

Vector Calculus Syllabus

MAT226 Vector Calculus: 4 hours, 4 credits. Vectors in two and three dimensions, equations of lines and planes, functions of several variables, partial differentiation, directional derivatives, gradients, optimization with Lagrange multipliers, multiple integration, line integrals and vector fields

Prerequisite: A grade of C (or better) in MAT 176.

Instructor: Your instructor will provide contact info, office hours and meeting times for your section.

Grading Policy

Expectations: Students are expected to learn both the mathematics covered in class and the mathematics in the textbook and other assigned reading. Completing homework is part of the learning experience. Students should review topics from prior courses as needed using old notes and books.

Homework: Approximately two hours of homework will be assigned in each lesson as well as additional review assignments over weekends.

Exams: There will be two midterm exams and a final exam.

Grades: The precise grading policy for your section will be distributed by your instructor.

Materials, Resources and Accommodating Disabilities

Textbook: Larson, Hostetler and Edwards, Calculus: Early Transcendentals Ed. 4, Houghton Mifflin OR Larson, Hostetler and Edwards, Calculus: Early Transcendentals Special Edition of Lehman College 175-176 Ed. 5, Houghton Mifflin

Technology: Students should purchase a basic scientific calculator able to compute trigonometric and exponential functions, but unable to complete algebraic manipulations and take derivatives.

Tutoring: Departmental tutoring is available in the Math Lab on the 2nd floor of Gillet.

Reliable Web Resources: See <http://comet.lehman.cuny.edu/calculus>

Reserve: Selected books have been placed on reserve in the library.

Accommodating Disabilities: Lehman College is committed to providing access to all programs and curricula to all students. Students with disabilities who may need classroom accommodations are encouraged to register with the Office of Student Disability Services. For more info, please contact the Office of Student Disability Services, Shuster Hall, Room 238, phone number, 718-960-8441.

Course Objectives:

At the end of the course students should be able to:

1. Graph and determine the equations for lines and planes (as part of dept objectives a & b)
2. Compute sums, differences, dot products and cross products of vectors (a)
3. Determine velocities and accelerations of vector-valued position functions (a, b & c)
4. Find level sets, gradients and tangent planes to functions of several variables (a, b & e)
5. Apply the method of Lagrange Multipliers (a, b & c)
6. Apply Fubini's Theorem and Green's Theorem to integrate functions and fields (a, b & e)

These objectives will be assessed on the final exam along with other important techniques.

Course Calendar

This course and its corequisite are carefully timed to match topics, so stay on schedule. Your instructor may choose to assign other homework problems keeping in mind that there are two textbooks and so different problems have different numbers and some problems are just assigned by description where the student is expected to find them among the exercises. Answers to all odd problems are in the back so check your work!

Lesson I: Review of Vectors, Plotting in 3D, 11.1-11.2

All odd problems in 11.1-11.2

Lesson II: Dot and Cross Products 11.3-11.4

All odd problems in 11.3-11.4

Review Differentiation 3.1-3.2

Lesson III: Parametric Equations and Polar Coordinates 10.2, 10.4

10.2/ 1-50 odd, 10.4/ 1-50 odd

Lesson IV: Lines and Planes 11.5

11.5/ do five problems on parametric equations for lines, do five on equations of planes

Review Differentiation 3.3

Lesson V: Hyperboloids, Paraboloids 11.6 (if time)

11.6/ 1-6, 9, 11, 13, 15

Review Differentiation 3.4

Lesson VI: Cylindrical and Spherical Coordinates 11.7

11.7/ 1-71 odd, sketch these

Review Limits and Continuity 2.3-2.4

Lesson VII: Vector valued functions, limits and continuity 12.1

12.1/ 1-13 odd, sketch 3 curves using the function, evaluate 3 limits, find 2 intervals of continuity, *Review Integration 5.1, 5.5*

Lesson VIII: Differentiation and Integration 12.2

12.2/ 1-17 odd, find 3 indefinite integrals, find two definite integrals

Lesson IX: Velocity and Acceleration, 12.3

12.3/ 1-16 odd, do 4 projectile motion, 1 cycloidal motion and 2 circular motion problems

Lesson X: Tangent Vectors and Arc length 12.4-12.5

12.4/ 1-16 odd, 19, 31, 33, 35, 45; 12.5/ 1, 3, 5

Doing these problems reviews many of the topics on Exam I.

Lesson XI: Midterm Exam I

Lesson XII: Functions of several variables 13.1

13.1/ 3 find and simplify function values, 3 describe domain and range,

Lesson XIII: Level sets, 13.1,

13.1/ 2 contour maps, 3 descriptions of level sets, 3 sketch graph of levels, 3 applications

Review HW: Dot products and planes 11.3-11.5

Lesson XIV: Partial derivatives 13.3, (13.2 if time)

13.3/ 9-25 odd, 37, 53, 65, show mixed derivatives are equal, Laplace's equation, wave

equation, heat equation, marginal productivity, ideal gas

Lesson XV: Gradients 13.6 (and the chain rule 13.5)

13.5/ 1-11 odd, 23, 27, 31; 13.6/ 1, 3, 13, 15, 21, *Review HW: Extrema in 4.1*

Lesson XVI: Tangent Planes 13.7

13.6/23, 25, 27, 31, normal to level, topography, heat seeking, meteorology

13.7/ 5, 7, 9, 17, 19, 21

Lesson XVII: Extrema and Saddle Points 13.8

13.8/ 1, 3, 25, 27, (ed4: 41, 45, 53, 57) or (ed5: 55, 37, 43, 45, 47)

Lesson XVIII: Optimization 13.9 as a review

13.9/ Max volume package, max volume ellipsoid, max revenue, max profit, min cost

Lesson XIX: Midterm Exam II

Review HW: Definition of Integration 5.2-5.3

Lesson XX: Lagrange Multipliers 13.10

13.10/ 1, 3, 5, 7, *Review HW: Techniques of Integration 5.5*

Lesson XXI: More Lagrange Multipliers 13.10

13.10/ max vol, min cost, refraction of light, production level, putnam challenge

Lesson XXII: Iterated Integrals and Area 14.1

14.1/ 1-9, 11-15, 2 areas of region,

Lesson XXIII: Double Integrals 14.2

14.2/ 1, 3, 7, 9, 13, 15,

Lesson XXIV: More Integration 14.2

14.2/ 4 volumes of sketched regions, 3 set up and evaluate double integral, Putnam challenge,

Review HW: Polar Coordinates 10.4

Lesson XXV: Integration and polar coordinates 14.3

14.3/ 1, 3, 5, 7, 9, 11, 3 use double integral to find shaded region problems

Students who have taken linear algebra already should read 14.8

Review HW: Vector-valued functions 12.2-12.3

Lesson XXVI: Vector Fields and Line Integrals 15.1-15.2

15.1/ 1, 3, 5, 7, 9, 11, find gradient vector field, verify conservative and find potential, find curl,

find divergence, 15.2/ 1, 3, 5, 7, 9, 27, 35, 39,

Lesson XXVII: Path independence and Green's Theorem 15.3-15.4 (if time)

15.3/ 1, 3, 5, 7, 11, 15b, 19a, 25, 27, 35, 53, 15.4/ 1, 3, 5, 7, 11, 21,

Lesson XXVIII: Last class: Review for final

Final Exam: The Final Exam will be given during Finals Week covering the entire course especially topics needed in future courses.

This syllabus and others are available at: <http://comet.lehman.cuny.edu/calculus/>.

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