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Topics in Mathematics that you need to learn for Data Science

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Important topics

- Linear Algebra
- Calculus
- Probability and Statistics
- Discrete Math
- Optimization Techniques

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Linear Algebra

This is an essential branch of mathematics for understanding how machine-learning algorithms work on a stream of data to create insight. Eg: It is used in Singular-Value Decomposition, PCA, etc.

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Some topics are:

- Basic properties of Matrix and Vectors
- System of Equations
- Vector Space and Basis
- Eigenvalues and Eigenvectors
- LU Decomposition

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Calculus

Calculus plays an "integral" role in many machine learning algorithms. It is behind the simple-looking solution of an OLSE in linear regression and is even embedded in every back-propagation your neural network makes to learn a new pattern. Eg: It is used in Gradient Descent.

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Some topics are:

- Limit, Continuity and Differentiability
- Maxima and Minima
- Integral and Differential Calculus
- Taylor's series
- Partial different equations

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Probability and Statistics

Many practitioners in the Data Science field consider classical machine learning to be nothing but statistical learning, so statistical concepts cannot be overstated. Eg: It is used to analyse and infer insights from data.

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Some topics are:

- Descriptive Statistics
- Basic and Conditional Probability
- Bayes Theorem
- Probability Distributions
- Hypothesis Testing

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Discrete Math

All modern data science is done with the help of computational systems, and discrete math is at the heart of such systems. It is involved in the daily use of algorithms and data structures in an analytics project. Eg: It is used in Social Network Analysis.

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Some topics are:

- Sets, Subsets and Power Sets
- Combinatorics
- Stacks, Queues, Graphs, Arrays
- Recurrence Relations and Equations
- Growth of Functions

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Optimization Techniques

Every machine-learning algorithm aims to minimize some kind of estimation error subject to various constraints which is an optimization problem. Hence, it is an important, but underrated concept for Data Science. Eg: It is used in calculation of loss function in deep learning algorithms.

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Some topics are:

- Maxima, Minima, Convex Function
- Linear Programming
- Simplex Algorithm
- Randomized Optimisation Techniques
- Constraint Programming

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