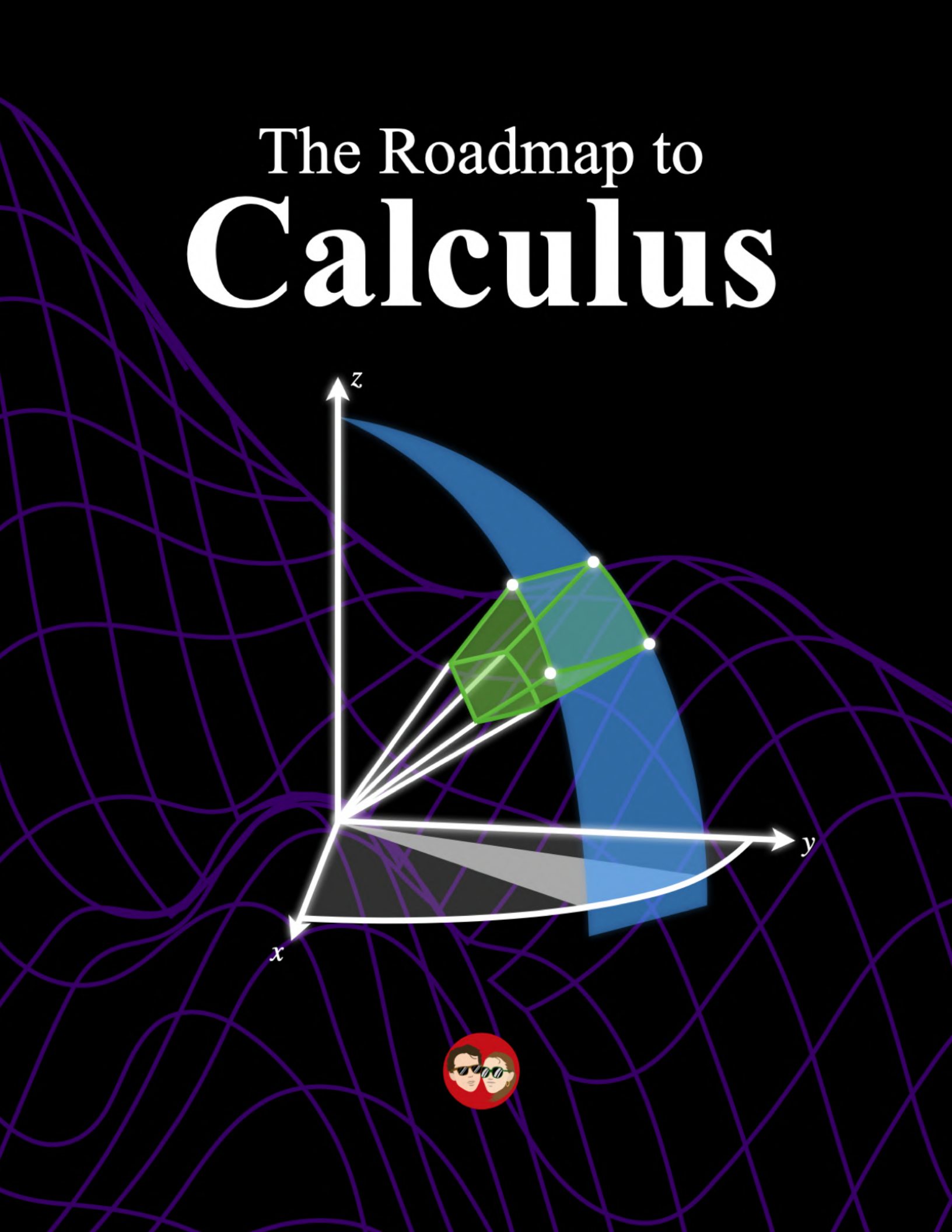
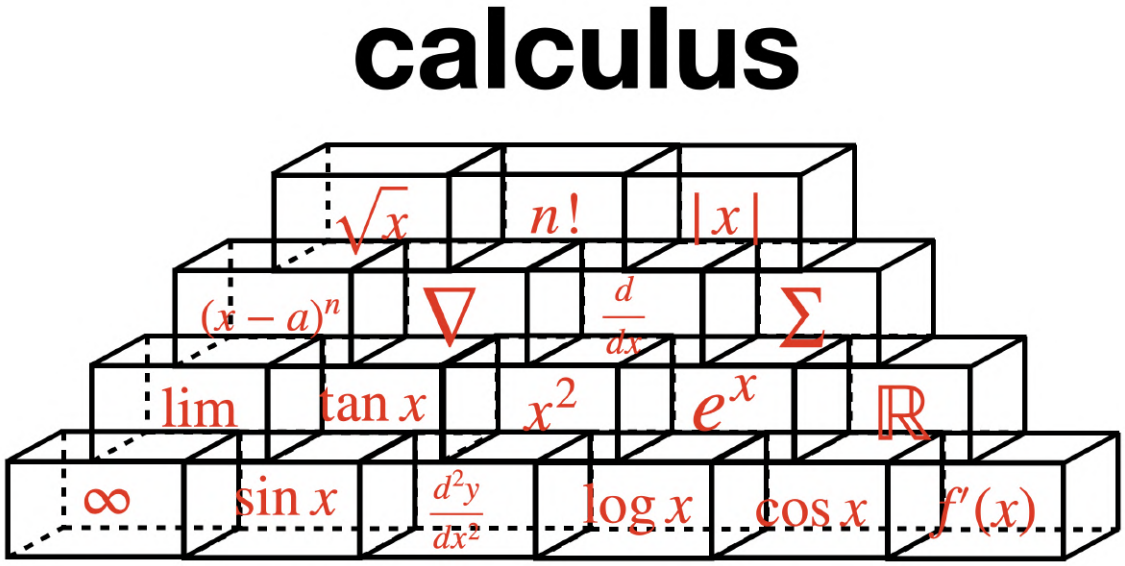
The Roadmap to Calculus



The Roadmap to Master Calculus

by DIBEOS



"The calculus was the first achievement of modern mathematics and it is difficult to overestimate its importance. I think it defines more unequivocally than anything else the inception of modern mathematics; and the system of mathematical analysis, which is its logical development, still constitutes the greatest technical advance in exact thinking." – **John von Neumann**

Do not forget to check out our catalogue of **PDFs right here** You might find something that interests you!

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This PDF is a deeper look at the material discussed in the following YouTube video:

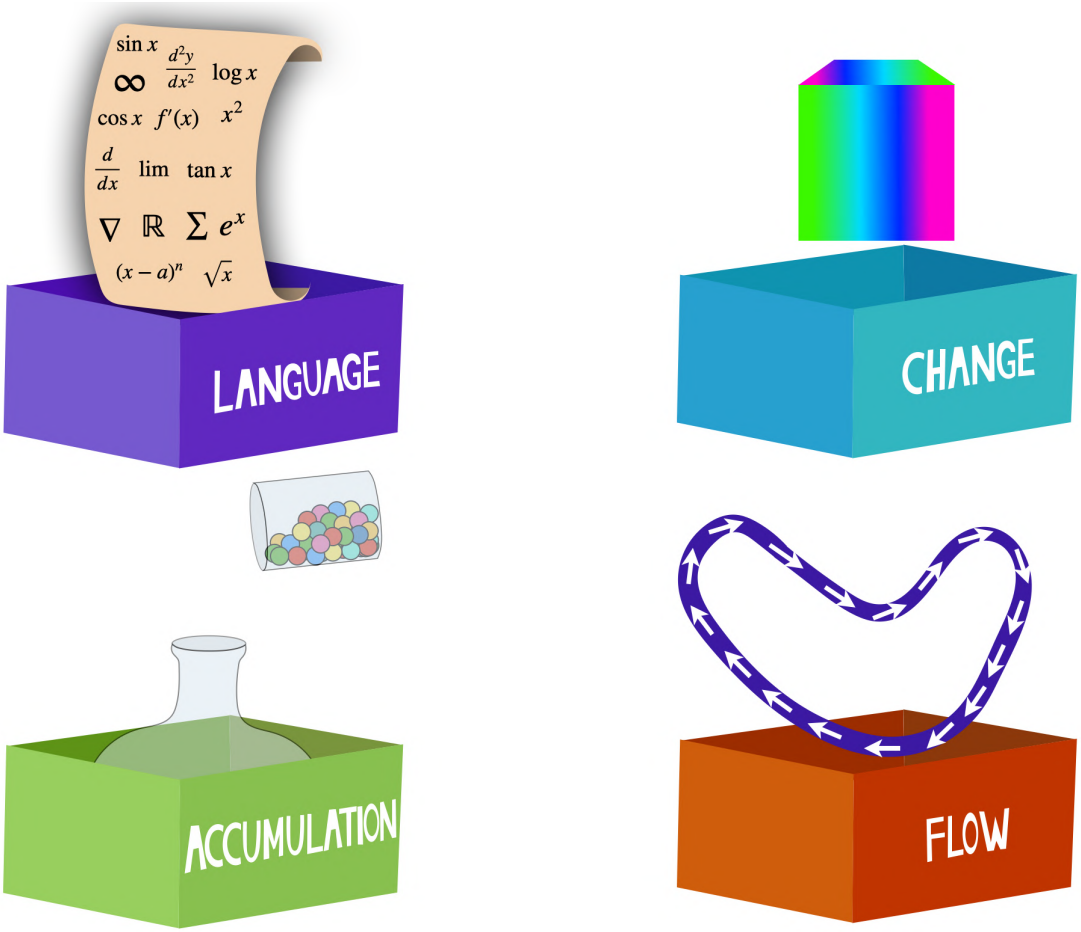
The Roadmap to Master Calculus.

We highly recommend watching the video first to get a basic understanding, and then reading this PDF.

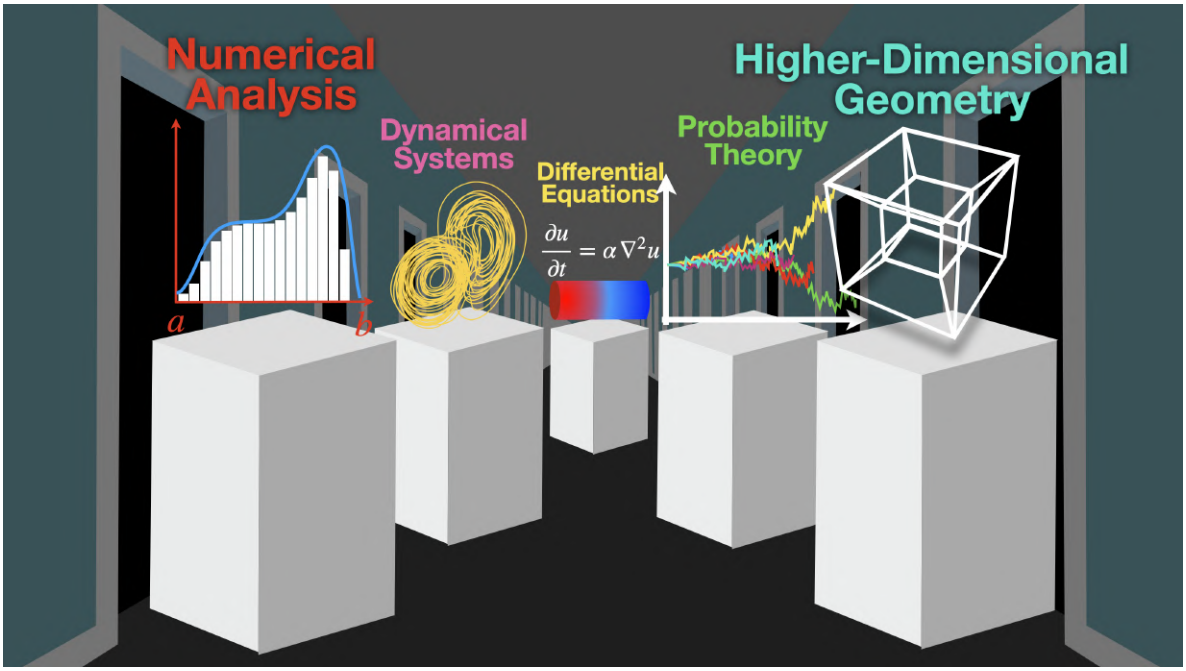
Introduction

Your roadmap to master Calculus can be boiled down to understanding 4 concepts:

1. **Language**
2. **Change**
3. **Accumulation**
4. **Flow**



Learning these concepts will open many interesting doors for you, like the world of **Differential Equations**, **Dynamical Systems**, **Probability Theory**, **Numerical Analysis**, **Higher-Dimensional Geometry**, and more.



Even though this document does not cover all concepts in Calculus (which would require an entire book, to be honest), it will give you a very good overview of what you need to learn in order to master the subject.

Summary

Language

Algebra: equations, systems of equations, inequalities, systems of inequalities (linear, quadratic, rational, exponential and logarithmic).

Functions: domain, image and sketch graphs of functions (polynomial, rational, exponential, logarithmic, piecewise functions).

Trigonometry: unit circle in radians, the main functions (sin, cos, tan), trigonometric identities, and solving trigonometric equations.

Change

Limits: concept of a limit, the 7 indeterminate forms and solving limits.

Derivatives: concept of a derivative, definition of a derivative via limit, power rule, product rule, quotient rule, chain rule.

Applications of Derivatives: optimization problems, sketching graphs of functions, linear approximations, Mean Value Theorem.

Accumulation

Integrals: indefinite integrals, definite integrals, integration techniques (substitution, integration by parts, trigonometric integrals, trigonometric substitution, partial fractions), Riemann sums and Fundamental Theorem of Calculus.

Applications of Integrals: areas between curves, arc lengths, surface areas, work in physics.

Sequences & Series: convergence vs divergence, ratio test, comparison test, alternating series, power series, Taylor series.

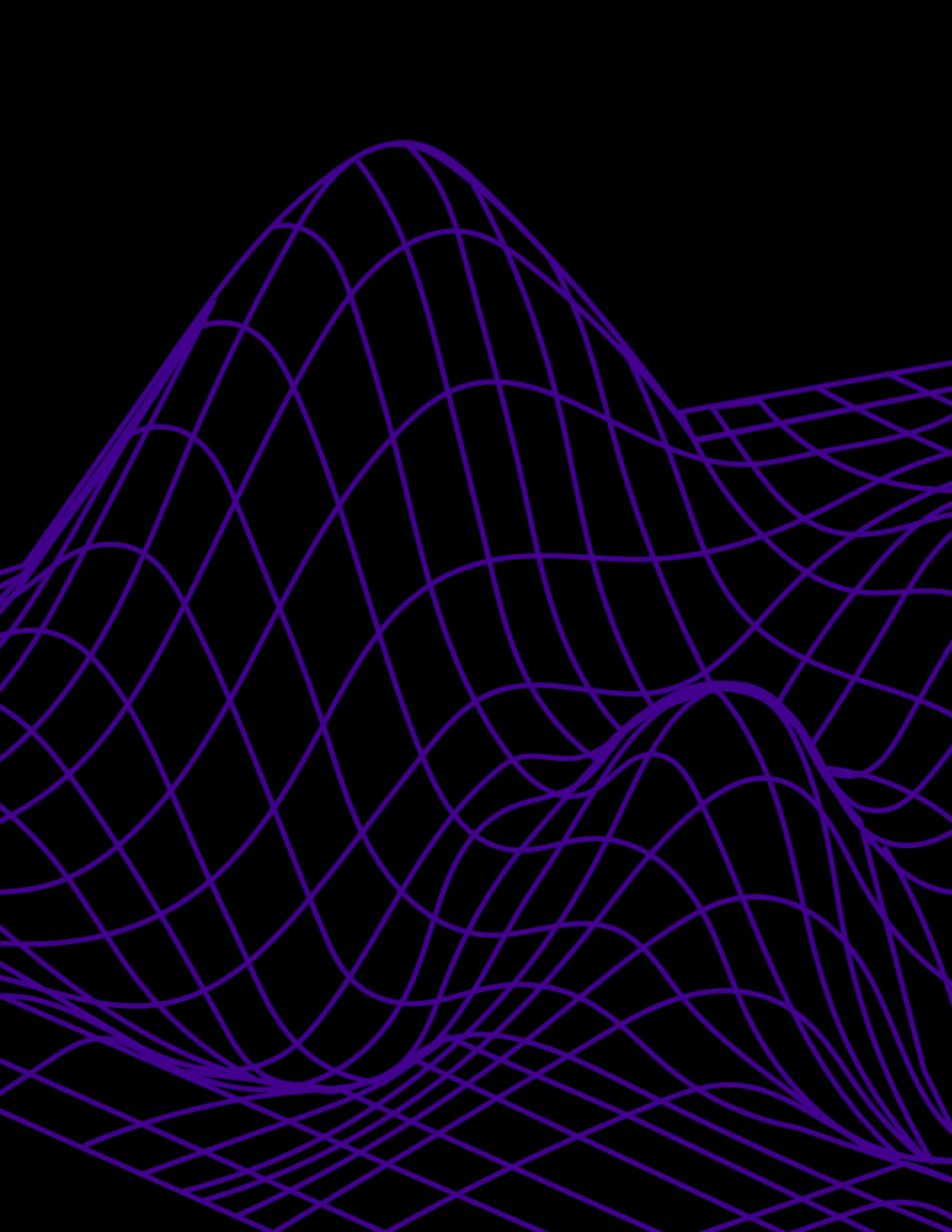
Flow

Vectors & Geometry: 3D coordinate system, dot product, cross product, lines and planes.

Partial Derivatives: functions of multiple variables and their derivatives, gradient, directional derivatives, tangent planes and optimization with constrains (Lagrange multipliers).

Multiple Integrals: double integrals, triple integrals, polar coordinates, cylindrical coordinates and spherical coordinates.

Vector Calculus: vector fields, line integrals, surface integrals, Green's Theorem, Stokes' Theorem and Divergence Theorem.

CLICK HERE TO CONTINUE READING

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