

OSSD - Calculus and Vector

MCV4U

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Unit 1: Limits and the Derivative. The transition from average to instantaneous rates of change. Introduction to the limit operator, continuity, and the formal definition of the derivative from first principles.

Unit 2: Rules of Differentiation. Development of the algebraic machinery for differentiation. The Power, Product, Quotient, and Chain rules are applied to polynomials and rational functions to bypass the limit definition.

Unit 3: Derivatives of Transcendental Functions. Extension of differential calculus to non-algebraic functions. Analysis of the derivatives of sinusoidal, exponential, and logarithmic functions, including applications to composite functions.

Unit 4: Applications of Derivatives. Utilization of the derivative to solve real-world problems. Topics include velocity and acceleration in kinematics, related rates of change, and mathematical optimization problems.

Unit 5: Curve Sketching. A systematic approach to analyzing function behavior. Using the first and second derivatives to determine intervals of increase/decrease, concavity, points of inflection, and asymptotic behavior.

Unit 6: Introduction to Vectors. The shift from scalar to vector quantities. Geometric and algebraic representations of vectors in \mathbb{R}^2 and \mathbb{R}^3 , including operations such as vector addition, scalar multiplication, and the dot and cross products.

Unit 7: Lines and Planes in \mathbb{R}^3 . Analytic geometry in three-dimensional space. Derivation of vector, parametric, and Cartesian equations for lines and planes, and the analysis of their intersections and distances.

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1 Coutunity

1.1 Rate of Change

Theorem 1.1. *When we met our friends*

In reality, this is wrong!

2 Reference Sheet

2.1 Assume Knowledge

2.1.1 Log Laws

$$\log_b A + \log_b B = \log_b (A \times B)$$

$$\log_b \left(\frac{M}{N}\right) = \log_b M - \log_b N$$

$$\log_b M^k = k \log_b M$$

$$\log_b b^k = k$$

$$b^{\log_b k} = k$$

2.1.2 Trig Laws

$$\tan \theta = \frac{\sin \theta}{\cos \theta}$$

$$\cot \theta = \frac{\cos \theta}{\sin \theta}$$

$$\csc \theta = \frac{1}{\sin \theta}$$

$$\sec \theta = \frac{1}{\cos \theta}$$

$$\sin^2 \theta + \cos^2 \theta = 1$$

$$1 + \cot^2 \theta = \csc^2 \theta$$

$$\tan^2 \theta + 1 = \sec^2 \theta$$

$$\sin(A \pm B) = \sin A \cos B \pm \sin B \cos A$$

$$\cos(A \pm B) = \cos A \cos B \mp \sin A \sin B$$

$$\tan(\alpha \pm \beta) = \frac{\tan \alpha \pm \tan \beta}{1 \mp \tan \alpha \tan \beta}$$

sin Law:

$$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$

Cosine Law:

$$a^2 = b^2 + c^2 - 2bc \cos A$$

Unit Circle:

