University of New Mexico-Math 1522: Calculus II

Spring 2022

Course Description

Transcendental functions, techniques of integration, numerical integration, improper integrals, sequences and series, Taylor series with applications, complex variables, differential equations.

Required Materials

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

Prerequisites

Prerequisites: Math 1512 (or equivalent) with ”C” (not ”C−”) or better

Course Objectives

1. Know the definitions, graphs, special values, derivatives and integrals (when possible) of transcendental functions, including exponential, logarithmic, inverse trigonometric and hyperbolic functions.
2. Use the methods of substitution, integration by parts, partial fractions and trigonometric substitution to compute proper and improper integrals. Evaluate improper integrals using correct mathematical limit notation.
3. Use rectangles or trapezoids to approximate integrals.
4. Solve separable differential equations. Plot direction fields and solution curves. Find equilibrium solutions.
5. State the definition of the value of a series, as well as necessary conditions for convergence. Use the definition to determine the value of a series. Determine the value of known Taylor series at particular points. State various tests for convergence, including all conditions, and apply them. Approximate alternating series and estimate the error.

6. Determine the asymptotic behavior of functions $f(x)$ as $x \to \pm\infty$ and the limit of indeterminate forms.

7. State the definition of the Taylor series of a function and describe its properties. Find Taylor series using the definition, or by substitution into, or differentiation or integration of known series, and determine their interval/radius of convergence. Approximate functions by Taylor polynomials within the interval of convergence and estimate the error. Include approximations of definite integrals or quantities depending on parameters, such as arise in applications in physics, chemistry, biology and engineering.

8. Use Taylor series to derive Euler's formula for the exponential of a complex number. Evaluate sums, products, powers, roots, and exponentials of complex numbers. Evaluate integrals of complex functions.

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: **No Class Monday**; §7.1 **Inverse Functions**; §7.2 **Natural Exponential Functions and Logarithms**

- §**7.1** Self Check: 1-55; **Hand In**: 10, 13, 18, 26, 34, 36, 42, 44, 48, 52, 54, 64
- §**7.2** Self Check: 1-97; **Hand In**: 14, 22, 28, 38, 42, 46, 68, 70, 90, 92, 94, 98
- Recognize where a function has an inverse and be able to compute it, if possible.
- State and apply the Inverse Function Theorem. Give an example which illustrates it graphically.
- Graph exponential and logarithmic functions and explain how $\log_b(x)$ is the inverse of b^x for $b > 0,\ b \neq 1$.
- Compute the derivatives/integrals of exponential functions and apply the chain rule to functions involving compositions of these functions.
- Solve logarithmic and exponential equations.
- Compute the derivatives logarithmic functions and apply the chain rule to functions involving compositions of these functions.
- Compute integrals of the form $\int \frac{du}{u}$ or use substitution to put integrals into this form.

Week 02, 01/24 - 01/28: §7.3 **Other Bases**; §7.5 **Inverse Trigonometric Functions**

- §**7.3** Self Check: 1-73; **Hand In**: 20, 28, 32, 36, 38, 54, 64, 70, 102
- §**7.5** Self Check: 1-71, 77-91; **Hand In**: 16, 20, 24, 26, 42, 54, 56, 62, 72, 80, 82, 86
- Graph exponential and logarithmic functions and explain how $\log_b(x)$ is the inverse of b^x for $b > 0,\ b \neq 1$.
- Compute the derivatives/integrals of exponential functions and apply the chain rule to functions involving compositions of these functions.
- Solve logarithmic and exponential equations.
- Compute the derivatives logarithmic functions and apply the chain rule to functions involving compositions of these functions.
- Compute integrals of the form $\int \frac{du}{u}$ or use substitution to put integrals into this form.
- Graph $\arcsin x$, $\arccos x$, $\arctan x$ and explain where their domain/range restrictions come from.
- Evaluate inverse trig functions at standard values (such as $\arcsin(-0.5)$).
- Compute the derivatives of the inverse trigonometric functions. Apply the chain rule to functions involving compositions of one or more of these functions.
- Compute integrals of functions which have antiderivatives involving inverse trigonometric functions (for example $\int \frac{e^{3x}}{e^{6x}+1}\,dx$).

Week 03, 01/31 - 02/04: §§**4.7/7.6 L'Hopital's Rule and Growth Rates**; §**7.7 Hyperbolic Functions**

- §**4.7**: Self -Check: 1-61; **Hand In**: 16, 18, 24, 32, 58
- §**7.6** Self Check: 1-43; **Hand In**: 6, 10, 12, 16, 20, 22, 28, 34, 36, 52, 54
- §**7.7** Self Check: 11-29, 37-45; **Hand In**: 24, 26, 30, 38, 40, 70, 74
- Apply L′Hopital′s when applicable. If possible, rewrite functions into a form so that the rule can be applied.
- Compare growth rates of various functions using infinite limits.
- Know the definitions of $\sinh x$, $\cosh x$ and $\tanh x$ in terms of exponential functions and use these to compute their derivatives as well as to determine their long term behavior.

Week 04, 02/07 - 02/11: §**8.1/8.2 Basic Approaches and Integration by Parts**; §**8.3 Trigonometric Integrals**

- §**8.1** Self Check: 1-65; **Hand In**: 8, 10, 12, 16, 22, 26, 28, 38, 54, 64, 74
- §**8.2** Self Check: 1-39; **Hand In**: 10, 12, 14, 16, 18, 20, 22, 24, 30, 32, 34, 38, 40, 42, 44, 48, 58, 60
- §**8.3** Self Check: 1-63; **Hand In**: 10, 12, 16, 18, 28, 30, 40, 54, 64
- Integrate functions using the method of integration by parts (be able to derive the formula from the product rule!).
- Use appropriate trigonometric identities and substitutions to evaluate trigonometric integrals.

Week 05, 02/14 - 02/18: **Exam 1 on Thursday during recitation time**; §**8.4 Trigonometric Substitution**; §**8.5 Partial Fraction Decomposition**;

- §**8.4** Self Check: 1-57; **Hand In**: 8, 12, 14, 18, 26, 30, 34, 38, 42, 60
- §**8.5** Self Check: 1-65; **Hand In**: 26, 28, 32, 42, 50, 58, 62, 76
- Integrate functions using an appropriate trigonometric substitution: $a^2 - x^2$ vs $a^2 + x^2$ vs $x^2 - a^2$.
- Integrate functions using a partial fraction decomposition (there are four cases, you should know them well!).

Week 06, 02/21 - 02/25: §**8.8 Numerical Integration**; §**8.9 Improper Integrals**

- §**8.8** Self Check: 1-25; **Hand In**: 14, 16, 22, 24
- §**8.9** Self Check: 1-57; **Hand In**: 8, 10, 16, 18,28, 38, 42, 52, 58, 66, 78, 84
- Derive and use the Trapezoid and Simpson's rules to approximate the value of a definite integral. Compare this to the rectangle approximation rules. If time permits, discuss the error in this approximation and compare it to the error used in the Midpoint rule.
- Recognize an improper integral (infinite limits of integration and/or discontinuities in the domain of the integrand) and determine whether it diverges or converges. Determine the exact value if possible.
- Use the comparison test to determine whether an integral converges or diverges.

Week 07, 02/28 - 03/04: §**10.1 Overview of Sequences and Series**; §**10.2 Sequences**

- §**10.1** Self Check: 1-53; **Hand In**: 6, 8, 10, 12, 16, 20, 22, 28, 34, 36, 38, 48, 50, 62, 68
- §**10.2** Self Check: 1-53; **Hand In**: 4, 10, 14, 18, 22, 28, 32, 48, 56, 83, 88
- Use limits to determine whether a sequence of real numbers converges or diverges.
- Use limits to determine whether a sequence of real numbers is increasing/decreasing/bounded.
- Explain what it means for a sequence to be monotonic and give two examples: the first being a monotonically increasing sequence which diverges, and the other a sequence which increases monotonically and converges. Be able to prove a sequence is monotonic!
- Find a formula or recurrence relation to define all the terms of a given sequence.
- Explain how the convergence or divergence of an infinite series $\sum_{k=1}^{\infty} a_n$ is defined in terms of the sequence of its partial sums.

Week 08, 03/07 - 03/11: §**10.3 Intro to Series**; §**10.4 Divergence and Integral Test**

- §**10.3** Self Check: 1-41, 47-57, 87; **Hand In**: 6, 8, 22, 24, 26, 34, 38, 42, 50, 56, 68, 70, 87
- §**10.4** Self Check: 1-37; **Hand In**: 10, 12, 14, 18, 20, 22, 26, 28, 32, 34, 47, 48, 58, 60
- Explain how the convergence or divergence of an infinite series $\sum_{k=1}^{\infty} a_n$ is defined in terms of the sequence of its partial sums.
- Define a geometric series. Under what conditions do geometric series converge? Diverge? How do you find the sum of a convergent geometric series? Give several examples.
- Define a telescoping series. Describe how to determine whether or not it converges. Can you compute the exact value of a convergent telescoping series? Explain.
- Recognize when the Integral Test can be applied to a series and use it to determine whether or not a series converges or diverges. Does the integral test give you the exact value of a convergent series? Explain.
- Define the *Harmonic Series* and use the Integral Test to determine whether it converges of diverges.
- Recognize p-series and know when they converge or diverge.

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

Week 10, 03/21 - 03/25: §**10.5 Comparison Tests**; §**10.6 Alternating Series**

- §**10.5** Self Check: 1-61; **Hand In**: 6, 8, 12, 14, 22, 26, 37, 44, 46, 50, 54
- §**10.6** Self Check: 1-65; **Hand In**: 8, 10, 12, 18, 22, 24, 26, 32, 36, 42, 46, 50, 58, 60, 65
- Describe the difference between the Direct and Limit Comparison tests. When might one be better to use than the other?
- Recognize when the Comparison Tests can be applied to a series and use it to determine whether or not a series converges or diverges. Do the Comparison Tests give you the exact value of a convergent series? Explain
- Recognize when the Alternating Series Test can be applied to a series and use it to determine whether the series converges or diverges.
- State the Alternating Series Estimation Theorem and use it to approximate the sum of a series.

Week 11, 03/28 - 04/01: **Exam 2 on Thursday during recitation time**; §**10.7 Absolute Convergence/Ratio and Root Tests**; §**10.8 Strategies for Series**

- §**10.7** Self Check: 1-47; **Hand In**: 8, 10, 14, 16, 20, 30, 31, 34, 42, 48
- §**10.8** Self Check: 1-87; **Hand In**: 8, 14, 18, 22, 30, 34, 42, 62, 87
- Describe the difference between what means for a series to be *Conditionally Convergent* vs *Absolutely Convergent*. Be able to give several examples to illustrate this.
- Be able to apply the Ratio or Root Tests and to determine when they are inconclusive.
- Given an infinite series, be able to determine: 1. Which tests may be used to determine whether it converges or diverges; 2. It is possible to find the exact value of the series if it converges?; 3. If it converges, does it converge absolutely or conditionally?

Week 12, 04/04 - 04/08: §**11.1 Approximating Functions With Polynomials**; §**11.2 Power Series**;

- §**11.1** Self Check: 1-27; **Hand In**: 8, 10, 18, 20, 26, 32, 42, 46, 54, 56, 65
- §**11.2** Self Check: 1-63; **Hand In**: 8, 10, 16, 20, 30, 38, 42, 46, 52, 54, 58, 63, 68
- Recognize Power Series and be able to determine the interval and radius of convergence for a given series. (What are the three possibilities?)
- Know when a power series can be integrated/differentiated term-by-term. What happens to the radius of convergence? What about the interval of convergence? What about the index of summation?
- Represent a function as a power series and determine the interval of convergence (for example things like $\frac{x^3}{1+x^2}$, $\tan^{-1} x$, $\frac{3}{(1+x)^2}$).

Week 13, 04/11 - 04/15: §**11.3 Taylor Series**; §**11.4 Applications of Series**;

- §**11.3** Self Check: 1-41; **Hand In**: 8, 10, 12, 14, 16, 24, 30, 36, 66, 67
- §**11.4** Self Check: 1-31, 37-43; **Hand In**: 6, 8, 10, 14, 22, 28, 30, 37, 38, 56
- Define the *Taylor Series of* $f(x)$ *centered at* $x = a$ (the case $a = 0$ is called a *Maclaurin Series*).
- Be able to derive the general formula for the nth coefficient of a Taylor Series (the derivation begins on page 731 in the text).
- Compute the nth order Taylor Polynomial $T_n(x)$ at $x = a$.
- Find the Taylor series for a function $f(x)$ at a specified value a (for example $f(x) = 1/x$, $a = -3$). Determine the interval/radius of convergence.
- Know the Maclaurin series for e^x, $\cos x$, $\sin x$, $\frac{1}{1-x}$ and use them to construct power series for functions that are combinations of these.
- Use power series to evaluate limits and estimate the value of integrals when possible. item Use power series to evaluate limits and estimate the value of integrals when possible.
- State and use *Taylor's Theorem/Inequality* (page 780) to determine the error in approximating $f(x)$ by its Taylor polynomial $T_n(x)$ at $x = a$.
- Apply series to solve physical application problems.
- Use series to derive Euler's formula: $e^{i\theta} = \cos\theta + i\sin\theta$.

Week 14, 04/18 - 04/22: **Exam 3 on Thursday during recitation time**; **Complex Numbers**; §**9.1 Intro to Differential Equations**

- §**9.1** Self Check: 1-41; **Hand In**: 10, 12, 20, 24, 26, 30, 32, 36, 40, 42, 54
- §**Complex Numbers** MML Online, TBA
- Define what a differential equation is and be able to give and solve examples of first and second order intial value problems (masses on springs, Newton's Law of Cooling, etc...).
- Perform algebraic operations on complex numbers in standard and polar form (addition/subtraction, multiplication/division, powers).

Week 15, 04/25 - 04/29: §**9.3 Separation of Variables** ; §**9.4 Linear Equations**; §**9.5 Modeling**

- §**9.3** Self Check: 1-41; **Hand In**: 6, 10, 16, 26, 32, 34, 40
- §**9.4** Self Check: 1-27; **Hand In**: 6, 10,16, 20, 24, 28
- §**9.5** Self Check: 15-25; **Hand In**: 16, 18, 20, 24, 26
- Identify when a differential equation is separable/linear and use the appropriate method to solve the equation or initial value problem.
- Describe how the exponential growth model differs from the logistic growth model. Be able to solve both types of differential equations and describe the long term behavior of the solutions.
- Determine the carrying capacity of a population modeled by the logistic equation (be able to do it by solving the equation explicitly and also by using a direction field).
- Identify when a differential equation is separable/linear and use the appropriate method to solve the equation or initial value problem.

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

Week 17, 05/09 - 05/13: Cumulative Final Exam on Monday May 9th, 10:00 AM-12:00 PM.