**MATHS FOR DATA SCINECE AND AI**

**Step 1: Basic Arithmetic and Algebra**

1. **Arithmetic Operations:**
   * Addition, subtraction, multiplication, division
   * Fractions, decimals, percentages
2. **Basic Algebra:**
   * Variables and constants
   * Solving linear equations
   * Understanding algebraic expressions

**Step 2: Descriptive Statistics**

1. **Central Tendency:**
   * Mean, median, mode
2. **Dispersion:**
   * Range, variance, standard deviation
3. **Data Visualization:**
   * Histograms, box plots, scatter plots

**Step 3: Probability Theory**

1. **Basic Probability:**
   * Probability rules and axioms
   * Independent and dependent events
2. **Probability Distributions:**
   * Binomial, Poisson, normal distributions
3. **Bayes' Theorem:**
   * Understanding conditional probability
   * Applying Bayes’ theorem

**Step 4: Linear Algebra**

1. **Vectors and Matrices:**
   * Vector operations
   * Matrix operations (addition, multiplication)
2. **Advanced Matrix Operations:**
   * Determinants and inverses
   * Eigenvalues and eigenvectors
3. **Applications in Data Science:**
   * Singular Value Decomposition (SVD)
   * Principal Component Analysis (PCA)

**Step 5: Calculus**

1. **Differentiation:**
   * Basic derivative rules
   * Partial derivatives
2. **Integration:**
   * Basic integration techniques
   * Understanding areas under curves
3. **Optimization:**
   * Gradient, Hessian matrix
   * Gradient descent method

**Step 6: Inferential Statistics**

1. **Sampling Methods:**
   * Types of sampling (random, stratified)
   * Sampling distributions
2. **Hypothesis Testing:**
   * Null and alternative hypotheses
   * t-tests, chi-square tests
3. **Confidence Intervals:**
   * Constructing and interpreting intervals
4. **Significance Levels:**
   * p-values and their interpretation

**Step 7: Regression Analysis**

1. **Linear Regression:**
   * Simple linear regression
   * Multiple regression
2. **Logistic Regression:**
   * Understanding logistic function
   * Applying logistic regression
3. **Regularization:**
   * Ridge and Lasso regression

**Step 8: Multivariate Statistics**

1. **Multivariate Analysis:**
   * Multivariate normal distribution
   * Covariance and correlation matrices
2. **Dimensionality Reduction:**
   * Principal Component Analysis (PCA)
   * Factor analysis

**Step 9: Time Series Analysis**

1. **Components of Time Series:**
   * Trend, seasonality, noise
2. **Modeling Techniques:**
   * Autoregressive models (AR)
   * Moving average models (MA)
   * ARIMA models

**Step 10: Advanced Topics**

1. **Bayesian Statistics:**
   * Prior, likelihood, posterior
   * Markov Chain Monte Carlo (MCMC)
2. **Machine Learning Algorithms:**
   * Support Vector Machines (SVM)
   * Neural networks and backpropagation

**Step 11: Optimization Techniques**

1. **Convex Optimization:**
   * Basic concepts and techniques
2. **Stochastic Optimization:**
   * Simulated annealing
3. **Linear Programming:**
   * Formulating and solving linear programs

**Step 12: Information Theory**

1. **Entropy:**
   * Understanding and calculating entropy
2. **Mutual Information:**
   * Measuring information gain
3. **Kullback-Leibler Divergence:**
   * Comparing probability distributions

**Resources for Learning:**

1. **Online Courses:**
   * Coursera, edX, Udacity for structured learning paths
   * Khan Academy for foundational topics
2. **Books:**
   * "Introduction to Probability" by Dimitri P. Bertsekas and John N. Tsitsiklis
   * "Linear Algebra and Its Applications" by Gilbert Strang
   * "The Elements of Statistical Learning" by Trevor Hastie, Robert Tibshirani, and Jerome Friedman
3. **Practice:**
   * Kaggle for hands-on projects
   * GitHub repositories for code examples

By following these steps and utilizing the resources mentioned, you will build a strong foundation in the mathematics required for data science.