



MATH 275: Multivariable Calculus

Course Syllabus

Summer Session I – 2027

Instructor: Seth Watkins, PhD

Credits: 4

Contact Hours: 60

Prerequisites: Calculus of One Variable II (Calc II) or equivalent

Class Meeting Days & Time: TBD

Office Hours: by appointment after a class or via Zoom (see Moodle site)

Email: *(omitted)*

Course Type: Standard Course

Course Fee: TBA

Course Description

Topics include real valued functions of several variables, multiple integration, differential calculus of functions of several variables, vector field theory.

Learning Outcomes and Assessment Measures

Below are the course's learning outcomes, followed by the methods that will be used to assess students' achievement for each learning outcome. By the end of this course, students will be able to:

- Perform basic vector operations such as the dot product and cross product and utilize these operations in applications.
- Find equations of lines and planes in $\mathbb{R}^3$, and identify basic quadric surfaces and cylinders.
- Evaluate limits, derivatives, and integrals of vector-valued functions of one variable and for the associated curves find arc length, curvature, tangent lines, unit tangent vectors, principle unit normal vectors, and binormal vectors.
- Compute limits, partial derivatives, directional derivatives, and gradients for functions of several variables, and use differentiation to determine tangent planes, relative extrema, and absolute extrema of continuous functions on closed and bounded regions for functions of several variables.
- Use Lagrange multipliers to find extrema of a function subject to one constraint.
- Evaluate multiple integrals in two and three dimensions, in various coordinate systems (Cartesian, polar, cylindrical, and spherical), and apply these integrals to calculate areas, volumes, surface areas, mass, and centers of mass.
- Evaluate scalar line integrals, work integrals, surface integrals and flux integrals directly, and be able to apply the Fundamental Theorem of Calculus for Line Integrals, Green's Theorem, Stokes' Theorem, and the Divergence Theorem appropriately.
- Identify conservative vector fields and find potential functions for conservative vector

Course Materials

Readings

Textbook (optional): *Calculus - Early Transcendentals*, 3rd Edition, by Briggs and Cochran

(ISBN: 97801347663644). The course's Moodle site is the primary location for readings and assignments.

Assessment

Attendance	10%
Homework	60%
Exams	30%

Grading

Students are reminded that it is their responsibility to note the dates of exams and other assignments. No alternative exam dates will be offered and professors are not required to give partial credit for any late work (they do so at their discretion: the Institute's default policy is no extensions and a zero for any work turned in late). Students who book travel when they have an exam or other assessment will have to change their plans or accept a zero. Letter grades for student work are based on the following percentage scale:

Letter Grade Range	Numerical Score Equivalent	Student Performance
A	93% - 100%	Exceptional
A-	90% - 92%	Excellent
B+	87% - 89%	Superior
B	83% - 86%	
B-	80% - 82%	
C+	77% - 79%	Satisfactory
C	73% - 76%	
C-	70% - 72%	
D+	67% - 69%	Low Pass
D	63% - 66%	
D-	60% - 62%	
F	59% or less	Fail (no credit)

Please note: decimal numerals between 1-4 are rounded down while 5-9 are rounded up: e.g., expect 89.4 to be 89.0 while 89.5 to round up to 90.

Course Requirements

Grades are based on the following criteria.

Attendance (10%)

Attendance is an important part of this course. You are allowed 2 unexcused absences per course without penalty, per Institute policy. If you attend all the other meetings, you will receive 10% for this part of your grade. There are no make-ups offered for attendance.

Homework (60%)

These are short assignments that will be completed in class or submitted online. Students can use their notes and work in groups for these assignments.

Exams (30%)

The exams will be administered in class, and students will have to work on them individually with no help from others.

Extension & Submitting Late Work

Work submitted after the deadline will receive a grade of zero, not partial credit. Each student is allowed one extension of 24 hours over the entire semester. This can be used for any assignment but the final project. Students need to email the instructor before the deadline and inform the instructor of their use of the extension. Any work submitted after the 24-hour extension will be marked zero.

As for all policies, exceptions can be made by the Director for students with special accommodations or in case of medical emergencies, etc.

Attendance Policy

Attendance is expected and mandatory for classroom times and co-curricular activities. The first two absences per course due to illness will be considered excused “sick days” and do not require medical documentation. To receive additional excused absences due to illness, students are required to see a local physician or request a letter from an Institute-approved doctor documenting they should be excused from class for illness.

Unexcused absences will adversely affect a student’s academic performance and will result in a reduction of the student’s final course grade by 4% per absence up to a maximum of 10%. Excessive unexcused absences (4 or more, not including the excused “sick day”) may lead to receiving a failing grade or disciplinary action. It is the student’s responsibility to be aware of the number of absences or late arrivals for each course, and to ask the instructor when in doubt.

If students miss class, they are responsible for obtaining class notes from other students and/or for meeting the professor during office hours. Any work missed in class because of an excused absence may be made up within one week of the return to the class. Any work missed that was a quiz or other test must be made up outside of class time and will, in the interest of intellectual honesty, be a slightly different test than the one given in class.

Presence during mandatory field trips is especially important.

Legitimate reasons for an excused absence or tardiness includes: death in immediate family, religious observances, illness or injury, local inclement weather, medical appointments that cannot be rescheduled.

Students who request an approved absence to observe a religious holiday must submit a formal request to the Institute’s Director within one week after the add/drop period when course schedules, including any field trips, are finalized. No exceptions will be made after this deadline.

Except in the case of medical emergencies, absences are not accepted when tests are scheduled; tests cannot be made up. Furthermore, scheduled times and dates indicated for exams, quizzes, oral presentations, and any other graded assignments cannot be changed for any reason. Even if more sections of the same class are activated, students may only take exams during the scheduled times and dates for the section they are enrolled in.

Tardiness Policy

Students are expected to attend all classes punctually. Any student arriving up to 15 minutes late or leaving up to 15 minutes earlier than the scheduled class end time will be marked as tardy. Each incident of tardiness (late arrivals to or early departures from class) is 1% off the final grade. However, should a student arrive more than 15 minutes late or depart more than 15 minutes before the conclusion of the class, it will be recorded as an absence.

Students are also expected to remain in class during the time of instruction except for a reasonable amount of time to use the restroom. Students who leave class and do not return during the class session will receive an unexcused absence or late penalty.

Academic Integrity

All forms of cheating (i.e., copying during exam either from a fellow student or making unauthorized use of notes) and plagiarism (i.e., presenting the ideas or words of another person for academic evaluation without acknowledging the source) will be handled according to the Institute Academic Policy, which can be found in the Umbra Institute Academic Policies and Conduct Guidelines.

Utilizing ChatGPT or other artificial intelligence (AI) tools for the generation of content submitted by a student as their own as part of any assignment for academic credit at the Institute constitutes a form of plagiarism.

Should the Institute become aware of a student’s use of such platforms and services, the student will be subject to the same consequences and judicial proceedings as are in place for plagiarism (defined above).

Classroom Policy

Students are expected to follow the policy of the Institute and demonstrate the appropriate respect for the historical premises that the school occupies. Students are not allowed to use their cell phones, ear buds, or laptops while in class or during co-curricular events and activities, unless otherwise specified in the course syllabus or expressly permitted by the instructor for special learning. This policy also applies to earbuds and headsets. Students who do not respect these rules will be subject to disciplinary warnings and probation, be given an unexcused absence from class, and other disciplinary action including dismissal from the course.

Moodle

Please note that Moodle, not this syllabus, is the ultimate reference for due dates, assignment prompts, and course announcements. It is *the student's responsibility* to check the site regularly to be aware of announcements as well as to see and record all due dates for assignments.

Schedule of Topics, Readings, and Exams

Note: On Moodle the student will find a detailed description of each day's topics and specific pages for the reading.

WEEK 1—VECTORS AND GEOMETRY OF SPACE

Meeting 1: Vectors (sections 13.1 and 13.2)

Meeting 1: Dot Product (section 13.3)

Meeting 1: Cross Product (section 13.4)

Meeting 1: Lines and Planes in Space (section 13.5), Exam 1

Reading: Chapter 13.

WEEK 2—VECTOR-VALUED FUNCTIONS

Meeting 1: Vector-Valued Functions (sections 14.1 and 14.2)

Meeting 1: Motion in Space (section 14.3)

Meeting 1: Length of Curves (section 14.4)

Meeting 1: Curvature and Normal Vectors (section 14.5), Exam 2

Reading: Chapter 14.

WEEK 3—FUNCTIONS OF SEVERAL VARIABLES

Meeting 1: Graphs, Limits, and Continuity (sections 15.1 and 15.2)

Meeting 1: Partial Derivatives and the Chain Rule (sections 15.3 and 15.4)

Meeting 1: The Gradient and Tangent Planes (sections 15.5 and 15.6)

Meeting 1: Maximum/Minimum Problems (sections 15.7 and 15.8), Exam 3

Reading: Chapter 15.

WEEK 4—MULTIPLE INTEGRATION

Meeting 1: Double Integrals (sections 16.1 and 16.2)

Meeting 1: Double Integrals with Polar Coordinates (sections 16.3)

Meeting 1: Triple Integrals (section 16.4)

Meeting 1: Triple Integrals with Cylindrical and Spherical Coordinates (section 16.5), Exam 4

Reading: Chapter 16.

WEEK 5—VECTOR CALCULUS

Meeting 1: Vector Fields and Line Integrals (sections 17.1 and 17.2)

Meeting 1: Conservative Vector Fields and Green's Theorem (sections 17.3 and 17.4)

Meeting 1: Divergence, Curl, and Surface Integrals (sections 17.5 and 17.6)

Meeting 1: Stoke's Theorem and Divergence Theorem (sections 17.7 and 17.8), Exam 5

Reading: Chapter 17.