MTH/MATH 252Z Integral Calculus

The following provides a summary of the 2023 Recommendation Report for the CCN Math Subcommittee. Transfer Council recommends that due to changes in course information under OAR 715-025-0065 through 0115, colleges and universities should ensure students' academic progress is not disrupted. Courses completed before CCN changes should count toward graduation, even if requirements shift. Holding students harmless means honoring their efforts, supporting them through transitions, and keeping learning—not compliance—the central focus. CCN course information should be adopted as written. For more detailed information on what can be added to the course description and course learning outcomes, see the CCN Revised Framework and for more general information, see CCN Reports & Memos on the Educator Resources—Common Course Numbering webpage.

Approved CCN Course Information

Date Approved:
October 17, 2024

Catalog Dates:
Required to begin appearing in the 2025-26 catalog.

Review Timeline:

- First Annual Review: Winter 2026
- First Triennial Review: Winter 2027

Course Number and Prefix:
MTH or MATH 252Z

Course Title:
Integral Calculus

Course Credits:
4

Course Description:
This course explores Riemann sums, definite integrals, and indefinite integrals for real-valued functions of a single variable. These topics will be explored graphically, numerically, and symbolically in real-life applications. This course emphasizes abstraction, problem-solving, modeling, reasoning, communication, connections with other disciplines, and the appropriate use of technology.

Course Learning Outcomes:
At the end of the course, students will be able to

1. Approximate definite integrals using Riemann sums and apply this to the concept of accumulation and the definition of the definite integral.
2. Explain and use both parts of the Fundamental Theorem of Calculus.
3. Choose and apply integration techniques including substitution, integration by parts, basic partial fraction decomposition, and numerical techniques to integrate combinations of power, polynomial, rational, exponential, logarithmic, trigonometric, and inverse trigonometric functions.
4. Use the integral to model and solve problems in mathematics involving area, volume, net change, average value, and improper integration.
5. Apply integration techniques to solve a variety of problems, such as work, force, center of mass, or probability.

Review Cycle:

At the end of the course, students will be able to

1. Approximate definite integrals using Riemann sums and apply this to the concept of accumulation and the definition of the definite integral.
    a. Students will be able to express finite sums using sigma notation.
    b. Students will be able to use Riemann sums to describe the process of approximating the net signed area between a curve and an axis.
    c. Students will be able to relate the definite integral with the concept of accumulation of area or other infinitesimal quantities, including the use of appropriate units.
2. Explain and use both parts of the Fundamental Theorem of Calculus.
    a. Students will be able to recognize and express the definite integral as a limit of a Riemann sum.
    b. Students will use and compare different methods for calculating definite integrals, such as linear properties of integrals, net-signed area, and graphical approaches.
    c. Students will explain and apply the concept of indefinite integrals and its connection to antidifferentiation.
    d. Students will explain the connection between derivatives and integrals and apply their understanding using the Fundamental Theorem of Calculus.
3. Choose and apply integration techniques including substitution, integration by parts, basic partial fraction decomposition, and numerical techniques to integrate combinations of power, polynomial, rational, exponential, logarithmic, trigonometric, and inverse trigonometric functions.
    a. Students will be able to integrate power, polynomial, rational, exponential, logarithmic, trigonometric, and inverse trigonometric functions using basic rules.
    b. Students will be able to use substitution and integration by parts to algebraically integrate appropriate combinations of functions.

   c. Students will be able to use partial fraction decomposition to evaluate integrals of rational functions whose denominators may be expressed as products of distinct linear factors.
   d. Students will be able to use numerical techniques, such as Midpoint, Trapezoidal, and Simpson's rules, to approximate definite integrals.
4. Use the integral to model and solve problems in mathematics involving area, volume, net change, average value, and improper integration.
   a. Students will be able to use definite integrals to find the area between two curves.
   b. Students will be able to calculate volumes of solids, such as solids of revolution or prisms, using integrals.
   c. Students will be able to apply the integral to find the average value of a function over an interval.
   d. Students will be able to apply the integral to find the net change of a function over an interval.
   e. Students will be able to recognize, describe, and calculate improper integrals.
5. Apply integration techniques to solve a variety of problems, such as work, force, center of mass, or probability.
   a. Students will apply integration to problems in the instructor's choice of context, including but not limited to the possible options above. At least two distinct applications are recommended based on the population of students in the class.

Review Cycle:

Our annual meetings, likely 6 hours each (split over 2-3 weeks) would be dedicated to discussing faculty and student experience of commonly numbered courses, looking at data collected either by our local institutions or the HECC, and identify areas of improvement and suggested changes to the courses aligned above.

Our triennial workshops, likely 12 hours (perhaps split into 6 weeks, or 2 long days) would be dedicated to more definitive problem-solving and recommendation-making based on the data and experiences referenced above. We believe that a three-year review cycle will be sufficient to keep these courses up-to-date and ensure continued transferability around the state.
