

## Syllabus for MATH 21-259, Calculus in Three Dimensions, Section 2

Carnegie Mellon University, Fall 2019

**Instructor:** Dr. Neranga Fernando

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*Office phone:* 412-268-5608

*Office hours:* Mondays and Wednesdays 4pm – 5.30pm.

*Meeting times and location:* MWF, 12.30pm – 1.20pm at WEH 7500.

**Course Objectives:** At the end of this course, students should be able to:

- Extend the techniques of calculus to functions of several variables;
- Visualize 3-dimensional graphs;
- Evaluate limits, extreme values of functions, derivatives and integrals of functions of two variables.
- Apply vector calculus theorems to line and surface integrals and relate to engineering problems.

**Textbook:** *Calculus, Early Transcendentals*, by James Stewart, 8<sup>th</sup> edition.

**Web materials:** All class announcements, material, and grades will be posted on Canvas.

### Quizzes:

You will be taking a 30-minute quiz in recitation meeting every other Tuesday starting from the second week. Unless you have a very serious, well-documented, and compelling reason to miss a quiz, there will be NO make-up quizzes. No quiz grade will be dropped.

Here are the dates you will be taking a quiz:

Quiz 1 (September 3), Quiz 2 (September 17), Quiz 3(October 1), Quiz 4 (October 22), Quiz 5 (November 5), Quiz 6 (December 3)

### Homework:

Homework is due at the beginning of the recitation meeting every other Tuesday starting from the third week, i.e. on Tuesdays you are not taking a quiz. If you do not hand them in at the beginning of the recitation meeting when collected by your TA, they will be counted as a zero. Even if your work is partially complete, please submit your work. Because partially complete is better than a zero. Discussion on homework is allowed, but each student must prepare and submit their own assignment. No homework grade will be dropped.

Here are the due dates of homework:

Homework 1 (September 10), Homework 2 (September 24), Homework 3 (October 29), Homework 4 (November 12)

You should only submit the homework problems with an asterisk, but it is strongly advised that you do all of assigned homework since the quizzes will closely resemble the homework problems.

### Mid-term exams and final exam:

There will be two mid-term exams and a cumulative final exam in this course. The mid-term exams are 50-minute in-class exams; they will be on Friday, October 11 and Friday, November 22. Location and time of the final exam are to be determined. Unless you have a very serious, well-documented, and compelling reason to miss an exam, there will be NO make-up exams. No mid-term exam grade will be dropped.

**Grading:** The course grade will be determined as follows:

Final exam: 30%

Mid-term exams: 40% (20% each)

Quizzes: 20%

Homework: 10%

Letter grades are determined numerically:

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

The grade I (Incomplete) will be given only if you have at least a C in class before the final exam, have completed all quizzes and homework before the final exam, and have missed the final exam for a valid reason, and otherwise are doing passing work. An incomplete grade is given at the discretion of the instructor.

**Calculators** : Calculators are NOT permitted on quizzes, mid-term exams and the final exam.

**Additional resources:**

*Course TA information and recitation meetings on Tuesdays:*

| <i>Name</i> | <i>Recitation meeting time and location</i> | <i>Office hours and location</i>     |
|-------------|---|--------------------------------------|
| Son Van     | Section F, 8.30am – 9.20am, SH 220          | Mon 3-4pm, Thu 3.30-4.30pm, WEH 8205 |
| Hang Liao   | Section G, 9.30am – 10.20am, WEH 5310       | Tue 10.30am – 12.30pm, WEH 8215      |
| Ziyang Liu  | Section H, 12.30pm – 1.20pm, WEH 5310       | Thu 12pm – 2pm, WEH 6215             |
| Yuwen Huang | Section I, 3.30pm – 4.20pm, BH 235B         | Wed 1.30 – 3.30pm, WEH 6215          |
| Luwei Chen  | Section J, 4.30pm – 5.20pm, BH237B          | Thu 2-4pm, WEH 6215                  |

*EXCEL Group Program:*

The EXCEL Group Program is an academic enrichment program that integrates “what to learn” with “how to learn.” Each group is comprised of up to nine students and are formed on an as-needed basis, with multiple groups per course. Groups meet weekly throughout the term and are facilitated by trained student leaders who have already completed the course and earned an A. Sessions are interactive and geared specifically to the group members. We will begin accepting requests on Tuesday, September 3rd, through our websites at: <https://www.cmu.edu/acadev/excel/index.html>

**Academic Honesty:** Collaboration on quizzes, mid-term exams and final exam is NOT allowed.

A necessary prerequisite to the attainment of the goals of the University is maintaining complete honesty in all academic work. Students are expected to present as their own only that which is clearly their own work in tests and in any material submitted for credit. Students may not assist others in presenting work that is not their own. Offenders are subject to disciplinary action.”

For more on Academic Integrity see: <https://www.cmu.edu/policies/student-and-student-life/academic-integrity.html>

**Important:**

1) Any student with a disability is encouraged to meet with the instructor during the first week of classes to discuss accommodations. The student must bring a current Memorandum of Accommodations from the Office of Disability Resources.

2) If you are an athlete and have conflicts with an important class activity (quiz, mid-term, or final), you should let your instructor know before the end of second week of classes. You should also bring an official letter from the Office of Athletics.

3) All electronic devices (mobile phones, laptops etc.) should be turned off during class time, recitation meetings, quizzes, mid-term exams and final exam.

**Syllabus:** Syllabus is subject to change. It is your responsibility to be aware of any changes the instructor may make to the syllabus as they are announced in class. Students are responsible for all information given when they are absent.

**Schedule of Topics and Suggested Homework Exercises****Week 1: August 26 – 30**

Section 12.1 Three-Dimensional Coordinate Systems 5, 7, 8, 11, 14, 26, 28, 30, 32, 34, 38

Section 12.2 Vectors 1, 5, 6, 7, 8, 10, 14, 20-22, 26, 30, 31, 36, 38, 41

Section 12.3 The Dot Product 1, 2-6, 8, 17-19, 20, 24, 27, 34, 40, 42, 45, 53

**Week 2 (partial): September 3 – 6**

**Monday, September 2: Labor Day – no classes**

**Quiz 1**

Section 12.4 The Cross Product 1, 2, 3, 6\*, 13, 16, 22\*, 28, 30\*, 34\*, 37, 38, 44\*

Section 12.5 Equations of Lines and Planes 2-5, 6, 10\*, 19, 20\*, 23-25, 26\*, 28-30, 32\*, 42, 44, 46\*, 47, 52-54

**Week 3: September 9 - 13**

Section 12.6 Cylinders and Quadric Surfaces 3 - 8, 10, 12-15, 16, 21 - 28, 32, 34, 36, 44, 46

**Homework 1**

Section 13.1 Vector Functions and Space Curves 2, 4, 8, 10, 11, 12, 21 - 27, 42, 44

Section 13.2 Derivatives and Integrals of Vector Functions 3-5, 6, 9 - 11, 12, 23, 24, 34, 41, 42

**Week 4: September 16 - 20**

Section 13.3 Arc Length and Curvature 1-3, 4\*, 15, 16\* 18\*, 21-23, 47-49, 50\*

**Quiz 2**

Section 14.1 Functions of Several Variables 2, 6, 11, 12\*, 14, 16, 20, 28, 29-31, 32\*, 36, 41-44, 46, 48\*, 61-66

Section 14.3 Partial Derivatives 5-9, 15, 16, 21, 22, 25, 29, 42\*, 47, 48, 52, 65, 66\*, 83, 90\*

**Week 5: September 23 - 27**

Section 14.4 Tangent Planes and Approximations 2, 4, 6, 12, 14, 18, 34, 36, 39, 42

**Homework 2**

Section 14.5 The Chain Rule 2, 4, 6, 8, 10, 14, 21, 22, 24, 28, 34, 39, 44, 52

Section 14.6 Directional Derivatives and the Gradient Vector 7-9, 10, 12, 16, 22, 24, 29, 34, 37, 38, 39, 40, 42, 44, 46, 58, 59, 63

**Week 6: September 30 – October 4**

Section 14.7 Maximum and Minimum Values 3, 6, 7, 8, 12, 17, 18, 21, 31, 32, 36, 37, 42, 45, 46, 48, 49, 54, 55

**Quiz 3**

Section 14.8 Lagrange Multipliers 3-5, 6, 11, 12, 13, 15, 16, 18, 19, 22, 44

**Week 7: October 7 - 11**

Section 15.1 Double Integrals over Rectangles 6, 9, 10, 13, 15, 16, 19, 22, 27, 28, 34, 38, 41

Review

Test 1 – All sections covered up to review

**Week 8 (partial): October 14 – 17**

Section 15.2 Double Integrals over General Regions 2, 3, 7, 11, 12, 13, 16, 18, 19, 21, 23, 24, 28, 35, 36, 45, 47, 52

Section 15.3 Double Integrals in Polar Coordinates 1-4, 5, 6, 7, 10, 15, 16, 20, 25, 26, 29, 32

**Friday, October 18: Mid-Semester Break – no classes**

**Week 9: October 21 - 25**

Section 15.4 Applications of Double Integrals (Density and Mass) 4\*, 6\*, 8\* (find only mass in all three problems)

**Quiz 4**

Section 15.6 Triple Integrals 3, 5, 6\*, 9, 10\*, 12, 14\*, 17-19, 20\*, 27, 28, 33

Section 15.7 Triple Integrals in Cylindrical Coordinates 5-12, 15, 16\*, 17, 20\*, 22, 29, 30\*

**Week 10: October 28 – November 1**

Section 15.8 Triple Integrals in Spherical Coordinates 3-14, 15, 16, 17, 18, 20, 24, 25, 30, 36

**Homework 3**

Section 15.9 Change of Variables in Multiple Integrals 2, 3, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 18, 19, 23, 26

Section 16.1 Vector Fields & Section 11-18, 29-32

16.5 Curl and Divergence 1-3, 5, 9-11, 13, 14, 15, 19, 20, 23-29, 37

**Week 11: November 4 - 8**

Section 16.2 Line Integrals 1-5, 6\*, 8\*, 11-13, 14, 17, 18, 20\*, 21, 32\*, 41, 43, 44\*

**Quiz 5**

Section 16.3 The Fundamental Theorem for Line Integrals 3, 4, 5\*, 6, 10, 11, 12, 13, 14\*, 19, 20, 24\*, 29, 30\*

Section 16.4 Green's Theorem 1-5, 6, 10\*, 11, 12\*, 17, 27, 28\*, 31

**Week 12: November 11 - 15**

Section 16.6 Parametric Surfaces and Their Areas 13-18, 20, 22, 23, 24, 33, 34, 39, 40, 43, 48

Section 15.5 Surface Area 2, 3, 5, 10, 21

**Homework 4**

Section 16.7 Surface Integrals 5, 6, 7, 8, 13, 17, 21, 22, 25, 38

**Week 13: November 18 - 22**

Section 16.9 The Divergence Theorem 5, 6, 7, 8, 14, 25-30

Review

Test 2 – All sections covered after Test 1

**Week 14 (partial): November 25 - 26**

Section 16.8 Stokes' Theorem (day 1) 2, 3, 4, 7, 8, 16, 27

**Wednesday – Friday, November 27 – 29: Thanksgiving break: no classes**

**Week 15: December 2 - 6**

Section 16.8 Stokes' Theorem (day 2) 2, 3, 4, 7, 8, 16, 27

**Quiz 6**

Section 14.2 Limits and Continuity (if time permits)

Review

**December 6, Friday, Last day of classes**  
**Final Exam is based on all sections covered in class.**