MATH 201

Multivariable Calculus

Semester 3 Spring 2022

Lectures:	MoTuWeTh: 13:15--14:30
Recitations:	MoWe 7:15—8:15
Academic credit:	4 DKU credits

Instructor's information

Dr. Lin Jiu: Lecturer of Mathematics, Duke Kunshan University
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Wednesday 20:00—21:00 Online 952 7201 2990
or by appointment

Teaching Assistants (for recitation, WeBWork, & Mathematica)

Edward Yue Heng.Yue@dukekunshan.edu.cn
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ZOOM PASSCODE: MATH201

What is this course about?

This course is a continuation of MATH 101/105 in which essential topics and concepts of single variable calculus are introduced. We live in a three-dimensional world. Whether to fully understand Kepler's Laws of planetary motion discovered four hundred years ago, or the two linked, intertwined parallel helixes as the structure of the DNA molecule discovered in the 1950s, whether to calculate atmospheric pressure at a given time which is a function of longitude and latitude, or to find the rate of fluid flow across a surface, and to answer many more questions in physical and social life sciences related to multi-dimensional structures, multivariable calculus is the course to start from. Main topics of this course include vectors and vector functions, the geometry of higher dimensional Euclidean spaces, partial derivatives, multiple integrals, line integrals, vector fields, Green's Theorem, Stokes' Theorem and the Divergence Theorem.

What background knowledge do I need before taking this course?

Prerequisite: MATH 101/105.

What will I learn in this course?

Upon successful completion of the course, students will be able to

- Parametrize plane and space curves, surfaces.
- Curves in polar coordinates
- Interpret real-world situations in terms of related multivariable calculus concepts.
- Understand the concept of vectors and its connection to physics, apply operations on vectors

- Algebraically and geometrically, calculate the dot product and the cross product of vectors.
- Develop analytical and computational skills required for working with lines, curves, planes, and surfaces in space
- Find limits, partial derivatives, directional derivatives, tangent plane, linear approximation and the gradient of functions of several variables
- Understand the definitions of double integrals, triple integrals, line integrals, and surface integrals;
- Recognize and implement appropriate techniques to evaluate them, and apply them to solve
- Apply the Fundamental Theorem of Line Integrals, Green's Theorem, Stokes' Theorem, and the Divergence Theorem, to simplify integration problems.

What will I do in this course?

The course will be comprised of video lectures, synchronous meetings dedicated to problem solving and lecturing, assigned readings, homework, and exams.

How can I prepare for the class sessions to be successful?

To succeed, students should be prepared to devote several hours to this course on a daily basis. They are strongly encouraged to use the online tutoring resources of ARC, to work with classmates, and to contact instructors in a timely manner for additional help as needed.

What required texts, materials, and equipment will I need?

" Calculus, Volume III " , by OpenSTAX.
Find it HERE or on Sakai/Resources

What optional texts or resources might be helpful?

Any multivariate calculus book can be used as a supplement for more practice problems.

How will my grade be determined?

1. Homework: 24% (=4%×6)
    - HW1 due Apr. 02 23:59
    - HW2 due Apr. 09 23:59
    - HW3 due Apr. 16 23:59
    - HW4 due Apr. 23 23:59
    - HW5 due Apr. 30 23:59
    - HW6 due May 07 23:59
    - HW7 due May 11 23:59
2. Quizzes: 8%(=2%×4)
3. Formula Sheet: 1%
4. Mathematica Project: 12%
5. Midterm: 20% Apr. 13 & 14 Lecture Time
6. Final exam: 35%

Please refer to the following scale for your grading. *This is also subject to change, based on the overall performances of the whole class.*

A+= 98.00% - 100%**;** **A** = 93.00 - 97.99%%; **A-** = 90.00% - 92.99%;
B+=87.00% - 89.99%; **B** = 83.00% - 86.99%; **B-** = 80.00% - 82.99%;
C+=77.00% - 79.99%; **C** = 73.00% - 76.99%; **C-** = 70.00% - 72.99%;
D+=67.00% - 69.99%; **D** = 63.00% - 66.99%; **D-** = 60.00% - 62.99%;
F =59.99% and below.

Remarks: In case of documented illness or family emergency or documented University sponsored trips, you may miss the midterm, but the supporting documentation must be submitted to the instructor in advance. With the document, your missing midterm score can be counted as the same as your final. Do remember: let me know **BEFORE** the exam. An unexcused absence from any exam will be counted as a zero.

Homework. Weekly homework will be assigned each Thursday and will be due on the following Saturday mindnight, except for the last week. *We will use the **WeBWork system** for homework assignments*. **No late homework will be accepted**. Each homework problem set is worth 4% and the LOWEST one will be dropped.

Quiz. Weekly quiz will be assigned each week during the last lecture day of each week, except for the weeks of Midterm and the 1st week. Each quiz will be counted 2% and the LOWEST one will be dropped.

Midterm. The midterm is scheduled in the 4th week and it will be separated into two parts:

- The first part is assigned via WeBWorK, during the first 25 mins of the lecture on April 13th; (5%)
- and the second written part is on April 14th, lecture time. (15%)

Midterm covers all the materials from Week 1 to Week 3.

Final Exam. **May 12th, 2022, 16:00—18:00,** (**AB 2107** well…. Just in case)
Due to the current situation, the final exam will be online and open-book. (Therefore, the 2% of formula sheets is added to the project). An announcement will be made in the 7th week, on more details about the final exam. It will be on Sakai->Tests&&Quizzes (instead of Gradescope, though I will grade your submissions via Gradescope).

Formula Sheet. You are REQUIRED to prepare ONE piece of formula sheet for the midterm, and it can have at maximum an A4 size, double sided. **Brining more pieces or larger size of sheets, will be considered as cheating, and leads to 0 for the corresponding test**. This piece is worth 1%. Note that this is not automatically given: if you failed or forgot to turn in your formula sheet, you will lose the point.

Mathematica Project. We shall form 10 groups, with each group consisting of 3-4 students. A list of projects will be given in the 4th week and each group should pick one by the end of 5th week. First come first served. The deadline for submitting the programming file **is May 14th, NOON**. **Plagiarism of the code will lead to 0 for the project**.

What are the course policies?

Collaboration with peers on homework is allowed, but solutions are to be written individually. You are not allowed to use other books/online resources. Late homework will not be accepted.

We do not give make-up exams for any reason if you miss a midterm exam. Thus, missing an exam is a very serious matter. An unexcused delay in taking any exam will be counted as a zero. Excuses may be accepted, at the discretion of the instructor, and any alternative arrangements must be made well in advance.

Academic Integrity:
As a student, you should abide by the academic honesty standard of the Duke Kunshan University. Its community Standard states: "Duke Kunshan University is a community comprised of individuals from diverse cultures and backgrounds. We are dedicated to scholarship, leadership, and service and to the principles of honesty, fairness, respect, and accountability. Members of this community commit to reflecting upon and upholding these principles in all academic and non-academic endeavors, and to protecting and promoting a culture of integrity and trust." For all graded work, students should pledge that they have neither given nor received any unacknowledged aid.

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Academic Policy & Procedures:
You are responsible for knowing and adhering to academic policy and procedures as published in University Bulletin and Student Handbook. Please note, an incident of behavioral infraction or academic dishonesty (cheating on a test, plagiarizing, etc.) will result in immediate action from me, in consultation with university administration (e.g., Dean of Undergraduate Studies, Student Conduct, Academic Advising). Please visit the Undergraduate Studies website for additional guidance related to academic policy and procedures. Academic integrity is everyone's responsibility.

Academic Disruptive Behavior and Community Standard:
Please avoid all forms of disruptive behavior, including but not limited to: verbal or physical threats, repeated obscenities, unreasonable interference with class discussion, making/receiving personal phone calls, text messages or pages during class, excessive tardiness, leaving and entering class frequently without notice of illness or other extenuating circumstances, and persisting in disruptive personal conversations with other class members. Please turn off phones, pagers, etc. during class unless instructed otherwise. If you choose not to adhere to these standards, I will take action in consultation with university administration (e.g., Dean of Undergraduate Studies, Student Conduct, Academic Advising).

Academic Accommodations:
If you need to request accommodation for a disability, you need a signed accommodation plan from Campus Health Services, and you need to provide a copy of that plan to me. Visit the Office of Student Affairs website for additional information and instruction related to accommodations.

What campus resources can help me during this course?

Academic Advising and Student Support
Please consult with me about appropriate course preparation and readiness strategies, as needed. Consult your academic advisors on course performance (i.e., poor grades) and academic decisions (e.g., course

changes, incompletes, withdrawals) to ensure you stay on track with degree and graduation requirements. In addition to advisors, staff in the Academic Resource Center can provide recommendations on academic success strategies (e.g., tutoring, coaching, student learning preferences). Please visit the Office of Undergraduate Advising website for additional information related to academic advising and student support services.

Writing and Language Studio

For additional help with academic writing—and more generally with language learning—you are welcome to make an appointment with the Writing and Language Studio (WLS). You can register for an account, make an appointment, and learn more about WLS services, policies, and events on the WLS website. You can also find writing and language learning resources on the Writing & Language Studio Sakai site.

IT Support

If you are experiencing technical difficulties, please contact IT:

- China-based faculty/staff/students 400-816-7100, (+86) 0512- 3665-7100
- US-based faculty/staff/students (+1) 919-660-1810
- International-based faculty/staff/students can use either telephone option (recommend using tools like Skype calling)
- Live Chat: https://oit.duke.edu/help
- Email: service-desk@dukekunshan.edu.cn

What is the expected course schedule?

Tentative, Subject to Change

Week 1 **(Mar. 21—Mar. 24)**	● Parametric Equations ● Calculus of Parametric Curves ● Polar Coordinates
Week 2 **(Mar. 28—Apr. 2)**	● Vectors ● Dot product ● Cross product ● Equations of lines and planes ● Vectors functions and space curves ● Derivatives and integrals of vector functions ● Arc lengthArc length function and parametrization with respect to arc length ● Curvature

Week 3 **(Apr. 6—Apr. 7)**	● Motion in space: velocity and acceleration ● Functions of several variables ● Limits and continuity ● 1st Order Partial derivatives
Week 4 **(Apr. 11—Apr. 14)**	● Higher-order Partial derivatives ● Tangent planes and linear approximations ● The Chain Rule ● Directional derivatives and the gradient vector ● Maximum and minimum values ● Lagrange multipliers **Midterm: April 13th and 14th**
Week 5 **(Apr. 18—Apr. 21)**	● Double integrals over rectangles ● Iterated integrals ● Double integrals over general regions ● Double integrals in polar coordinates ● Applications of double integrals (only for normal distributions) ● Triple integrals ● Triple integrals in cylindrical coordinates ● Triple integrals in spherical coordinates
Week 6 **(Apr. 25—Apr. 28)**	● Triple integrals in spherical coordinates ● Vector fields ● Line integrals ● The fundamental theorem for line integrals ● Green's Theorem
Week 7 **(May 4—May 7)**	● Parametric surfaces and their areas ● Surface integrals ● Curl and divergence

	• Stokes' Theorem • The Divergence Theorem

Final Exam

May 12th, 2022, 16:00—18:00, AB 2107