equal is called equilateral triangle.

Collinear Points: Points lying on same line are called collinear points.

Trapezium: A quadrilateral having two parallel sides and two non parallel sides is called trapezium.

Inclination Of A Line: The angle made by a line with positive x-axis in anti clock wise direction is called inclination of line.

Declination Of A Line: The angle made by a line with positive x-axis in clock wise direction is called declination of line.

Slope or Gradient: The measure of steepness (تھلوان) is called slope or gradient.

Centroid: The point of concurrency of medians is called centroid.

Ortho Centre: The point of concurrency of altitudes of the triangle is called ortho centre.

Circum Centre: The point of concurrency of right bisectors of the triangle is called circum centre.

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Chapter No. <5> Problem Constraint: Each linear inequality that related to certain problem of everyday life is called problem constraint.

Decision Variable: The variable used in system of linear inequalities relating with the problem are called decision variable.

Feasible Region: The solution region of an inequality restricted to first quadrant is called feasible region.

Feasible Solution: Each point of feasible region is called feasible solution of system of linear inequality.

Feasible Solution set: Set of all feasible solution of the system of linear inequality is called feasible solution set.

Linear Programming: Mathematical techniques in which we get maximize or minimize value of variables of linear function is called linear programming.

Objective Function: A function which is to be maximized or minimized is called objective function.

Optimal Solution: The feasible solution which maximizes or minimizes the objective function is called optimal solution.

Corner Points: Corner points of solution region are called vertex or corner point.

Theorem Of Linear Programming: The theorem of linear programming state that optimal solution of objective function occurs at corner points of feasible region.

Chapter No. <6> Cone: A solid figure generated by a straight line passing through a fixed point and revolving about a fixed line is called cone.

Nappes: Two parts of cone are called nappes.

Circle: "A set of all points in a plane which are equidistant from a fixed point is called circle." The fixed point is called centre and fixed distance is called radius of circle.

Point Circle: A circle whose radius is zero is called point circle.

Parabola: "A set of all points in a plane which are equidistant from fixed point and fixed line." The fixed point is called focus and fixed line is called directrix of parabola.

Ellipse: A set of all points in a plane such that distance of each point from a fixed point bear a constant ratio less then one to the distance from a fixed line.

Hyperbola: A set of all points in a plane such that distance of each point from a fixed point bear a constant ratio greater then one to the distance from a fixed line.

Chapter No. <7> Scalar: A quantity which has magnitude only is called scalar. E.g. time, speed, area, volume, heat and work.

Vector: A quantity which has both magnitude and direction is called vector. E.g. velocity, acceleration, momentum and force.

Unit Vector: A vector whose magnitude is one is called unit vector.

Null or Zero Vector: A vector whose magnitude is zero is called null or zero vector.

Position Vector: A vector whose initial point is at origin "O" and terminal point is at point "P" is called position vector of point "P".

Coplanar Vectors: The vectors lying in the same plane are called the coplanar vectors.

Parallel Vectors: Two vectors \vec{a} and \vec{b} are said to be parallel if $\vec{a} = k\vec{b}$ or $\vec{b} = k\vec{a}$ where k is any scalar number.

Perpendicular or Orthogonal Vectors: Two vectors \vec{a} and \vec{b} are said to be Perpendicular if $\vec{a} \cdot \vec{b} = 0$.

State Parallelogram Law Of Vector Addition: The resultant of two vectors acting along the sides of parallelogram is the diagonal of the parallelogram.

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