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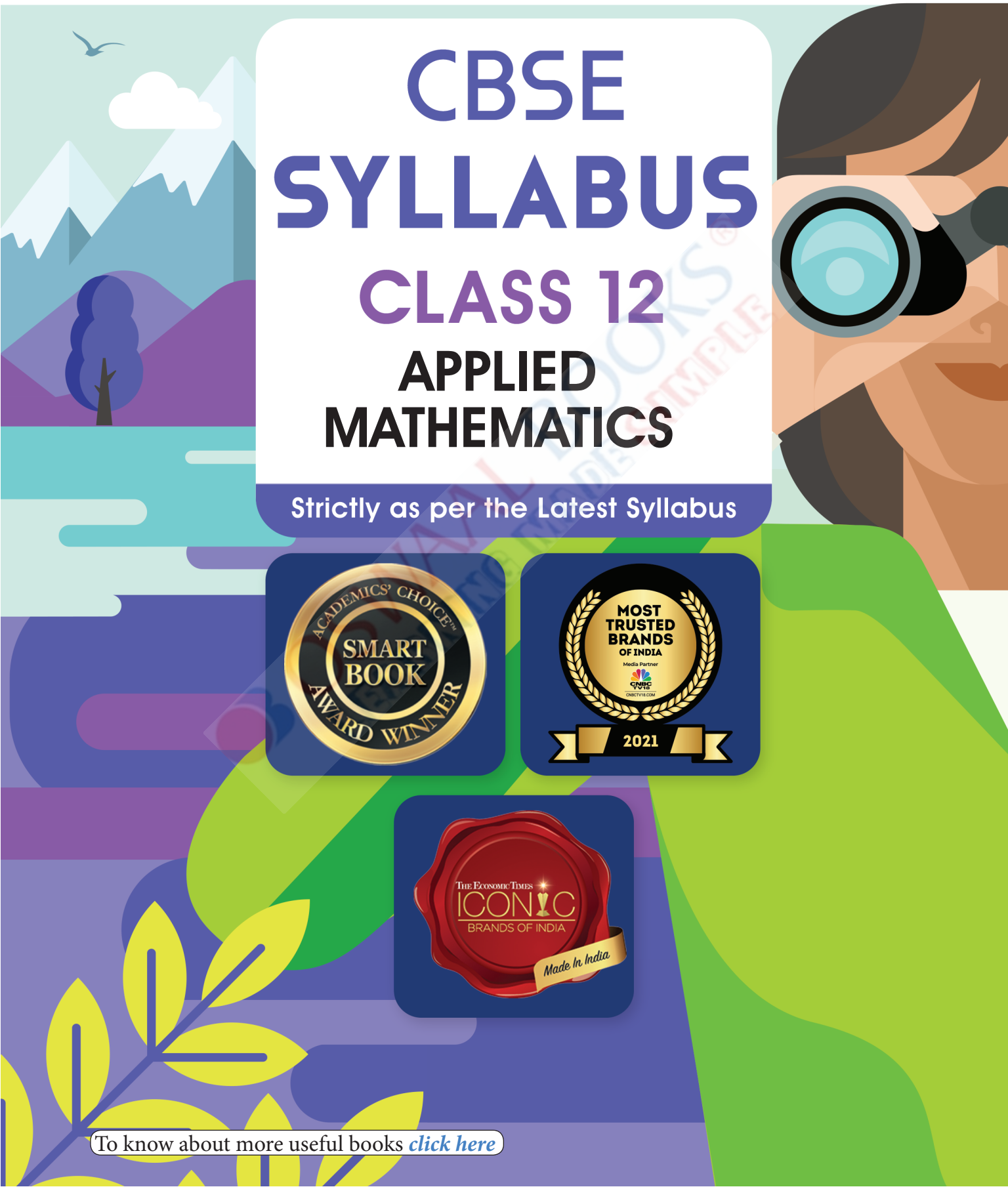
CBSE SYLLABUS

CLASS 12

APPLIED MATHEMATICS

Strictly as per the Latest Syllabus



SYLLABUS

Latest Syllabus
APPLIED MATHEMATICS (Code No.- 055)
CLASS-XII

Number of Paper : **1**
Total number of Periods : **240 (35 Minutes Each)**
Time : **3 Hours**
Max Marks : **80**

No.	Units	No. of Periods	Marks
I	Numbers, Quantification and Numerical Applications	30	09
II	Algebra	20	10
III	Calculus	50	15
IV	Probability Distributions	35	10
V	Inferential Statistics	10	05
VI	Index Numbers and Time-based data	30	10
VII	Financial Mathematics	50	15
VIII	Linear Programming	15	06
	Total	**240**	**80**
	Internal Assessment		**20**

SI. No.	Contents	Learning Outcomes : Students will be able to	Notes / Explanation
UNIT - 1 NUMBERS, QUANTIFICATION AND NUMERICAL APPLICATIONS			
1.1	Modulo Arithmetic	• Define modulus of an integer • Apply arithmetic operations using modular arithmetic rules	• Definition and meaning • Introduction to modulo operator • Modular addition and subtraction
1.2	Congruence Modulo	• Define congruence modulo • Apply the definition in various problems	• Definition and meaning • Solution using congruence modulo • Equivalence class
1.3	Simple Arithmetic Functions	• Define arithmetic function • Enlist different arithmetic functions • Apply the arithmetic functions on given number	Properties and Examples of: (i) Euler totient function (ii) Number of divisor function (iii) Divisor sum function (iv) Mobius function
1.4	Alligation and Mixture	• Understand the rule of alligation to produce a mixture at a given price • Determine the mean price of a mixture • Apply rule of alligation	• Meaning and Application of rule of alligation • Mean price of a mixture
1.5	Numerical Problems	Solve real life problems mathematically	
	Boats and Streams (upstream and downstream)	• Distinguish between upstream and downstream • Express the problem in the form of an equation	• Problems based on speed of stream and the speed of boat in still water

SYLLABUS

	Pipes and Cisterns	• Determine the time taken by two or more pipes to fill or empty the tank	• Calculation of the portion of the tank filled or drained by the pipe(s) in unit time
	Races and Games	• Compare the performance of two players w.r.t. time, distance	• Calculation of the time taken/ distance covered / speed of each player
	Partnership	• Differentiate between active partner and sleeping partner • Determine the gain or loss to be divided among the partners in the ratio of their investment with due consideration of the time	• Definition, Profit division among the partners
	Scheduling	• Define scheduling • Differentiate between FCFS & SJF • Solve problems based on FCFS and SJF	• Definition and meaning • Use of Gantt chart Simple problems based on FCFS (First come First serve) and SJF (shortest job first)
1.6	Numerical Inequalities	• Describe the basic concepts of numerical inequalities • Understand and write numerical inequalities	• Comparison between two statements/situations which can be compared numerically • Application of the techniques of numerical solution of algebraic inequations
UNIT - 2 ALGEBRA			
2.1	Matrices and types of matrices	• Define matrix • Identify different kinds of matrices • Find the size / order of matrices	• The entries, rows and columns of matrices • Present a set of data in a matrix form
2.2	Equality of matrices, Transpose of a matrix, Symmetric and Skew symmetric matrix	• Determine equality of two matrices • Write transpose of given matrix • Define symmetric and skew symmetric matrix	• Examples of transpose of matrix • A square matrix as a sum of symmetric and skew symmetric matrix • Observe that diagonal elements of skew symmetric matrices are always zero
2.3	Algebra of Matrices	• Perform operations like addition & subtraction on matrices of same order • Perform multiplication of two matrices of appropriate order • Perform multiplication of a scalar with matrix	• Addition and Subtraction of matrices • Multiplication of matrices (It can be shown to the students that Matrix multiplication is similar to multiplication of two polynomials) • Multiplication of a matrix with a real number
2.4	Determinants	• Find determinant of a square matrix • Use elementary properties of determinants	• Singular matrix, Non singular matrix • $\|AB\| = \|A\|\|B\|$ • Simple problems to find determinant value

SYLLABUS

2.5	Inverse of a matrix	• Define the inverse of a square matrix • Explain elementary row operations and use to it find the inverse of a matrix • Apply properties of inverse of matrices	• Inverse of a matrix using: (a) cofactors (b) elementary row operations • If A and B are invertible square matrices of same size, (i) $(AB)^{-1} = B^{-1}A^{-1}$ (ii) $(A^{-1})^{-1} = A$ (iii) $(AT)^{-1} = (A^{-1})^{T}$
2.6	Solving system of simultaneous equations using matrix method, Cramer's rule and row reduction method	• Solve the system of simultaneous equations using (i) Cramer's Rule (ii) Inverse of coefficient matrix (iii) Row reduction method • Formulate real life problems into a system of simultaneous linear equations and solve it using these methods	• Solution of system of simultaneous equations upto three variables only (non- homogeneous equations)
2.7	Simple applications of matrices and determinants including Leontiff input output model for two variables	• Apply simple applications of matrices and determinants in different areas of mathematics, physics, coding, encryption etc. • Apply real life applications particularly for Leontiff input output model for two variables in economics	• Real life applications of Matrices and Determinant • Leontiff Input–output model that represents the interdependencies between different sectors of a national economy or different regional economies
UNIT - 3 CALCULUS			
Differentiation and its Applications			
3.1	Higher Order Derivatives	• Determine second and higher order derivatives • Understand differentiation of parametric functions and implicit functions	• Simple problems based on higher order derivatives • Differentiation of parametric functions and implicit functions (upto 2^{nd} order)
3.2	Application of Derivatives	• Determine the rate of change of various quantities • Understand the gradient of tangent and normal to a curve at a given point • Write the equation of tangents and normal to a curve at a given point	• To find the rate of change of quantities such as area and volume with respect to time or its dimension • Gradient / Slope of tangent and normal to the curve • The equation of the tangent and normal to the curve (simple problems only)
3.3	Marginal Cost and Marginal Revenue using derivatives	• Define marginal cost and marginal revenue • Find marginal cost and marginal revenue	• Examples related to marginal cost, marginal revenue, etc.
3.4	Increasing / Decreasing Functions	• Determine whether a function is increasing or decreasing • Determine the conditions for a function to be increasing or decreasing	• Simple problems related to increasing and decreasing behaviour of a function in the given interval

SYLLABUS

3.5	Maxima and Minima	• Determine critical points of the function • Find the point(s) of local maxima and local minima and corresponding local maximum and local minimum values • Find the absolute maximum and absolute minimum value of a function • Solve applied problems	• A point x= c is called the critical point of f if f is defined at c and f′(c)=0 or f is not differentiable at c • To find local maxima and local minima by: (i) First Derivative Test (ii) Second Derivative Test • Contextualized real life problems
Integration and its Applications			
3.6	Integration	• Understand and determine indefinite integrals of simple functions as anti-derivative	• Integration as a reverse process of differentiation • Vocabulary and Notations related to Integration
3.7	Indefinite Integrals as family of curves	• Evaluate indefinite integrals of simple algebraic functions by method of: (i) substitution (ii) partial fraction (iii) by parts	• Simple integrals based on each method (non-trigonometric function)
3.8	Definite Integrals as area under the curve	• Define definite integral as area under the curve • Understand fundamental theorem of Integral calculus and apply it to evaluate the definite integral • Apply properties of definite integrals to solve the problems	• Evaluation of definite integrals using properties
3.9	Application of Integration	• Identify the region representing C.S. and P.S. graphically • Apply the definite integral to find consumer surplus-producer surplus	Problems based on finding • Total cost when Marginal Cost is given • Total Revenue when Marginal Revenue is given • Equilibrium price and equilibrium quantity and hence consumer and producer surplus
Differential Equations and Modeling			
3.10	Differential Equations	• Recognize a differential equation • Find the order and degree of a differential equation	• Definition, order, degree and examples
3.11	Formulating and Solving Differential Equations	• Formulate differential equation • Verify the solution of differential equation • Solve simple differential equation	• Formation of differential equation by eliminating arbitrary constants • Solution of simple differential equations (direct integration only)
3.12	Application of Differential Equations	• Define Growth and Decay Model • Apply the differential equations to solve Growth and Decay Models	• Growth and Decay Model in Biological sciences, Economics and business, etc.

SYLLABUS

UNIT - 4 PROBABILITY DISTRIBUTIONS			
4.1	Probability Distribution	• Understand the concept of Random Variables and its Probability Distributions • Find probability distribution of discrete random variable	• Definition and example of discrete and continuous random variable and their distribution
4.2	Mathematical Expectation	• Apply arithmetic mean of frequency distribution to find the expected value of a random variable	• The expected value of discrete random variable as summation of product of discrete random variable by the probability of its occurrence.
4.3	Variance	• Calculate the Variance and S.D. of a random variable	• Questions based on variance and standard deviation
4.4	Binomial Distribution	• Identify the Bernoulli Trials and apply Binomial Distribution • Evaluate Mean, Variance and S.D of a binomial distribution	• Characteristics of the binomial distribution • Binomial formula: $P(r) = {}^{n}C_{r}\, p^{r}\, q^{n-r}$ Where n = number of trials p = probability of success q = probability of failure Mean = np Variance = npq Standard Deviation = $\sqrt{npq}$
4.5	Poison Distribution	• Understand the Conditions of Poisson Distribution • Evaluate the Mean and Variance of Poisson distribution	• Characteristics of Poisson Probability distribution Poisson formula: $P(x) = \frac{\lambda^{x}.e^{-\lambda}}{x!}$ • Mean = Variance = λ
4.6	Normal Distribution	• Understand normal distribution is a Continuous distribution • Evaluate value of Standard normal variate • Area relationship between Mean and Standard Deviation	• Characteristics of a normal probability distribution • Total area under the curve = total probability = 1 • Standard Normal Variate: $Z = \frac{x-\mu}{\sigma}$ where x = value of the random variable μ = mean σ = S.D.
UNIT - 5 INFERENTIAL STATISTICS			
5.1	Population and Sample	• Define Population and Sample • Differentiate between population and sample • Define a representative sample from a population • Differentiate between a representative and non-representative sample	• Population data from census, economic surveys and other contexts from practical life • Examples of drawing more than one sample set from the same population • Examples of representative and non-representative sample

		• Draw a representative sample using simple random sampling • Draw a representative sample using and systematic random sampling	• Unbiased and biased sampling • Problems based on random sampling using simple random sampling and systematic random sampling (sample size less than 100)
5.2	Parameter and Statistics and Statistical Interferences	• Define Parameter with reference to Population • Define Statistics with reference to Sample • Explain the relation between Parameter and Statistic • Explain the limitation of Statistic to generalize the estimation for population • Interpret the concept of Statistical Significance and Statistical Inferences • State Central Limit Theorem • Explain the relation between Population-Sampling Distribution-Sample	• Conceptual understanding of Parameter and Statistics • Examples of Parameter and Statistic limited to Mean and Standard deviation only • Examples to highlight limitations of generalizing results from sample to population • Only conceptual understanding of Statistical Significance/Statistical Inferences • Only conceptual understanding of Sampling Distribution through simulation and graphs
5.3	t-Test (one sample t-test and two independent groups t-test)	• Define a hypothesis • Differentiate between Null and Alternate hypothesis • Define and calculate degree of freedom • Test Null hypothesis and make inferences using t-test statistic for one group / two independent groups	• Examples and non-examples of Null and Alternate hypothesis (only non-directional alternate hypothesis) • Framing of Null and Alternate hypothesis • Testing a Null Hypothesis to make Statistical Inferences for small sample size • (for small sample size: t- test for one group and two independent groups • Use of t-table
UNIT - 6 INDEX NUMBERS AND TIME BASED DATA			
6.1	Index Numbers	• Define Index numbers as a special type of average	• Meaning and Definition • Utility of Index Numbers
6.2	Construction of Index numbers	• Construct different type of index numbers	• Simple Index numbers • Weighted index numbers
6.3	Test of adequacy of Index numbers	• Apply unit test and time reversal test	• Unit test • Time reversal test
6.4	Time Series	• Identify time series as chronological data	• Meaning and Definition
6.5	Components of Time Series	• Distinguish between different components of time series	• Secular trend • Seasonal variation • Cyclical variation • Irregular variation

SYLLABUS

6.6	Time Series analysis for univariate data	• Solve practical problems based on statistical data and Interpret the result	• Fitting a straight line trend and estimating the value
6.7	Secular Trend	• Understand the long term tendency	• The tendency of the variable to increase or decrease over a long period of time
6.8	Methods of Measuring trend	• Demonstrate the techniques of finding trend by different methods	• Moving Average method • Method of Least Squares
UNIT - 7 FINANCIAL MATHEMATICS			
7.1	Perpetuity, Sinking Funds	• Explain the concept of perpetuity and sinking fund • Calculate perpetuity • Differentiate between sinking fund and saving account	• Meaning of Perpetuity and Sinking Fund • Real life examples of sinking fund • Advantages of Sinking Fund • Sinking Fund vs. Savings account
7.2	Valuation of Bonds	• Define the concept of valuation of bond and related terms • Calculate value of bond using present value approach	• Meaning of Bond Valuation • Terms related to valuation of bond: Coupon rate, Maturity rate and Current price • Bond Valuation Methods: (i) Present Value Approach (ii) Relative Price Approach
7.3	Calculation of EMI	• Explain the concept of EMI • Calculate EMI using various methods	• Methods to calculate EMI: (i) Flat-Rate Method (ii) Reducing-Balance Method • Real life examples to calculate EMI of various types of loans, purchase of assets, etc.
7.4	Calculation of Returns, Nominal Rate of Return	• Explain the concept of rate of return and nominal rate of return • Calculate rate of return and nominal rate of return	• Formula for calculation of Rate of Return, Nominal Rate of Return
7.5	Compound Annual Growth Rate	• Understand the concept of Compound Annual Growth Rate • Differentiate between Compound Annual Growth Rate and Annual Growth Rate • Calculate Compound Annual Growth Rate	• Meaning and use of Compound Annual Growth Rate • Formula for Compound Annual Growth Rate
7.6	Stock, Shares and Debentures	• Explain the concept of stock, shares and debentures • Enlist features related to equity shares and debentures • Interpret case studies related to shares and debentures (Simple Case studies only)	• Meaning of Stock, shares and debentures • Types of Shares and Debentures • Features and advantages of equity shares and debentures • Real life examples of shares & debentures

SYLLABUS

7.7	Linear method of Depreciation	• Define the concept of linear method of Depreciation • Interpret cost, residual value and useful life of an asset from the given information • Calculate depreciation	• Meaning and formula for Linear Method of Depreciation • Advantages and disadvantages of Linear Method
UNIT - 8 LINEAR PROGRAMMING			
8.1	Introduction and related terminology	• Familiarize with terms related to Linear Programming Problem	• Need for framing linear programming problem • Definition of Decision Variable, Constraints, Objective function, Optimization and Non Negative conditions
8.2	Mathematical formulation of Linear Programming Problem	• Formulate Linear Programming Problem	• Set the problem in terms of decision variables, identify the objective function, identify the set of problem constraints, express the problem in terms of inequations
8.3	Different types of Linear Programming Problems	• Identify and formulate different types of LPP	• Formulate various types of LPP's like Manufacturing Problem, Diet Problem, Transportation Problem, etc.
8.4	Graphical method of solution for problems in two variables	• Draw the Graph for a system of linear inequalities involving two variables and to find its solution graphically	• Corner Point Method for the Optimal solution of LPP • Iso-cost/ Iso-profit Method
8.5	Feasible and Infeasible Regions	• Identify feasible, infeasible, bounded and unbounded regions	• Definition and Examples to explain the terms
8.6	Feasible and infeasible solutions, optimal feasible solution	• Understand feasible and infeasible solutions • Find optimal feasible solution	• Problems based on optimization • Examples of finding the solutions by graphical method

Practical: Use of spreadsheet

Graphs of an exponential function, demand and supply functions on Excel and study the nature of function at various points, maxima/minima

Matrix operations using Excel

Suggested practical using the spreadsheet

(i) Plot the graphs of functions on excel and study the graph to find out the point of maxima/minima

(ii) Probability and dice roll simulation

(iii) Matrix multiplication and the inverse of a matrix

(iv) Stock Market data sheet on excel

(v) Collect the data on weather, price, inflation, and pollution analyze the data and make meaningful inferences

(vi) Collect data from newspapers on traffic, sports activities and market trends and use excel to study future trends

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