# Basic Mathematics

- Foundations of Mathematics
  - Mathematical Logic
    - Propositions: True and False
    - Relations: binary, reflexive, symmetric, anti-symmetric, transitive, equivalence
    - Reasoning: inductive, deductive, direct proof, proof by contradiction
    - Axiomatic Method
  - Boolean Algebra
    - Truth Tables
    - De Morgan Laws
  - Set Theory
    - Elements, Void/Empty Set and Universal Set
    - Venn Diagrams
    - Sets Properties
    - Operations with Sets
- Arithmetic
  - Number Theory
  - Number Concepts
    - Numbers as Abstraction
    - Elementary Number Theory: Successions and Congruence
    - Basic Operations with Numbers
    - English and Metric Measurement Systems
    - Odd, Even and Prime Numbers
    - Factors and Multiples
  - Integers
    - Positive and Negative
    - Infinity
    - Geometric Representation
  - Rational Numbers
    - Ratio
    - Basic Operations with Rational Numbers
    - Least Common Denominator
    - Proportions and Properties
    - Percent
  - Irrational Numbers
  - Real Numbers
- Elementary Algebra
  - Algebra as Number Abstraction
  - Fundamental Operations and Properties
  - Monomials and Polynomials
  - Fundamental Operations

- Algebraic Functions
- Linear, Quadratic and Higher Degree Equations and Inequalities
- Systems of Equations and Inequalities
- Radicals and Exponents; Translations
- Progressions: Arithmetic, Geometric, Harmonic, Weighted
- Complex Numbers

- Elementary Geometry
  - 2-dimension space
  - 3-dimension space
  - Properties: Reflection, Rotations, Translation
  - Intersections and Angles: Acute, Obtuse, Right
  - Congruence and Similarity
  - Parallelism and Orthogonality (Perpendicularity)
  - Graphing Points, Lines and Planes
  - Geometric Properties
    - Triangle: right, isosceles, scalene, equilateral, segments, angles, altitude, median, properties
    - Parallelogram, Rectangle, Square
    - Rhombus and Trapezoid
    - Polygons
    - Circle
    - Pyramid
    - Cube
    - Cone
    - Cylinder, Sphere
  - Perimeter / Circumference, Area / Surface, Volume
  - Physical properties: Mass, Time, Temperature
  - Theorems; Pythagorean
  - Geometric Constructions
    - Straight-edge and compass
    - Proving the constructions
  - Euclidean vs. Non-Euclidean Geometry
  - n-dimension space
- Trigonometry
  - Coordinate system, 2- and 3-dimensions
  - Degrees and Radians
  - Six relationships between angles and edges
  - Graphing: period, amplitude, displacement, shift, asymptote
  - Functions
  - Laws of Sinus, Cosines, Tangent and Cotangent
  - Hypergeometric Functions

  - Formulas and Functions
  - Proving Identities
  - Solving Trigonometric Equations and Inequalities
  - Conversion between Rectangular and Polar Coordinate Systems
  - Trigonometric Form of Complex Numbers; DeMoivre's Theorem
- Mathematics of Finance
  - Compound Interest
  - Present Value
  - Future Value
  - Annuities
  - Amortization of Loans
  - The Rule of 78's

# Advanced Mathematics

- Algebra
  - Absolute Value
  - Fractional and Negative Exponents
  - Scientific Notation
  - Quadratic Inequalities
  - Real and Complex Numbers; Properties
  - Logarithms
  - Linear and Abstract Algebra
    - Properties of Groups, Rings and Fields
    - Matrices and Determinants; Inverse and Properties; Operations
    - Vector and Vector Spaces
    - Cramer's Rule
    - Linear Transformations
  - Linear Programming
    - Linear Inequalities
    - Multiple Optimum Solutions
    - Simplex Method
    - Minimization
- Analytical Geometry
  - Cartesian Coordinates
  - Equations of Lines and Planes
  - Calculations: Distance between Points, Lines, and Planes
  - Translation between geometric definition and conic section and its equation
- Calculus
  - Finite vs. Infinity
  - Functions
    - domain
    - range
    - intercepts
    - symmetries
    - intervals
    - increase and decrease in continuity
    - asymptotes
  - Functions
    - Algebraic
    - Trigonometric
    - Logarithmic
    - Exponential
  - Composite and Inverse Functions

  - One-to-one mapping
  - Recursive Functions
  - Graphical Representation and Properties of Functions; Applications
  - Series; Taylor Series
  - Mapping into or onto a Set
  - Convergence of Series; Standard Tests
  - Limits; Continuity
  - Epsilon-Delta Proof
  - Difference between Continuity and Differentiation
  - L'Hospital's Rule
  - Maxima and Minima; Concavity
  - Newton's Method
  - Differentials
  - Relate the derivatives of a function to a limit and to the slope of a curve
  - Least Upper Bound Properties
  - Polar Coordinates
  - Derivatives; properties and applications
  - Chain Rule and Power Rule
  - Higher-Order Derivatives
  - Integrals: properties and applications
  - Standard Derivation and Integration Techniques
  - Integration by Parts, Partial Fractions
  - Integration by Tables
  - Single vs. Multiple Variables Calculus
  - Partial Derivatives
  - Multiple Integrals
  - Numerical Approximations; Estimation and Errors
  - Applications: rates, approximation of roots, calculating areas of plane figures and volumes of solids
- Computer Science and Discrete Mathematics
  - Symbolic Logic
  - Numbering Systems and Conversions
  - Algorithms
  - Pseudocode
  - Data Structures
  - Basic Computer Architecture
  - Problem Solving Process
  - SDLC
  - Simple Computer Programs

# Statistics and Probabilities

- Probabilities
  - Counting Principles
  - Permutations, Arrangements, Combinations
  - Expectations
  - Finite and Continuous Probability
  - Events; Independence
  - Conditional Probability
  - Bayes Formula
  - Binomial Distribution
  - Random Variables
  - Applications
- Statistics
  - Data
  - Representation of Data
  - Histograms, Leaf-and-Stem, Bar and Paretto Charts, Pie Charts, Run Charts
  - Summarization of Data
  - Sample vs. Population
  - Range, Frequency, and Distribution
  - Mean, Mode, Median, as measures of Central Tendency
  - Variations, Deviation, Standard Deviation
  - Sampling Methods and Sampling Distributions
  - Normal Distribution; Properties
  - z-values
  - t-Student values (small samples)
  - Hypothesis Testing: Null and Alternative
  - Types of Errors
  - One- and Two-Tale Test
  - Proportions
  - Sample Size
  - F-values
  - Chi-Square Distribution
  - Correlation: Least Square, Linear, Multi-Linear, Non-Linear
  - Regression
  - Non-normal distributions
  - Non-parametric Methods: Analysis of Ranked Data
  - Index Numbers

- Time Series Analysis
- Decision Making under Uncertainty
- Forecasting
- Statistical Process Control
- Using Calculator and Software Packages

- Management Science
  - Decision making
  - Linear programming
    - Graphical Method
    - Sensitivity Analysis and Computer Solution
    - Applications
    - Simplex Method
    - Simplex-based Sensitivity Analysis
    - Transportation, Assignment, and Transshipment Problems
    - Integer Linear Programming
  - Network Models
  - Project management: PERT/CPM
  - Inventory Models
  - Waiting Line Models
  - Computer Simulation
  - Decision Analysis
  - Multi-criteria Decision Problems
  - Forecasting
  - Markov Process
  - Dynamic Programming
  - Calculus-based Solution Procedures

# Other

- History of Mathematics
- Branches of Mathematics
- Trends
- Professional Journals and Organizations
- Mathematics Education
- Relationship to other domains
- Role of Mathematics
- Pedagogical Issues
  - Teaching Methods
  - Curriculum