

MATH 3404 – Multivariate Calculus

Fall 2021

Instructor: Dr. Kassie Archer

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Office hours: Thursday, 9-12 (subject to change for certain weeks). Zoom link posted on Canvas.

Scheduled lectures:

Section 029

MWF, 10:30 A.M. – 11:45 A.M.

Location: RBN 4039

Course Information

Course Webpage: All course information and documents will be available on Canvas.

Textbook: *Essential Calculus: Early Transcendentals (Second Edition)* by James Stewart. (ISBN: 978-1-133-11228-0)

Prerequisites: A grade of C or better in Calculus II (MATH 2414 or equivalent).

Course Description

Vector calculus in Euclidean n -space, functions of several variables, partial differentiation and multiple integration.

Student Learning Outcomes

Upon completion of this course, students should be able to do the following:

- Use vectors to describe lines, planes, and curves in three-dimensional Euclidean space.
- Compute velocity, acceleration, curvature, and arc length along curves in space.
- Apply the operations of calculus to compute limits and derivatives of multivariable functions.
- Use derivatives to find maxima and minima of multivariable functions in both constrained and unconstrained settings.
- Set up and compute iterated integrals (i.e., double and triple integrals) of multivariable functions in rectangular, cylindrical, and spherical coordinates.
- Set up and compute line integrals and surface integrals of vector fields in two- and three-dimensional Euclidean space.
- Use the Fundamental Theorem of Line Integrals, Green's Theorem, Stokes's Theorem, and the Divergence Theorem to simplify the computation of line and surface integrals.
- Solve assorted real-world problems using all the techniques of multivariable calculus.

Assignments and Grading

Homework

Homework will be posted on Canvas. Homework will not be turned in but it is important for you to do it to learn and understand the material.

Quizzes and Other Assignments

There will be weekly quizzes and occasionally other assignments (sometimes in-class, sometimes take-home).

Exams

There will be three exams given during the semester, with each covering approximately four weeks of material. The tentative dates are:

- **Exam 1:** September 17
- **Exam 2:** October 15
- **Exam 3:** November 12

In addition, you will take a comprehensive final exam at the conclusion of the semester. Unless otherwise stated, the final exam will cover all of the material from the semester.

Grading

Your grade will be computed as listed on the left below and the grading scale will be no more harsh than that listed below on the right.

| Assignment | Total % |
|-------------------------------------|----------------------|
| Quizzes, Assignments, Participation | 16 |
| Exams | $18\% \times 3 = 54$ |
| Final exam | 30 |
| Total | 100 |

| Numerical | Letter |
|-----------|--------|
| 90 – 100 | A |
| 80 – 89 | B |
| 70 – 79 | C |
| 60 – 69 | D |
| Below 60 | F |

Course Policies

Canvas

You must activate your Canvas account and check it regularly. You can activate your account and log in at <https://www.uttyler.edu/canvas>. If you are registered for the course, then you should already have access to the Canvas page. All announcements and important documents will be posted there.

Attendance and Make-Up Policy

Attendance is very important for doing well in the course. However, if you are sick and/or are experiencing any COVID-19 symptoms, please stay home. Send me an email if this happens and we will figure out make-ups, note sharing, etc.

For absences not related to COVID-19 (such as official UT Tyler activities), let me know beforehand that you will be missing class so we can plan around it.

Cell Phones, Calculators, and Electronic Devices

When class is about to begin, place any electronic devices (e.g., cell phones) in silent mode and put them out of sight. You may use a laptop or tablet to take notes or consult the textbook (if you have the electronic version). If you are using these devices for other purposes, I will ask you to put them away. No calculators of any kind are allowed on exams.

COVID-19 Mitigation

As of August 2021, the city of Tyler is in a high-transmission area for COVID-19. Per CDC guidelines, it is strongly recommended that you wear a facial covering during class meetings *regardless of your vaccination status*.

Changes to Syllabus

I reserve the right to make changes to the syllabus during the semester. Any changes to course policies will be announced in class, and an updated version of the syllabus will be posted to Canvas.

Important Dates

- **August 23:** Classes begin.
- **September 3:** Census date. Last day to change schedule or file for grade replacement.
- **September 6:** Labor Day holiday. No class.
- **November 1:** Last day to withdraw.
- **November 22–27:** Thanksgiving break. No classes.
- **December 6:** Study day.
- **December 7-10:** Final exam week.

University Policies

Information on University policies concerning the following topics:

- UT Tyler Honor Code
- Students Rights and Responsibilities
- Campus Carry

- UT Tyler Tobacco-Free Policy
- Grade Replacement/Forgiveness and Census Date
- State-Mandated Course Drop Policy
- Student Accessibility and Resources
- Student Absence due to Religious Observance
- Student Absence for University-Sponsored Events and Activities
- Social Security and FERPA Statement
- Emergency Exits and Evacuation
- Student Standards of Academic Conduct
- UT Tyler Resources for Students

can be found at

<https://www.uttyler.edu/academic-affairs/files/syllabuspolicy.pdf>

Tentative Daily Schedule

This schedule is subject to change as we move through the semester, though we should follow it pretty closely (barring any unforeseen circumstances).

| Week | Date | Topics covered | Textbook |
|------|-------|--|----------|
| 1 | 8/23 | Overview of multivariable calculus. The geometry of three-dimensional Euclidean space. | §10.1 |
| | 8/25 | Vectors. | §10.2 |
| | 8/27 | The dot product, length, and distance. | §10.3 |
| 2 | 8/30 | Determinants and the cross product. | §10.4 |
| | 9/1 | Lines and planes in \mathbb{R}^3 . | §10.5 |
| | 9/3 | Cylinders and quadric surfaces. | §10.6 |
| 3 | 9/6 | Labor Day – no class. | |
| | 9/8 | Vector functions and space curves. | §10.7 |
| | 9/10 | Arc length and curvature. | §10.8 |
| 4 | 9/13 | Application to physics: motion in three-dimensional space. | §10.9 |
| | 9/15 | Functions of several variables. | §11.1 |
| | 9/17 | Exam 1 | |
| 5 | 9/20 | Limits and continuity for functions of several variables. | §11.2 |
| | 9/22 | Partial derivatives. | §11.3 |
| | 9/24 | Tangent planes and linear approximations. | 11.4 |
| 6 | 9/27 | The multivariable Chain Rule. | §11.5 |
| | 9/29 | Directional derivatives and the gradient of a function. | §11.6 |
| | 10/1 | Maxima and minima of multivariable functions. | §11.7 |
| 7 | 10/4 | Constrained optimization and Lagrange multipliers. | §11.8 |
| | 10/6 | Double integrals over rectangles. | §12.1 |
| | 10/8 | Double integrals over general regions. | §12.2 |
| 8 | 10/11 | Double integrals in polar coordinates. | §12.3 |
| | 10/13 | Applications of double integrals. | §12.4 |
| | 10/15 | Exam 2 | |
| 9 | 10/18 | Triple integrals. | §12.5 |
| | 10/20 | Triple integrals. | §12.5 |
| | 10/22 | Triple integrals in cylindrical coordinates. | §12.6 |
| 10 | 10/25 | Triple integrals in spherical coordinates. | §12.7 |
| | 10/27 | The change of variables formula for multiple integrals. | §12.8 |
| | 10/29 | Vector fields. | §13.1 |
| 11 | 11/1 | Line integrals. | §13.2 |
| | 11/3 | Line integrals. | §13.2 |

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|----|-------|---|-------|
| | 11/5 | The Fundamental Theorem of Calculus for line integrals. | §13.3 |
| 12 | 11/8 | Green's Theorem. | §13.4 |
| | 11/10 | Curl and divergence. | §13.5 |
| | 11/12 | Exam 3 | |
| 13 | 11/15 | Parametric surfaces. | §13.6 |
| | 11/17 | Surface integrals. | §13.7 |
| | 11/19 | Stokes's Theorem. | §13.8 |
| 14 | 11/22 | Thanksgiving break – no classes | |
| 15 | 11/29 | Stokes's Theorem. | §13.8 |
| | 12/1 | The Divergence Theorem. | §13.9 |
| | 12/3 | Summary of the Stokes family of theorems. | |
| | 12/10 | Final Exam | |