

Mathematics 9

Multivariable Differential Calculus with Linear Algebra

Overview: This course includes the multivariable calculus material present in Math 8 along with a brief introduction to concepts from linear algebra. First-year students who have successfully completed a BC calculus curriculum in secondary school may complete multivariable calculus either by taking the two-term sequence Math 9, 13 or by taking the single course Math 11.

Topics include vector geometry, equations of lines and planes, matrices and linear transformations, space curves (velocity, acceleration, arclength), functions of several variables (limits and continuity, partial derivatives, the derivative as a linear transformation, tangent planes and linear approximation, the Chain Rule, directional derivatives and applications, and optimization problems including the use of Lagrange multipliers).

Sample Syllabus:

- Week 1: Vectors, dot products, lines and planes
- Week 2: Matrices, systems of linear equations and row reduction
- Week 3: Linear independence/dependence, determinants and their geometric interpretation, cross products
- Week 4: Linear transformations and their matrices, space curves
- Week 5: Vector functions, introduce functions of several variables
- Week 6: Level sets, limits and continuity, partial derivatives
- Week 7: Derivatives of functions of several variables, linear approximation
- Week 8: Chain rule, directional derivatives, gradient
- Week 9: Optimization: Maxima, minima, Lagrange multipliers
- Week 10: Wrap up