18.01 Goals

The basic objective of Calculus is to relate small-scale (differential) quantities to large-scale (integrated) quantities. This is accomplished by means of the Fundamental Theorem of Calculus. Students should demonstrate an understanding of the integral as a cumulative sum, of the derivative as a rate of change, and of the inverse relationship between these operations.

Students completing 18.01 can:

1. Use both the definition of derivative as a limit and the rules of differentiation to differentiate functions.

2. Sketch the graph of a function using asymptotes, critical points, and the derivative test for increasing/decreasing and concavity properties.

3. Set up max/min problems and use differentiation to solve them.

4. Set up related rates problems and use differentiation to solve them.

5. Evaluate integrals by using the Fundamental Theorem of Calculus.

6. Apply integration to compute areas and volumes by slicing, volumes of revolution, arclength, and surface areas of revolution.

7. Evaluate integrals using techniques of integration, such as substitution, inverse substitution, partial fractions and integration by parts.

8. Set up and solve first order differential equations using separation of variables.

9. Use L'Hospital's rule.

10. Determine convergence/divergence of improper integrals, and evaluate convergent improper integrals.

11. Estimate and compare series and integrals to determine convergence.

12. Find the Taylor series expansion of a function near a point, with emphasis on the first two or three terms.