# Mathematics 253X F02: Calculus III
# Fall 2005

**Instructor:** John Rhodes

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**Office Hours:** M 11:45-12:45, T 9:15-10:15, F 9:15-10:15, and by appointment

**Web page:** `https://jarhodesuaf.github.io/M253.html`

**Prerequisites:** Math 252X

**Credit Hours:** 4.0

**Required Text:** Calculus (standard or 'early transcendentals') or Multivariable Calculus, 8th ed., by J. Stewart, Brooks/Cole, Chapters 12-16 only

**Required Online Access:** WebAssign

**Class Meetings:** M T W F 8:00-9:00 in 208 Gruening

**In-class Hour Exams:** Friday, September 27; Monday, October 28

**Final Exam:** 1 - 3 p.m., Tuesday, December 10 (Note: This is NOT the standard final time for the class meeting time; it is a special time for multi-section math classes.)

**Catalog Description:** Multivariable calculus. Topics include vectors in 2- and 3-dimensions; differential calculus of functions of several variables; multiple integration; vector calculus, including Green's and Stokes' Theorem; and applications.

**Course overview and goals:**

Though you have must have completed a year of college-level calculus to be in this course, you've only seen the subject used in very special circumstances. Most importantly, you have dealt with derivatives and integrals only of functions of one variable.

In the real world, most things do not depend on just one variable. For instance, the temperature at any point in space might depend on the 3 variables giving the coordinates of the point. Moving from point to point in any of the $x$-, $y$-, or $z$-directions may produce a change in temperature. For a situation such as this, what do we mean by a derivative?, an integral?

In a slightly different direction, consider a planet orbiting the sun. While the planet's position is a function of time, it really has three components (the $x$-, $y$-, and $z$- coordinates), so we need three functions of the sort appearing in

Calculus I and II to in order to talk about 'the' position function. What should a derivative mean for this sort of three-fold function, and how might it occur in an integral?

Our goal for the semester is to extend your knowledge of calculus into the two- and three-dimensional settings that naturally occur in many situations in the sciences. This builds strongly on the material from Math 251 and 252, as we will ultimately see all the methods of calculating derivatives and integrals learned there can be used in this new multidimensional setting. However, understanding how these methods apply requires developing new conceptual frameworks.

This material is essential for further study in mathematics, the physical sciences, and engineering. It also appears often in some branches of economics and the biological sciences as well.

Finally, be warned that understanding two and three dimensions mathematically is harder for many people than they might at first expect. You will have to think hard about the material. It is challenging, but also very rewarding.

**Mechanics of the course:**

The class will be run as an interactive lecture. That means that while I will be presenting material at the board (and you should be taking notes), I will also be asking for suggestions, ideas, and questions about the material as we go along. I don't expect 'correct' answers, but I do expect you to be actively following and participating — that makes the class more interesting for us all.

Online homework in WebAssign will be assigned daily. Ideally you will do it before the next class, although you will have two days to do it before late penalties apply. Written homework will also be assigned on most days, but will only be collected each XXXday. Selected problems will be graded by a teaching assistant, with the entire assignment checked for completeness.

I will typically begin each class by asking if there are questions about the last lecture and its homework assignment. That means you should review notes and make at least an initial attempt on homework problems before the next class meeting. While it never hurts to ask, in general I will defer questions about any earlier assignment to my office hours, in order to keep the course moving along.

Although I will not formally take roll, regular class attendance is expected. If you miss a class, you should get notes from another student, and can find homework assignments posted on the course web page.

Short surprise quizzes will be given randomly, about once per week. These will typically take 10-15 minutes and be similar to recent homework. These serve two primary purposes 1) to encourage you to be present in every class and 2) to ensure that you stay current with the homework. If you expect to miss a class, you should talk to me in advance about having any potential quiz waived — you must have a good reason and, except in emergencies, you cannot get retroactive approval.

I encourage you to work with others on the homework, but you must *write up solutions independently.* You will learn nothing from simply copying someone's

solution. Even though you may find you can't do every problem, you must make a reasonable attempt on them all.

I will not accept *any* late homework that has not been cleared ahead of time or is not due to a genuine emergency (e.g., a death in the family).

For missed examinations that are not approved in advance, no make-up exams will be given except in extreme circumstances (e.g., family death, documented illness, etc.)

**Grades:**

Your performance will be evaluated based on 10% quizzes, 10% written homework, 10% WebAssign 20% first midterm exam, 20% second midterm exam, 30% final exam.

Course grades will be determined according to the following cutoffs:

$$A \geq 90\%,$$
$$B \geq 80\%,$$
$$C \geq 70\%,$$
$$D \geq 60\%,$$

with $+/-$ assigned to the lowest and highest 3 points in each grade range.

I reserve the right to move the grade cutoff points downward if particular exams turn out to be unexpectedly difficult. Note that you are not in competition with your peers – everyone in the class may get an $A$, or everyone may get an $F$.

**Tutoring:**

You are encouraged to use the free, walk-in tutoring offered in the Math Lab in Chapman 305. Hours will be posted on the door, and at:

`https://uaf.edu/dms/mathlab/`

**Calculators:**

I have no strong feelings on whether you use a calculator when doing homework. As long as you are sure you have the skills to do all calculations by hand, it is fine for you to use technology as a time saver. However, *no calculators will be allowed on any examinations or quizzes.* This will ensure that testing conditions are equal for everyone.

**University and Department Policies:**

Your work in this course is governed by the UAF Honor Code. The Department of Mathematics and Statistics has specific policies on incompletes, late withdrawals, and early final exams which can be found at

`http://www.dms.uaf.edu/dms/Policies.html`.

If you have any disabilities that I should know about, you should bring them to my attention soon so that we can work with the Office of Disability Services to set up any necessary accommodations.

## Tentative Schedule

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| Week 1 | Aug. 26 – Aug. 30 | Chapter 12: two- and three-dimensional space, vectors, dot products, cross products |
| Week 2 | Sept. 2 – Sept. 6 | Chapter 12: LABOR DAY, lines and planes, quadric surfaces |
| Week 3 | Sept. 9 – Sept. 13 | Chapter 12: Polar, cylindrical and spherical coordinates, and Chapter 13: Vector-valued functions |
| Week 4 | Sept. 16 – Sept. 20 | Chapter 13: Derivative and integrals of vector functions, curves and arc length, velocity and acceleration |
| Week 5 | Sept. 23 – Sept. 27 | Chapter 14: Functions of several variables, limits and continuity, partial derivatives, EXAM 1 Friday (Chapters 12 and 13) |
| Week 6 | Sept. 30 – Oct. 4 | Chapter 14: Linear approximations and tangent planes, the chain rule |
| Week 7 | Oct. 7 – Oct. 11 | Chapter 14: Gradients and directional derivatives, optimization, Lagrange multipliers |
| Week 8 | Oct. 14 – Oct. 18 | Chapter 15: Integrals over 2-d regions, iterated integrals, integrals in polar coordinates |
| Week 9 | Oct. 21 – Oct. 24 | Chapter 15: Applications of double integrals, surface area |
| Week 10 | Oct. 28 – Nov. 1 | EXAM 2 Monday (Chapters 14 and part of 15); Chapter 15: Integrals over 3-d regions, integrals in cylindrical and spherical coordinates |
| Week 11 | Nov. 4 – Nov. 8 | Chapter 15: Change of variables in integrals, and Chapter 16: vector fields |
| Week 12 | Nov. 11 – Nov. 15 | Chapter 16: line integrals and path independence, |
| Week 13 | Nov. 18 – Nov. 22 | Chapter 16: Green's Theorem, curl, divergence |
| Week 14 | Nov. 25 – Nov. 29 | Chapter 16: Stokes' Theorem and the Divergence Theorem (if time permits), THANKSGIVING |
| Week 15 | Dec. 2 – Dec. 6 | Chapter 16: Stokes' Theorem and the Divergence Theorem (if time permits), final review |