University of New Mexico-Math 2531: Calculus III

Spring 2022

Course Description

Vector operations, vector representation of planes and curves, functions of several variables, partial derivatives, gradient, tangent planes, optimization, multiple integrals in Cartesian, cylindrical and spherical coordinates, vector fields, line integrals and Green's theorem.

Required Materials

- *Calculus*, Briggs-Cochran, 3e, Inclusive Access

Prerequisites

Prerequisites: 1522 with a grade of "C" (not "C-") or better.

Course Objectives

1. (**Vector Operations**) Perform basic operations on vectors in 3D: addition, subtraction, scalar multiplication, dot product. Visualize addition, subtraction and scalar multiplication geometrically, state geometric meaning of dot product and crossproduct, recognize and write down the equations defining lines and planes, and draw geometric information from the equations (such as a point on lines/planes, tangent and normal vectors, intersections)

2. (**Vector-valued Functions of One Variable**) Visualize given functions as curves in space, find functional parametrization of given curves, find their derivatives and interpret them as tangent vectors to curves; for functions describing the motion of a particle, interpret derivatives as velocity and acceleration; solve initial value problems.

3. (**Scalar-valued Functions of Several Variables**) Visualize functions of two variables by graphs in space or level curves in the plane; visualize functions of three variables by level

surfaces in space; recognize and graph equations for conic sections and for surfaces of revolution; state what it means for a limit of a function of several variables to exist; compute partial derivatives, gradients, directional derivatives and understand their meanings, e.g. with respect to direction of fastest growth and tangent planes; compute the gradient of a function and state its geometric significance; solve min/max problems with or without constraints (using substitution or Lagrange multipliers for the former) explain why the Lagrange multiplier method works.

4. (**Double and Triple Integrals**) Compute by reducing to an iterated integral, by changing the order of integration, by changing from Cartesian coordinates to cylindrical or spherical coordinates and vice-versa; use double and triple integrals to compute areas, volumes, centers of mass.

5. (**Vector Fields**) Visualize basic vector fields by flow lines and integral curves; state the definition of a gradient (or conservative) vector field and how to recognize one and compute a potential function; compute the divergence and curl of a vector field; rules for differentiation; recognize permissible and nonpermissible operations.

6. (**Line Integrals**) Compute line integrals such as arclength, work, circulation, and flux using the parametrization of a curve; compute using the Fundamental Theorem of Line Integrals when applicable; state Green's theorem (2-D), apply it to examples.

UNM Administrative Mandate on Required Vaccinations

UNM requires COVID-19 vaccination and a booster for all students, faculty, and staff, or an approved exemption (see: UNM Administrative Mandate on Required Vaccinations). Proof of vaccination and booster, or a medical, religious, or online remote exemption, must be uploaded to the UNM vaccination verification site. Failure to provide this proof may result in a registration hold and/or disenrollment for students and disciplinary action for UNM employees.
Booster Requirement: Individuals who received their second dose of a Pfizer or Moderna vaccine on or before June 15, 2021, or their single dose of a Johnson & Johnson vaccine on or before October 15, 2021, must provide documentation of receipt of a booster dose no later than January 17, 2022.

Individuals who received their second dose of a Pfizer or Moderna vaccine after June 15, 2021 or who received their single dose of Johnson & Johnson after November 15, 2021 must provide documentation of receipt of a booster within four weeks of eligibility, according to the criteria provided by the FDA (6 months after completing an initial two-dose Moderna vaccine, 5 months after completing the Pfizer sequence, and 2 months after receiving a one-dose Johnson & Johnson vaccine).

International students: Consult with the Global Education Office.

Exemptions: Individuals who cannot yet obtain a booster due to illness should request a medical, religious, or online remote exemption (which may have an end date) and upload this to the UNM vaccination verification site.

Medical and religious exemptions validated in Fall 2021 (see your email confirmation) are also valid for Spring 2022 *unless an end date was specified in the granting of a limited medical exemption.* Students must apply for a remote online exemption every semester.

UNM Requirement on Masking in Indoor Spaces

ll students, staff, and instructors are required to wear face masks in indoor classes, labs, studios and meetings on UNM campuses, see the masking requirement. Students who do not wear a mask indoors on UNM campuses can expect to be asked to leave the classroom and to be dropped from a class if failure to wear a mask occurs more than

once in that class. Students and employees who do not wear a mask in classrooms and other indoor public spaces on UNM campuses are subject to disciplinary actions. **Medical/health grade masks are the best protection against the omicron variant and these masks should be used, rather than cloth**.

Consequences of not wearing a mask properly

If you do not wear a mask, or if you do not wear a mask properly by covering your nose and mouth, you will be asked to leave class. If you fail to wear a mask properly on more than one occasion, you can expect to be dropped from the class. If you insist on remaining in the classroom while not wearing a mask, class will be dismissed for the day to protect others and you will be dropped from the class immediately.

Communication on change in modality

The President and Provost of UNM may direct that classes move to remote delivery at any time to preserve the health and safety of the students, instructor and community. Please check your email regularly for updates about our class and please check https://bringbackthepack.unm.edu regularly for general UNM updates about COVID-19 and the health of our community.

COVID-19 Symptoms and Positive Test Results

Please do not come to a UNM campus if you are experiencing symptoms of illness, or have received a positive COVID-19 test (even if you have no symptoms). Contact your instructors and let them know that you should not come to class due to symptoms or diagnosis. Students who need support addressing a health or personal event or crisis can find it at the Lobo Respect Advocacy Center, https://loborespect.unm.edu/.

Credit-hour statement

This is a four credit-hour course. Unless you are taking an evening section, class meets for three 50-minute sessions of direct instruction for fifteen weeks during the Fall 2021 semester. You will have a TR recitation section that meets for 1.25 hours a week as well. If you are taking an evening section (meeting MTR from 530-645PM) there is no recitation section. Students are expected to complete a minimum of six hours of out-of-class work (or homework, study, assignment completion, and class preparation) each week.

Grading Policy

Your grade will be based on the following:

- **Make Up Policy** No late assignments will be accepted without a university excused absence. No early/late quizzes or exams (including the final) will be given without a university excused absence. Please note that it is the students responsibility to drop the course if he/she stops submitting assignments. A failing grade of F may be issued if the student stops submitting the required assignments and does not drop before the posted deadline. No early final exams will be permitted except in documented emergencies: flight reservations, weddings, vacations, birthdays, non-NCAA sporting events etc. are not considered emergencies.
- **3 in-class exams** (100 points each).
- **Online Homework** (50 points) Online HW will be completed using MyMathLab. Your lowest two online HW scores will be dropped.
- **Written Homework** (50 points) Written HW will be assigned weekly. Your lowest two written HW scores will be dropped.
- **Quizzes** (50 points) There will be weekly quizzes with the lowest two scores dropped.
- **Final Exam** (200 points) The final exam will be given on Monday May 9th from 7:30-9:30 AM.
- To get full credit on graded work students must address all mathematical components presented by the problem, showing all steps and calculations. The use of proper notation, well-structured procedures, and legibility will be taken into account when assigning points.
- Grades will be assigned using the standard scale of 90-100: A; 80-89: B: 70-79: C; 60-69: D; $<$60: F

Course Policies

Attendance and Participation

Attendance and Participation: Attendance (mandatory) and engagement in the class (regular homework completion, questions/comments inside and outside class, and in office hours) are necessary to succeed in this course. If you need to miss class, please let your instructor know. Any unexplained and continued absences and lack of homework may lead to being withdrawn from the course. Please make sure to stay in touch with your instructor in case of special circumstances that temporarily prevent you from participating as needed.

Homework

You are encouraged and welcome to work together on the homework. However, the writeup you hand in must be your own work, in your own words. Referral to other sources outside of the material given in class (such as searching the web for answers) is strongly discouraged. It does not lead to understanding. To understand the material you have to work through it. You learn mathematics, just as you do the violin, or soccer, by practice, practice, practice. And just like playing the scales, or doing the dribbling skills, it is not necessarily always fun, but necessary. But do not bang your head in frustration! If you are totally stuck on a problem, contact your instructor or TA to help you get unstuck.

Student Behavior

All students have to abide by the Student Code of Conduct: https://pathfinder.unm.edu . According to the Code of Conduct, student activities that interfere with the rights of others to pursue their education or to conduct their University duties and responsibilities will lead to disciplinary action. The Department of Mathematics and Statistics requests that students practice netiquette during online lectures and discussions. We expect students to behave in a courteous and respectful manner toward the instructor and their fellow students.

Attendance is mandatory. First 3 Weeks Drop Policy: Within the first 3 weeks for 16-week courses (2 weeks for 8-week courses), if a student misses two classes and/or misses two assignments (homework/quizzes), the student may be dropped by the instructor. You are expected to be available during the scheduled class time. This is when you will take exams, quizzes and attend lectures and drop in hours. Please note that it is the student's responsibility to drop the course if he/she stops attending. A failing grade of F may be assigned if the student stops attending and does not drop before the posted deadline. **No early final exams** will be given except in documented emergencies: flight reservations, weddings, vacations, birthdays, non-NCAA sporting events etc. are not considered emergencies.

Extra Help

here are several resources to help you succeed in this class. Please consider your instructor your primary resource. Visit them during drop-in hours, ask questions inside and outside of class, let us know what difficulties you are having. We want to hear from you and we want to help you succeed. A list of all resources:
-Instructor Drop In Hours, availbility in and outside of class

-TAs office hours
-The Tutoring Table, staffed by appropriate instructors throughout the week (see posted schedule)
- CAPS: Center for Academic Program Support. Located on the 3rd floor of Zimmerman Library, caps.unm.edu, 505 277 7205
- SHAC: Counseling and Therapy Services, Student Health Center, shac.unm.edu, 505 277 3136. (For test anxiety, etc.)
-ESS Center: Engineering Student Success Center, www.ess.unm.edu, 505 277 4354

Academic Dishonesty

Academic dishonesty will be reported to the Dean of Students. Academic dishonesty includes copying answers from other sources to complete your homework and copying or looking at another student's exam or quiz while it is being given.

Exam Dates

All exam dates are given in the syllabus at the beginning of the semester. Exams cannot be rescheduled except in documented emergencies. If you need to reschedule because of a documented emergency (eg, surgery), please let your instructor know as soon as you find out. If you miss an exam, for example due to sickness, contact your instructor immediately. Do not schedule a personal trip during exams as you will not be given a makeup. Non-NCAA sporting events are also not university authorized emergencies.

Grading

One of the main goals of the course is to develop your mathematical writing skills, clearly showing all steps taken using correct algebra and notation. Therefore, your homework will be graded on the clarity and correctness of your mathematical presentation. Please take care to submit neat, legible solutions, with problems listed in order. Solutions that are hard to find or read will receive zero credit. The same standards will be applied to exams.

Grade Mode Change and Withdrawals

Deadlines to make changes to your registration status are published by the Office of the Registrar in the schedule of classes: http://registrar.unm.edu. To change grade mode or to withdraw after the deadlines posted therein, you need to 1) talk to your instructor to fully understand your standing in the class, and then 2) meet with your advisor and discuss the best path for you to proceed, as well as all consequences for your studies. Please ask your advisor to email your instructor, with copy to you, of the final decision. For grade mode changes you may also be required to have your instructor sign a grade mode change form: http://www.unm.edu/ unmreg/images/Forms/EnrlAuth-GradeMode.pdf , and your instructor will accommodate the change. Please note that to receive a W you need to withdraw by 5 pm on the Friday before final exams week.

Deadlines

The instructor will adhere to all of the deadlines published by the Office of the Registrar in the schedule of classes: http://registrar.unm.edu .

Last day to add class, change sections: January 28
Last day to change grade mode: January 28
Last day to drop without grade: February 4
Last day to drop without Dean's permission: April 15

Accommodations

Accessibility Resources Center (Mesa Vista Hall 20121, (505) 277-3506) provides academic support to students who have disabilities. If you think you need alternative accessible formats for undertaking and completing coursework, you should contact this service right away to assure your needs are met in a timely manner. If you need local assistance in contacting Accessibility Services reach out to advisor@math.unm.edu .

Title IX

Our classroom and our university should always be spaces of mutual respect, kindness, and support, without fear of discrimination, harassment, or violence. Should you ever need assistance or have concerns about incidents that violate this principle, please access the resources available to you on campus, especially the LoboRESPECT Advocacy Center and the support services listed on its website (http://loborespect.unm.edu/). Please note that, because UNM faculty, TAs, and GAs are considered "responsible employees" by the Department of Education, any disclosure of gender discrimination (including sexual harassment, sexual misconduct, and sexual violence) made to a faculty member, TA, or GA must be reported by that faculty member, TA, or GA to the university's Title IX coordinator. You can read the full campus policy regarding sexual misconduct at https://policy.unm.edu/university-policies/2000/2740.html .

Please note that we fully support the rights of everyone to an education in an environment of respect, support, and free from fear of deportation, and we strive to build such an environment. We will maintain confidentiality and work with students who require immigration-related accommodations. For more information and/or resources,

please contact the New Mexico Dream Team at info@nmdreamteam.org. For more information on the campus policy regarding sexual misconduct, see here.

Land Acknowledgement

Founded in 1889, the University of New Mexico sits on the traditional homelands of the Pueblo of Sandia. The original peoples of New Mexico Pueblo, Navajo, and Apache since time immemorial, have deep connections to the land and have made significant contributions to the broader community statewide. We honor the land itself and those who remain stewards of this land throughout the generations and also acknowledge our committed relationship to Indigenous peoples. We gratefully recognize our history.

Schedule and Weekly Learning Goals

This schedule is tentative and subject to change. The learning goals below should be viewed as the key concepts you should grasp after each week, and also as a study guide before each exam, and at the end of the semester. Each exam will test on the material that was taught up until the review day prior to the exam. The applications in the second half of the semester tend to build on the concepts in the first half of the semester though, so it is still important to review those concepts throughout the semester. The "Hand in" problems are to be turned in for a grade (Week 01 problems are turned in on Monday of Week 02 class, etc.). These problems are graded so that you can receive feedback regarding your understanding of concepts and use of notation. The "Self-Check" problems are odd problems in the book that test your basic knowledge of the material. It is imperative that you do **ALL** of the Self-Check problems as well. It may be tempting to skip the Self-Check Problems because they are not turned in. However, the primary goal of this course is to learn to solve problems and demonstrate that knowledge on exams, and the best way to accomplish this goal is by understanding all of the homework. The collected problems alone are not intended to give you enough practice to learn calculus, so if you ignore the Self-Check Problems, you will make the course far more difficult for yourself. The recitation quizzes, midterms, and final exam will be based on both sets of problems.

Week 01, 01/17 - 01/21: §§13.1/13.2 Vectors and 3-D Space: $\mathbb{R}^3$

- §**13.1** Self Check: 1-47; **Hand In**: 10, 12, 14, 20, 28, 32, 34, 48, 62, 65, 66
- §**13.2** Self Check: 1-49; **Hand In**: 10, 14, 20, 24, 28, 32, 40, 48, 58, 64, 74
- Write vectors in component form and as linear combinations of the standard unit vectors.
- Compute the magnitude and direction of vectors.
- Compute sums and differences of vectors algebraically and geometrically.

Week 02, 01/24 - 01/28: §13.3 Dot Product ; §13.4 Cross Product; §13.5 Lines/Planes

- §**13.3** Self Check: 1-51; **Hand In**: 12, 18, 24, 28, 30, 32, 40, 44, 51, 52, 54, 62
- §**13.4** Self Check: 1-43; **Hand In**: 8, 16, 30, 26, 28, 32, 34, 40, 44, 57
- Compute dot products, determine angles between vectors. Know the geometric interpretation of the dot product.
- Compute vector projections.
- Compute cross products. Know the geometric interpretation of the cross product.
- Write parametric and symmetric equations of a line in $\mathbb{R}^3$.
- Write parametric equations for a line segment with initial point $A(x_1, y_1, z_1)$ and terminal point $B(x_2, y_2, z_2)$.

Week 03, 01/31 - 02/04: §13.5 Lines/Planes; §13.6 Quadric Surfaces; §14.1 Vector Functions

- §**13.5** Self Check: 1-83; **Hand In**: 8, 10, 14, 18, 22, 24, 28, 34, 38, 40, 46, 50, 52, 56, 60, 72, 74, 81, 84
- §**13.6** Self Check: 1-59; **Hand In**: 10, 16, 18, 20, 30, 32, 36, 38
- §**14.1** Self Check: 1-49; **Hand In**: 8, 10, 12, 16, 17, 34, 36, 37, 40, 41, 42, 45, 48, 52
- Compute cross products. Know the geometric interpretation of the cross product.
- Write parametric and symmetric equations of a line in $\mathbb{R}^3$.
- Write parametric equations for a line segment with initial point $A(x_1, y_1, z_1)$ and terminal point $B(x_2, y_2, z_2)$.
- Write the equation of a plane in $\mathbb{R}^3$.
- Determine distances between objects in $\mathbb{R}^3$ (lines, planes, points, spheres).
- Sketch traces of quadric surfaces and sketch graphs of them in space.
- Find the domains of vector functions. Sketch graphs of these functions in $\mathbb{R}^2$ and $\mathbb{R}^3$.

Week 04, 02/07 - 02/11: **Exam 1 on Thursday during recitation time**; **§14.2 Calculus with Vector Functions**; **§14.3 Motion in Space**

- §**14.2** Self Check: 1-79; **Hand In**: 8, 16, 28, 30, 38, 50, 62,70, 74,78, 79, 80
- §**14.3** Self Check: 1-57; **Hand In**: 8, 14, 16, 22, 28, 30, 32, 42, 48, 57
- Compute limits, derivatives, and integrals of vector functions.
- Compute the unit tangent vector to a curve at a given point.
- Solve projectile motion problems in $\mathbb{R}^2$.
- Compute the position, speed, and acceleration of a particle in the plane or in space.

Week 05, 02/14 - 02/18: **§14.4 Lengths of Curves**; **§14.5 Curvature and Normal Vectors**

- §**14.4** Self Check: 1-43; **Hand In**: 12, 20, 22, 26,27, 32, 34, 35, 38, 43
- §**14.5** Self Check: 1-49; **Hand In**: 14, 16, 20, 22, 26, 32, 34, 44, 49
- Compute the arc length and curvature of a curve.
- Parametrize a curve with respect to arc length.
- Compute the unit tangent, normal, and binormal vectors to a curve at a point.
- Find the tangential and normal components of acceleration.
- Compute the torsion of a curve.

Week 06, 02/21 - 02/25: **§15.1 Graphs and Level Curves**; **§15.2 Limits and Continuity**; **§15.3 Partial Derivatives**

- §**15.1** Self Check: 1-57; **Hand In**: 6, 10,12, 18, 22, 32, 36, 40, 52
- §**15.2** Self Check: 1-61; **Hand In**: 12, 20, 26, 30, 36, 38, 42, 80
- §**15.3** Self Check: 1-79; **Hand In**: 3, 10, 22, 26, 34, 37, 46, 66, 68, 69, 83, 88, 92
- Determine the domains and ranges of multivariable functions. Sketch level curves and surfaces of multivariable functions.
- Use limits to determine whether a multivariable function is continuous at a point.
- Be able to show when a limit of a multivariable function does not exist.
- Compute partial derivatives of multivariable functions (including implicit differentiation as well as higher order partial derivatives).
- Determine when a multivariable function is differentiable.
- Estimate the value of partial derivatives at a point, using a table or a graph.
- Be able to apply and interpret partial derivatives in application problems.

Week 07, 02/28 - 03/04: **§15.4 Chain Rule**; **§15.5 Directional Derivatives and the Gradient**

- §**15.4** Self Check: 1-49; **Hand In**: 8, 12, 26, 28, 32, 36, 40, 42, 58, 66, 69
- §**15.5** Self Check: 1-67; **Hand In**: 10, 16, 18, 24, 30, 34, 38, 50, 56, 67, 70
- Draw and use a tree diagram to write out an appropriate version of the chain rule for multivariable functions.
- Use the chain rule to derive the *Implicit Function Theorem*. Apply this to functions of two and three variables.
- Compute the directional derivative and the gradient of multivariable functions. Be able to estimate the value of the directional derivative at a point using a table or a graph.
- Use the gradient to determine in what direction(s) a function increases/decreases most rapidly at a point.
- Use the gradient to compute the normal line and tangent plane to a surface at a point.

Week 08, 03/07 - 03/11: **Exam 2 on Thursday during recitation time**; §**15.6 Tangent Planes and Linear Approximation**; §**15.7 Maxima and Minima**

- §**15.6** Self Check: 1-53; **Hand In**: 8, 10, 26, 30, 38, 40, 44, 50, 53, 56, 66
- §**15.7** Self Check: 1-67; **Hand In**: 8, 16, 22, 26, 38, 40 , 44, 48, 52, 56, 62, 66, 67
- Compute the linear approximation (linearization) and differential of a multivariable function. Understand where the differential comes from in terms of its linear approximation.
- Interpret the linear approximation of a function of two variables as the plane tangent to a surface at a given point.
- Use linear approximations/differentials to estimate the maximum error in the calculated value of a physical quantity (like area or volume, for example).
- Determine critical points of a function of two variables and classify them as local maxima, minima, or saddle points.
- Determine the absolute extrema of a function of two variables on a closed and bounded domain.

Week 09, 03/14 - 03/18: **Spring Break Hooray!**

Week 10, 03/21 - 03/25: §**15.8 Lagrange Multipliers**; §**16.1 Double Integrals Over Rectangular Regions**

- §**15.8** Self Check: 1-41; **Hand In**: 4, 6, 8, 14, 24, 28, 32, 38, 48, 62
- §**16.1** Self Check: 1-51; **Hand In**: 5, 16, 18, 20, 24, 28, 34, 36, 42, 51, 52
- Use the method of Lagrange Multipliers (one or two constraints) to solve optimization problems. You should understand why this works!!!!
- Define double integrals over rectangles in $\mathbb{R}^2$.
- Estimate the value of a double integral using the midpoint method.
- Evaluate double integrals over rectangles using iterated integrals in $\mathbb{R}^2$.
- State and apply *Fubini's Theorem* to double integrals over rectangles.

Week 11, 03/28 - 04/01: §**16.2 Double Integrals Over General Regions**; §**16.3 Double Integrals in Polar Coordinates**

- §**16.2** Self Check: 1-67, 71-79; **Hand In**: 8, 24, 32, 40, 48, 50, 66, 68, 74, 78
- §**16.3** Self Check: 1-55; **Hand In**: 1-, 12, 24, 28, 32, 36, 44, 54, 55
- Describe a region in $\mathbb{R}^2$ as a Type I or Type II region using inequallities. Be able to go back and forth between these if possible.
- Evaluate double integrals over Type I or Type II regions. Be able to reverse the order of integration when necessary or helpful (or just for practice).
- Evaluate $\int\int_R f(x,y)\,dA$ and determine if it is a volume in $\mathbb{R}^3$. Provide a sketch of the region in $\mathbb{R}^3$ for familiar objects like spheres, cones, paraboloids etc.
- Find the area of a region in $\mathbb{R}^2$ using a double integral.
- Describe a region in $\mathbb{R}^2$ using polar coordinate inequalities.
- Evaluate a double integral over a general region by converting it to polar coordinates.

Week 12, 04/04 - 04/08: §**16.4 Triple Integrals**; §**16.5 Triple Integrals in Cylindrical and Spherical Coordinates**;

- §**16.4** Self Check: 1-55; **Hand In**: 6, 12, 16, 18, 22, 24, 32, 34, 36, 48, 55
- §**16.5** Self Check: 1-55; **Hand In**: 16, 20, 22, 24, 30, 42, 46, 52, 54, 55, 60
- Define and evaluate triple integrals in rectangular coordinates. Be able to integrate in various orders, e.g. $dz\,dy\,dx$ or $dz\,dx\,dy$ or $dx\,dz\,dy$ by drawing a sketch of the region of integration.
- Compute the volume of a region D in $\mathbb{R}^3$ as $\int\int\int_D 1\,dV$
- Evaluate triple integrals by converting to spherical coordinates.
- Given $\int\int\int_B f(x,y,z)\,dV$, be able to convert it to any of the three coordinate systems.

Week 13, 04/11 - 04/15: **Exam 3 on Thursday during recitation time**; §**17.1 Vector Fields**; §**17.2 Line Integrals of Scalar Functions**

- §**17.1** Self Check: 1-53; **Hand In**: 6, 10, 11, 12, 15, 18, 24, 26, 34, 38, 42, 52, 53
- §**17.2** Self Check: 1-61; **Hand In**: 5, 6, 7, 18, 20, 28, 30, 32, 34
- Sketch vector fields in $\mathbb{R}^2$ and $\mathbb{R}^3$ (for $\mathbb{R}^3$ sketch the gravitational field).
- Compute gradient fields and define what a conservative vector field is.
- Evaluate line integrals of scalar functions with respect to arc length: $\int_C f(x,y)\,ds$ and $\int_C f(x,y,z)\,ds$

Week 14, 04/18 - 04/22: §**17.2 Line Integrals of Vector Fields/Work**; §**17.3 Fundamental Theorem of Line Integrals**

- §**17.2** Self Check: 1-61; **Hand In**: 42, 44, 46, 48, 50, 55, 58, 68, 72
- §**17.3** Self Check: 1-57; **Hand In**: 8, 14, 18, 20, 32, 40, 42, 44, 46, 52, 54, 57, 64
- Evaluate line integrals of vector fields $\int_C \mathbf{F}\cdot d\mathbf{r} = \int_C P\,dx + Q\,dy + R\,dz = \int_C \mathbf{F}\cdot\hat{\mathbf{T}}\,ds$
- Use a sketch of a vector field to determine whether a line integral of a vector field is positive, negative, or zero.
- Use a line integral to compute the work done by a field on a particle moving along a piecewise smooth curve C.
- Use a line integral to compute the circulation and flux of a vector field.
- Compute potential functions of simple conservative vector fields by inspection.
- Determine if a vector field is conservative and find a potential function.
- State the *Fundamental Theorem for Line Integrals* and apply it appropriately. Describe some physical applications of this (like conservation of energy).

Week 15, 04/25 - 04/29: §**17.4 Green's Theorem**; §**17.5 Divergence and Curl**

- §**17.4** Self Check: 1-49; **Hand In**: 14, 16, 18, 20, 28, 30,32, 34, 38, 40, 49
- §**17.5** Self Check: 1-39; **Hand In**: 16, 18, 21 (a,b), 22(a,b), 34, 36, 39, 41
- State Green's Theorem and apply it appropriately.
- Compute the curl and divergence of a vector field. What is curl($\nabla\mathbf{F}$)? div(curl $\mathbf{F}$)?

Week 16, 05/02 - 05/06: Catch Up and Review

Week 17, 05/09 - 05/13: Cumulative Final Exam on Monday May 9 from 7:30 AM-9:30 AM.