**Mathematics and Statistics for Data Science & AI**

1. **Linear Algebra**

* Applications of Linear Algebra with respect to Data Science and AI
  + Data Representation and Manipulation
  + Machine Learning and AI
    - Model Training
    - Dimensionality Reduction
    - Neural Network
  + Computer Graphics
  + Optimization
* Scalars and Vectors
  + Addition of Vectors
  + Multiplication of Vector
  + Vector Database
* Matrices and its operations
  + Matrix Addition and Subtraction
  + Scalar Matrix Multiplication
  + Matrix Multiplication
* Functions and Linear Transformations
  + Vector Transformations
  + Linear Transformations
    - Why Linear Transformations?
    - Linear Transformations Visualization
* Magnitude of Vector and Unit Vector
* Introduction to Projections
* Inverse of a Function
  + Application of Inverse Functions with respect to Data Science and AI
    - Standardization and Normalization
    - Data Distribution
    - Data Encryption and Decryption
  + How to find inverse of Matrix?
* Eigen Value and Eigen Vectors
* Equation of Line, Plane and Hyperplane (n-dimensional plane)

1. **Statistics**

* Introduction to Statistics and Applications with respect to Data Science and Data Analyst
* Population and Sample Data
* Types of Sampling Techniques
* Types of Data
  + Qualitative
    - Discrete
    - Continuous
  + Quantitative
    - Nominal
    - Ordinal
* Scales of Measurements of Data
* Types of Statistics
  + Descriptive Statistics
    - Measure of Central Tendency
      * Mean
      * Median
      * Mode
    - Measure of Dispersion
      * Range
      * Variance
      * Standard Deviation
      * Inter Quartile Range (IQR)
    - Percentile and Quartile
    - 5 Number Summary
    - Histogram and Skewness
    - Covariance and Correlation
    - Probability
    - Probability Distribution Function (PDF)
      * Probability Mass Function (PMF)
      * Probability Density Function (PDF)
      * Cumulative Distribution Function (CDF)
    - Types of Probability Distributions
    - Central Limit Theorem
    - Estimate
  + Inferential Statistics
    - Hypothesis Testing and Its Mechanism
    - P Value – P Table
    - Z Test – Z Table
    - Student T Distribution
    - Type 1 and Type 2 Errors
    - Bayes Statistics – Bayes Theorem
    - Confidence Interval and Margin of Error
    - Chi Square Test – CHI Square Table
      * CHI Square Test for Goodness of Fit
    - ANOVA Test
      * Assumptions in ANOVA
      * Types of ANOVA
      * Hypothesis Testing in ANOVA

1. **Differential Calculus**

* What is Slope and How to Calculate?
* Introduction to Derivatives
  + Mathematical notations of Derivatives with Limits
  + Finding Derivative at a Point
  + Power Rule in Derivatives
  + Derivative Rules
  + Derivatives for Trigonometric, Logarithmic and Exponential Functions
  + Product Rule in Derivatives
  + Chain Rule of Derivatives
  + Application of Derivatives in Deep Learning Neural Network
    - Chain Rule of Derivative during Back Prorogation
* Equation of Tangent of Polynomial

1. Applications of Linear Algebra, Statistics and Differential Calculus

* Simple Linear Regression
  + Cost Function in Regression
  + Convergence Algorithm
* Multiple Linear Regression
  + Performance Matrix
    - R-Squared
    - Adjusted R-Squared
  + Overfitting and Underfitting
* Dimensionality Reduction
  + Curse of Dimensionality
  + Model Performance Degrade
  + Feature Selection and Feature Extraction
* Artificial Neural Network
  + What is Perceptron and Its Working?
  + Multi-layered Neural Network
    - Forward Propagation
    - Backward Propagation and Weight Updating Formula
    - Optimizers