



Worcester Polytechnic Institute

MA 1024 Calculus IV E24
Mathematics Department
E Term 2024

Professor: Michael R. Johnson, PhD (Associate Teaching Professor, Mathematics Department)

Email: mrjohn@wpi.edu

Phone: 508-831-5134

Office Location: Online via Zoom

Assistant: Andrey Martemyanov (TA) (amartemyanov@wpi.edu)

Evan Sayer (TA)

(egsayer@wpi.edu)

Class Format:

Lectures None – asynchronous lectures are posted online via short videos.

Office Hours M, 2:00-3:00pm, R, 5:30-6:30pm (Prof. Johnson)

T, 5:00-6:30pm, W 4:00-5:30pm (TA: Andrey)

F, 2:00-4:00pm (TA: Evan)

Lab R 2:30-3:40pm (TA: Andrey)

Discussion R 1:00-2:10pm (TA: Andrey)

- Videos and Notes covering topics of our conventional Calculus IV course are provided.
- Lab and Discussion recorded for those who cannot be there in person.

Textbook (and/or other Required Materials):

Text: OpenStax Calculus Volume 3, Gilbert Strang and Edwin Herman,

ISBN-13: 978-1-947172-16-6, Updated 2024

Course software: Webwork – Find link through Assignments on Canvas course page.

Course Description:

<https://www.wpi.edu/pages/syllabus-ma-1021-1024-using-herman-and-strang>

Chapter 2: Quadratic Surfaces (6) & Cylindrical and Spherical Coordinates (7)

Chapter 4: Partial Differentiation Chapter 5: Multiple Integrals

Chapter 6: Vector Fields (1) & Line Integrals (2)

This course introduces Multivariable Calculus. Topics include vector functions, partial derivatives and gradient, multivariable optimization, double and triple integrals, cylindrical and spherical coordinates, and other coordinate systems and applications.

Learning Outcomes:

- Sketch graphs of multivariable functions and relate to limits, rates of change, and extrema in three-dimensional perspective.
- Construct partial derivatives and infer their meaning through vectors to directional application. Use concept for tangent planes and linear approximation.
- Employ analogies of differential and integral calculus techniques to a multivariable context.
- Construct integration bounds over areas and volumes. Apply integration techniques of substitution and integration by parts to multivariable integration.
- Extend polar variables to three-dimensions. Formulate integral models through further use of cylindrical and spherical coordinate systems. Adapting coordinate linear transformation using the Jacobian.



Worcester Polytechnic Institute

Office Hours:

Prof. Johnson (mjohn@wpi.edu): M 2-3:00pm, R 5:30-6:30pm online (follow Canvas Zoom link).
Andrey Martemyanov (amartemyanov@wpi.edu): T 5-6:30pm, W, 4-5:30pm online

Course Site:

canvas.wpi.edu links you to the course page.

- **Announcements** update you through the steps of the class.
- **Assignments** will correspond with your due dates and give you upload options.
- **Modules** will contain weekly plan documents that trace you from one topic to the next. The class notes and asynchronous recordings will also be available under **Modules**.
- Access office hours through **Zoom**.

Course Requirements:

1. Grade Determination Breakdown

A 90-100, B and C.

A score greater than 80 earns at least a B and above 70 is at least a C. Scaling can occur depending on the difficulty of exams. A passing grade (C) will scale no lower than a 65.

Exams 65%

Test 1: Date F, 6/7 Chapter 2.6, 4 25-30%

Test 2: Date T, 6/25 Chapter 5 35-40%

- Exams will be proctored via Zoom - requiring a working camera that is continuously on.
- Open notes/book: no calculator, no websites or software.
- Missing an exam is only excused under reasons clarified with me first.

Labs 15%

Provides instruction on use of software for Calculus applications. Topics include level curves of quadratic surfaces, critical point analysis and graphical examination of multivariable functions, and Riemann sums for volume estimation. Work by yourself or with one partner.

Lab 1: 3D Graphs and Traces with Desmos: Instruction R, May 23th – due R, 5/30

Lab 2: Second Derivative Test with MATLAB: Instruction R, May 30th – due T, 6/11

Lab 3: Riemann Sums with Data: Instruction R, June 13th – due R, 6/20

Students registered to labs receive synchronous instruction on Thursdays 2:30-3:40pm in the first week introducing the topic and software commands required to execute the scheduled labs. Asynchronous videos assist the student through a systematic process leading to understanding of graphing, algebraic, and Calculus commands. In the next week, lab instructors offer office hours for questions and a team assignment is due at noon of the due date.



Worcester Polytechnic Institute

HW Problem/Webwork Sets 16% due T, 5/28, M, 6/3, F, 6/14, F, 6/21 by 11pm

Webwork Problem Set 4% due W, 6/5 and M, 6/24 by 4pm

Upload electronically on Canvas by 11pm of due date. Random problems are graded.

We expect students to show work, keep problems in order, and be neat and readable.

POLICIES

Academic Integrity:

See school's policy: www.wpi.edu/offices/policies/honesty/studentguide.html

Working together is permissible except during exams. When working together you must show individual thought and writing in each problem assigned. Direct copying (and allowing someone to copy directly from you) or using ChatGPT for solutions is not acceptable.

Consequences for violating the Academic Honest Policy range from earning a zero on the assignment, failing the course, or being suspended or expulsion from WPI. The Dean of Students Office maintains judicial records for any act of academic dishonesty.

Common examples of violations include:

- Paraphrasing, summarizing, or rephrasing from a source without appropriate citations.
- Turning in work where a good portion is someone else's, even if properly cited.
- Use of ChatGPT for problem solving and presentation of its steps.

Academic Accommodations:

If you need course adaptations or accommodation, or if you have medical needs that may impact your performance or participation in this course, please make an appointment with us as soon as possible. If you have approved accommodations, please request your accommodation letters online through the Office of Accessibility Services student portal. Contact the Office of Accessibility Services as soon as possible to ensure that such accommodations are implemented in a timely fashion.

Email – AccessibilityServices@wpi.edu, Phone – (508) 831-4908, Campus – Unity Hall, 5th Floor
Please know it is important to me that you feel you are in the best position to succeed in the course. If you need accommodation and there is anything I can do to help, I will be happy to assist to the best of my abilities.



Worcester Polytechnic Institute

Expectations and Behavior:

Reasons for missing exams, labs, or conference need be discussed beforehand with the professor or TA/PLA/GLA.

Let me know of personal or academic difficulties you are experiencing.

- Personal struggles are referred to WPI Student Development and Counseling Office (SDCC). It is a great resource designed to help. SDCC is located at 16 Einhorn Road and can be contacted through sdcc@wpi.edu and x-5540.
- The OAS (Office of Accessibility Services) corresponds accommodations and helps with testing strategies to improve student performance. In particular, they are help with anxiety and other issues.

Week-by-week schedule:

Holidays: M, 5/27 Memorial Day, W, 6/19 Juneteenth

Week 1 (M, 5/20-24): 2.6, 4.1, 4.3-4

Week 2 (T, 5/28-F, 5/31): 4.2, 4.5-4.8 HW #1 due T, 5/28 and Lab 1 due R, 5/30

Week 3 (M, 6/3-F, 6/7): 5.1-5.2 HW #2, due M, 6/3 and Webwork #1 due W, 6/5

Wednesday, 6/5 Synchronous Review Session W, 2-4pm

Exam 1 on , F, 6/7 2-5pm on Ch 2.6, 4

Week 4 (M, 6/10-F, 6/14) 5.3-5.4, 5.6 Lab 2, due T, 6/11 and HW #3, due F, 6/14

Week 5 (M, 6/17-F, 6/21): 2.7, 5.7, 6.1-6.2 Lab 3, due R, 6/20 and HW #4, due F, 6/21

Week 6: (M, 6/24-T, 6/25): Webwork #2 due M, 6/24 by 2pm

Monday, 6/24 Synchronous Review Session M, 2-4pm

Exam 2 on T, 6/25 2-5pm on Ch 2.7, 5, 6.1-6.2



Worcester Polytechnic Institute

E-Term 2024

Class Schedule

Topics

Class 1 M, 5/20

Course Introduction and 2.6 Quadratic Surfaces

Class 2 T, 5/21

4.1 Multivariate Functions (Domain & Range, Level Curves)

Class 3 W, 5/22

4.3 Partial Derivatives

Class 4 R, 5/23

4.4 Tangent Planes and Linear Approximations

HW #1, 2.6, 4.1, 4.3-4.4 due on T, 5/28

Class 5 T, 5/28

4.6 Directional Derivatives and Gradient

Class 6 W, 5/29

4.2 & 4.5 Limits and Chain Rule

Class 7 R, 5/30

4.7 Maxima and Minima Problems

Class 8 F, 5/31

4.8 LaGrange Multipliers

HW #2, 4.2, 4.5-4.7 due on M, 6/3

Class 9 M, 6/3

5.1 Double Integrals over Rectangular Regions
Riemann Sums

Class 10 T, 6/4

5.2 Double Integrals for General Regions

Webwork #1 due W, 6/5

Class 11 R, 6/6

Study

Class 12 F, 6/7

Test 1: 2.6, 4.1-4.8, (5.1-5.2?) at 2pm

Class 13 M, 6/10

5.3 Double Integrals using Polar Coordinates

Class 14 T, 6/11

2.7 Cylindrical and Spherical Coordinates

Class 15, W, 6/12

5.4 Triple Integrals and 5.6 Center of Mass

Class 16, R, 6/13

5.5 Cylindrical Coordinate Triple Integrals
Spherical Coordinate Triple Integrals

HW #3, 5.1-5.3, 2.7 due on F, 6/14

Class 17, M, 6/17

5.7 Change of Variables in Multiple Integrals

Class 18, T, 6/18

6.1 Vector Fields

Class 19, R, 6/20

6.2 Line Integrals

HW #4, 5.4-5.7 due of F, 6/21

Webwork #2 due M, 6/24 by 2pm

Class 20, M, 6/24

Study

Class 21, T, 6/25

Test 2: 2.7, 5.1-5.7, 6.1-6.2 at 2pm