

MATH 1920 - Calculus II
4 Credit Hours

Course Description:

This course is a study of integral calculus, parametric equations and series. Compared with Math 1910, this course offers a more in-depth concentration into integration techniques (anti-derivatives, definite integrals, and their applications).

The topics studied in this course include:

- inverse functions
- techniques and applications of integration
- an introduction into the modeling and techniques for solving simple first order differential equations
- the study of parametric equations as well as the polar coordinate system and its use
- conic sections
- sequences and series to include conditions and tests for convergence.

Course Outcomes:

Upon successful completion of this course, students will be able to:

Goals:

General: Above the topical material covered in this course, the student will enhance their mathematical problem solving abilities:

- Technical reading/comprehension,
- Extracting useful information from the content of a problem's description,
- Pairing information contained in the problem's description to related mathematical truths (definitions/theorems/corollaries),
- Producing a rough sketch outlining the steps leading to the solution.

Topical: The topics included in this course will be covered to an extent that will meet the following goals:

- The ability to work with inverse functions using the definition of one-to-one (1:1) in a setting in which the function is not necessarily given explicitly:

- the calculus of inverse functions (finding the derivative of an inverse function at a point),
 - exponential functions, hyperbolic functions, their inverses, domain of definition and derivatives,
 - inverse trigonometric functions, their domain of definition and derivatives,
- The ability to evaluate limits of expressions that are classified as indeterminate as well as the ability to understand the proper use and application of L'Hospital's rule,
- A command of the techniques necessary for finding antiderivatives (that is, techniques for finding indefinite integrals). The student will learn to read the integrand and choose the most appropriate integration technique:
 - Integration by parts,
 - Trigonometric integration,
 - Trigonometric substitution,
 - Integration of rational functions by partial fractions,
 - Integration using tables (if time permits),
- The ability to apply certain techniques for approximating definite integrals and estimating their respective approximation errors:
 - Trapezoidal Rule,
 - Midpoint Rule,
 - Simpson's Rule,
- An understanding of common techniques for identifying and, if convergent, evaluating improper integrals,
- The ability to apply appropriate formulae for the determination of the length of a curve (arc length),
- The ability to apply mathematical theory and formulae required to determine the area of a surface that is constructed by rotating a curve about either the horizontal or vertical axis,
- An ability to apply the above topical material to applications in the fields of physics, engineering, economics, biology and probability (as time permits),
- The ability to solve simple first order differential equations involving exponential growth and decay,
- The ability to use techniques of parametric equations and polar coordinates to transform curves (that do not satisfy the definition of a function) into expressions that are functions by learning
 - parametric and polar graphing techniques,
 - to apply calculus to parametric and polar representations of curves to determine,
 - tangent lines,
 - arc length,
 - area under a curve,
 - surface area (parametric equations only),
- The ability to use the definitions of conics (parabolas, ellipses, and hyperbolas) and to derive their standard equations,
- The ability to analyze sequences and series to include establishing the value of the limit

if convergent,

- The ability to apply certain tests to determine the convergence properties of series,
 - Integral test (also used to estimate the limit of a convergent series),
 - Comparison test,
 - Alternating series test,
 - Ratio test (absolute convergence),
 - Root test (absolute convergence),
- The ability to analyze power series to include the determination of the radius and interval of convergence as well as the ability to represent a given function as a power series,
- An understanding of the Taylor series, a generalization of the Maclaurin series, to include the ability to present a function as either a Taylor or Maclaurin series,
- The ability to determine the remainder term of the Taylor or Maclaurin series,
- The ability to derive the Taylor or Maclaurin series for the main function categories (such as trigonometric, rational, exponential, logarithmic, etc.) as well as determining power series for products of functions as a product of power series (here, a product includes division),
- The understanding of the binomial series and one of its uses to determine power series representations.

Objectives:

In this course, the student will demonstrate an understanding of the topics outlined in the Goal section, 'Topical'. The student is cautioned not to memorize solution steps but rather to learn general thinking procedures that can be applied to any problem in a specific category. For example, to learn integration techniques is simple, but to apply these techniques is considered by many students difficult. One explanation is the following: When an integration technique is introduced, it can be described as a recipe or procedure. However, if exercises that cover many integration techniques are scrambled together, and the student is not told which procedure to use, troubles may surface. To avoid this, it is important to bring home the understanding that to "think" about a strategy for solving a problem in calculus (or, more generally, in mathematics), one must be able to associate definitions/theorems/etc. (that might be useful) to the information given in the problem description. The beginning point for achieving this is through memorization. That is, to become acquainted with the facts, it is helpful to first memorize them before expecting to be able to use them freely. Later, if the details of the facts are forgotten, they can be looked up - but what is not forgotten is their existence and their usefulness. Below, there are many references to "recite on demand", or to "memorize". These are to encourage you, the student, to stay on track by making the best use of your study time: First learn the facts (memorization), then learn how to use them (working exercises). The more important definitions/theorems (facts) may appear on quizzes/exams/etc. by asking that they be stated in detail, but for the majority the memorization is only a necessary step before understanding: To do well, you will need to understand the topical material. Here, the objectives for each topic will be given in reference to what defines "understanding":

- Inverse functions:
 - Recite on demand all definitions/theorems pertaining to inverse functions (e.g., one-one, domain/range, continuity theorem, differentiability theorem),
 - Read questions pertaining to inverse functions, write out all information contained in the question to then be followed by writing all information that might be helpful in answering the question (i.e., listing all definitions/theorems, related/similar examples, etc. that appear to be related to the question),
 - To be able to recite on demand the general behavior of exponential functions, their properties, graphs, derivatives, their inverses (i.e., be able to identify the appropriate log function for any exponential function) and the derivatives of the log functions,
 - To be able to recite on demand the general behavior of hyperbolic functions, their inverses, their derivatives (both for hyperbolic as well as their inverses), to write from memory the hyperbolic inverse functions in terms of logarithmic functions, their domain of definition and range,
 - For each inverse trigonometric function, to give from memory their domain of definition and derivative,
 - For each of the above, to demonstrate an ability to apply algebra, and any differentiation technique as applied to inverse functions,
 - For each of the above, to demonstrate an ability to apply part 1 and part 2 of the Fundamental Theorem of Calculus as they pertain to inverse functions,
 - To demonstrate an ability to apply the above in solving word problems.
- L'Hospital's Rule:
 - To recite on demand L'Hospital's Rule,
 - To recite on demand all indeterminate forms of a limit ($0/0$, infinity/infinity, mixed product, indeterminate differences, indeterminate powers),
 - To demonstrate an ability to read a question and determine the most appropriate technique for applying L'Hospital's Rule or any other technique covered in Calculus I for analyzing limits.
- Antiderivatives (that is, techniques for finding indefinite integrals),
 - The student will demonstrate a working knowledge of the procedures for integration (by working knowledge, it is meant that the student will be able to describe in procedural form how each technique is applied and be able to list the most appropriate structures to use for a given integration technique),
 - The student will demonstrate the ability to read the integrand and choose the most appropriate integration technique:
 - Integration by parts,
 - Trigonometric integration,
 - Trigonometric substitution,
 - Integration of rational functions by partial fractions,
 - If time permits, the student will demonstrate how integration tables are applied,
 - Approximating definite integrals and estimating their respective approximation errors:
 - To recite on demand the definition of each approximating integration method, the error produced from the approximation:

- Trapezoidal Rule,
- Midpoint Rule,
- Simpson's Rule,
 - To apply the definitions and error formulae for each approximating integration method as needed to answer questions,
- Improper integrals,
 - To know via memorization the definitions and theorems that pertain to improper integrals (e.g., definition of a convergent/divergent improper integral, the definition for all types of improper integrals (type 1 and type 2), the Comparison Theorem)
 - To demonstrate the ability for properly applying the above by answering questions pertaining to improper integrals.
- Length of a curve (arc length),
 - To recite on demand the arc length formula for curves given as $y=f(x)$ or as $x=g(y)$ for an appropriate interval,
 - To know what is meant by the term 'arc length function' and how to use it to derive the differential for arc length and the change in arc length,
 - To apply the above for the solution of any question involving arc length, to include word problems.
- Area of a surface of revolution.
 - To be able to answer questions involving the derivation of the various formulae for surface area found by rotating a curve about either the x- or y-axis,
 - To demonstrate a working ability to choose the proper surface area of rotation form for a particular question (exercise), to include word problems.
- Applications,
 - If time permits, the student will demonstrate their ability to apply the above topical material to applications in the fields of physics, engineering, economics, biology and probability as demonstrated via questions (exercises). As examples, the applications may include hydrostatic pressure and force, moments and centers of mass, the theorem of Pappus and its application,
 - For any of the applications covered, any formulae, definitions and theorems will be memorized for recitation on demand
- First order differential equations involving exponential growth and decay,
 - To recite on demand the general formulae that describes exponential growth and decay,
 - To recite on demand any and all terminology such as 'law of natural growth', 'relative growth rate', 'half-life',
 - To recite on demand certain applications in which the function value is proportional to its rate of change (examples may include Newton's law of cooling, and continuously compounded interest),
 - To demonstrate the knowledge required to solve exercises related to the above (to include word problems)
- Parametric equations,
 - To recite on demand any terminology needed to describe parametric equations

- (e.g., parameter, parametric equations, parametric curve, initial point, terminal point,
- To be able to recognize the curve of a cycloid,
 - To demonstrate the ability to analyze families of parametric equations,
 - To demonstrate the ability to recognize the graph of a parametric equation,
 - To demonstrate the ability to graph parametric equations, to include sketching the direction the curve takes with increasing values of the parameter,
 - To demonstrate the ability to eliminate the parameter to express the curve in the form $y=F(x)$, if possible,
 - To demonstrate the ability to apply calculus to parametric curves that includes,
 - tangents
 - areas
 - arc length,
 - surface area.
- Polar coordinates,
 - To recite on demand any terminology needed to describe polar coordinates (e.g., polar coordinate system, pole, polar axis, polar coordinates, polar equation, positive and negative angles),
 - To demonstrate the ability to plot polar coordinates, to switch from polar coordinates to Cartesian coordinates and from Cartesian coordinates to polar coordinates,
 - To demonstrate the ability to graph polar curves,
 - To recognize whether it is better to represent a described curve in Cartesian or polar coordinates, and then to write the equation out in detail,
 - To demonstrate the ability to match polar equations with its graph,
 - To demonstrate a working ability with polar coordinates by solving questions (to include word problems),
 - To demonstrate a working ability with the application of calculus to polar equations that includes,
 - areas,
 - arc lengths
 - tangent lines.
 - Conics
 - To recite on demand the definitions of conics (parabolas, ellipses, and hyperbolas),
 - To recite on demand any terminology that describes conics (e.g., parabola, directrix, axis of the conic, vertex, foci, focus, major and minor axes, ellipse, hyperbola, asymptotes, branches, standard equations),
 - To demonstrate the ability to put a conic into its standard form given any of a variety of data,
 - To graph (by hand) conics given general information pertaining to it (in either Cartesian or polar form)
 - To demonstrate the ability to write a polar equation of a conic given sufficient information,

- To demonstrate the ability to describe any defining element of the conic (given information in either polar or Cartesian form),
- Sequences,
 - To recite on demand any terminology (and notation) that describes sequences to include definitions/theorems (e.g., sequence, Fibonacci sequence, limit, convergent, divergent, increasing, decreasing, monotonic, bounded (above/below/sequence), Monotonic Sequence theorem)
 - To demonstrate the ability to describe sequences in various ways (notation),
 - To demonstrate the ability to analyze sequences by applying the definitions, theorems and definitions that define the main properties (convergence/divergence/limit),
 - To recite on demand the main arithmetic properties for limits of converging sequences (Limit laws for sequences),
 - To demonstrate the ability to use the Limit laws when determining properties of sequences,
 - To demonstrate the ability to write clear, concise arguments establishing the properties of sequences,
 - To demonstrate the ability to apply the above for answering word problems.
- Series,
 - To recite on demand any terminology (and notation) that describes series to include definitions/theorems (e.g., infinite series, series, partial sum, convergent, divergent, geometric series, harmonic series, necessary condition for convergence (theorem), test for divergence, p- series, remainder, alternating series, alternating series test, alternating series estimation theorem, absolutely convergent, conditionally convergent, ratio test, root test, rearrangement, power series about a , power series centered at a , power series in $(x-a)$, coefficients, Bessel function, radius of convergence, interval of convergence, term-by-term differentiation or integration, Taylor series, Maclaurin series, binomial series),
 - To demonstrate the ability to analyze series to determine their properties (convergence/divergence) that include the following skills,
 - the application of the laws governing the sum and product of two or more converging series,
 - the application of the various tests for convergence
 - Integral test (also used to estimate the limit of a convergent series),
 - Comparison test, Alternating series test,
 - Ratio test (absolute convergence),
 - Root test (absolute convergence),
 - To demonstrate the ability to analyze power series to include the determination of the radius and interval of convergence as well as the ability to represent a given function as a power series,
 - To demonstrate the ability needed to determine the Taylor series of a given function, or as a special case, to determine the Maclaurin series,
 - To demonstrate the ability needed to determine the remainder term of the

Taylor or Maclaurin series,

- The ability to derive the Taylor or Maclaurin series for the main function categories (such as trigonometric, rational, exponential, logarithmic, etc.) as well as determining power series for products of functions as a product of power series (here, a product includes division),
- The understanding of the binomial series and one of its uses to determine power series representation

Prerequisites and Corequisites:

A grade of C or better in MATH 1910

Course Topics:

The course topics will be covered and evaluated on a fixed schedule, i.e., the student is expected to continue at the prescribed pace regardless of their performance on their homework, quizzes or exams. For a detailed schedule, please refer to the Course Calendar (located at the left menu panel of the Course Homepage).

Specific Course Requirements:

Students will be required to learn and install free browser plug-ins, and install and use free downloadable mathematics software. Students may use a graphing calculator for homework and quizzes. The final exam will be an **unproctored** exam. Students will be allowed the use of a graphing calculator, their books/notes, etc. Please see below under "Assessment and Grading: Testing Procedures" for more information.

Homework will NOT be submitted electronically, that is, homework will not be graded directly. Instead, homework will be reported via the DROPBOX no later than the due date given in the course calendar. All homework assignments are first given on the first day of class (or there about). This is so the student can print out all assignments from one location. The second appearance of the homework assignment will be the day it is due - you must look forward approximately one to two weeks to find the due date for any particular homework. To report your homework, go to the Dropbox and click the appropriate homework assignment. Then type in the outlined sections that you worked (just tell me which sections you outlined, I don't need to see the outline) as well as a full list of all exercises attempted (not just looked at, but the ones an effort was given). I will award 3 points per outline and exercise that you report as having attempted with sufficient effort.

Required Textbooks:

Please visit the [Virtual Bookstore](#) to obtain textbook information for this course. Move your cursor over the "Books" link in the navigation bar and select "Textbooks & Course Materials." Select your Program, Term, Department, and Course; then select "Submit."

Supplementary Materials:

A graphing calculator is recommended but not required. The Texas Instruments TI-83, TI-83 Plus, and/or TI-89 are options. Mathematics software such as Matlab, Mathematica and Maple may also be used for homework, and for quizzes.

Hardware and Software Requirements:

Minimum hardware requirements can be found [here](#).

Minimum software requirements can be found [here](#).

Common applications you might need:

To read a PDF file download the latest version of [Adobe Reader here](#)

Don't have Microsoft Word? Explore an alternative [OpenOffice here](#)

Accessing a PowerPoint file? Download the [PowerPoint Viewer here](#)

Web Resources:

Purdue [OWL Online Writing Lab](#) (for APA, MLA, or Chicago style)

The Writing Center [Online Writer's Handbook](#)

Student Resources:

- Technical support information can be found on the [TN eCampus Help Desk](#) page.
- Smarthinking virtual tutoring is available **FREE** of charge. to access Smarthinking, visit the course homepage and select Smarthinking under Course Resources. You also view [sample sessions](#) to see what Smarthinking offers and how it works.
- Information on other student issues or concerns can be located on the [TN eCampus Student Resources](#) page.

Instructor Information:

Please see "Instructor Information" in the Getting Started Module for instructor contact information, virtual office hours, and other communication information. You can expect to receive a response from the instructor within 24-48 hours unless notified of extenuating circumstances.

Testing Procedures:

Ten quizzes (timed, open book) will be given online. The student will have to take each quiz sometime during its availability period (please refer to the Course Menu under "Assessments" for the availability time for each quiz). The first quiz will be allowed to be taken any number of times, the highest score being recorded as the Quiz 1 grade. For the first quiz, and only the first quiz (Quiz 1), the student will have an indefinite time period to complete and submit their work (per take). Note that you will not have access to Quiz 1 AFTER its availability period! It is well advised to take this quiz before you've read the book or tried any of the homework or exercises (since you can take it any number of times, it's best to start sooner rather than

waiting for the last day it's available). The second through tenth quizzes (Quiz 2 through Quiz 10) will be allowed to be taken three times, the highest score being recorded as the respective quiz grade. These remaining quizzes (Quiz 2 through Quiz 10) must be completed within 2 hours and, like Quiz 1, there is a period of availability; you will not have the entire semester to work each quiz. A comprehensive mid-term exam will be given in an UNPROCTORED environment. The student is expected to observe the honor system and submit his/her own personal work and not the result from someone else's help in any way. This midterm exam will be computer based in a format similar to that experienced for the quizzes. The student will only be allowed one time to take the mid-term exam. A comprehensive final exam will be given in a UNPROCTORED environment. Like the mid-term exam, the final exam will be computer based and the student will be allowed access to a calculator and the textbook and any notes. The student will only have access to the final exam once.

Ten (10) homework assignments will be reported electronically (see above, under Specific Course Requirements for more information) and graded for effort and completeness. Outlines will be required for the majority of the modules. The purpose is to ensure that the student has read the material and worked to organize the subject matter - this very important endeavor is often skipped by students who have trouble with the exercises.

Grading Procedures:

The total number of points allocated for this course is 600 (points). Homework will be assigned from the textbook as well as via using the online medium (to include at least one exercise that is open format, i.e., not multiple choice, true-false, but must be written using math symbols and English sentences). Any additional homework assigned from the textbook (outside the homework listed in the Calendar section of this course) is for the student's benefit only, it will not be submitted for grading nor will it count toward the overall grade. The homework (HW) reported online electronically will be graded for effort and completeness and be weighted 50 points toward the total number of points allocated. Note that by weighted, I take the homework points earned, divide by the total number of points possible (giving a decimal number between 0 and 1, inclusive) and then multiply by the weighted points (for homework, 50 pts.). Each of the ten quizzes (QZ1, QZ2, ..., QZ10) will be weighted 10 points (100 pts. total) toward the total number of points allocated. The mid-term exam (MTEXM) will be weighted 200 points toward the total number of points allocated. The final exam (FEXM) will be weighted 250 points toward the total number of points allocated.

HW + QZ1 + QZ2 + QZ3 + QZ4 + ... + QZ10 + MTEXM + FEXM

Final Average =

600

Graded Items:

Description	Percentage
10 Quizzes	16.7%
10 Homework Assignments (%'s vary)	8.33%
Mid-term Exam	33.3%
Final Exam	41.7%
Total Percentage	100%

Grading Scale:

Letter grades for this course will be assigned based on the following scale:

A	540-600 points
B	480-539 points
C	420-479 points
D	360-419 points
F	under 360 points

Assignments and Projects:

Homework will be assigned for each textbook section.

Class Participation:

To learn it is imperative for the student to take an active interest in their own education. To learn mathematics the student must read, think, and write in an analytical manner and this takes practice. When troubles arise, and they will, the student must ask questions. Questions may be posed to the instructor or to other students in a variety of ways; online office hours, online chat times, e-mail, phone.

Late Policy:

Quizzes, homework assignments, and the mid-term exam will all have specific deadlines. These graded activities must be completed by the due date and time. Make-up work will be accepted only under documented extreme circumstances.

Course Ground Rules:

The following two statements (1., 2.) were derived from the TBR System-wide Student Rules

document, released January 2012:

RULES OF THE TENNESSEE BOARD OF REGENTS STATE UNIVERSITY AND
COMMUNITY COLLEGE SYSTEM OF TENNESSEE SYSTEMWIDE STUDENT RULES
CHAPTER 0240-02-03 STUDENT CONDUCT AND DISCIPLINARY SANCTIONS

[Read the document in its entirety here.](#)

1. Standards of Conduct:

- Students are required to adhere to the same professional, legal and ethical standards of conduct online as on campus. In addition, students should conform to generally accepted standards of "netiquette" while sending e-mail, posting comments to the discussion board, and while participating in other means of communicating online. Specifically, students should refrain from inappropriate and/or offensive language, comments and actions.

2. [Review the TN eCampus Academic Integrity/Academic Honesty Policy:](#)

- In their academic activities, students are expected to maintain high standards of honesty and integrity. Academic dishonesty is prohibited.

Such conduct includes, but is not limited to:

- an attempt by one or more students to use unauthorized information in the taking of an exam
- to submit as one's own work, themes, reports, drawings, laboratory notes, computer programs, or other products prepared by another person,
- or to knowingly assist another student in obtaining or using unauthorized materials.

Plagiarism, cheating, and other forms of academic dishonesty are prohibited.

Students guilty of academic misconduct, either directly or indirectly through participation or assistance, are subject to disciplinary action through the regular procedures of the student's home institution. Refer to the student handbook provided by your home institution to review the student conduct policy.

In addition to other possible disciplinary sanctions that may be imposed, the instructor has the authority to assign an "F" or zero for an activity or to assign an "F" for the course.

Other Course Rules:

Students are expected to:

- Participate in all aspects of the course
- Communicate with other students
- Learn how to navigate in Brightspace
- Keep abreast of course announcements
- Use the assigned course management (Brightspace) email address rather than a personal email address
- Address technical problems immediately:
 - [Contact Technical Support](#)
 - [View Term Calendar here](#)
- Observe course netiquette at all times.

Guidelines for Communications:

Email:

- Always include a subject line.
- Remember without facial expressions some comments may be taken the wrong way. Be careful in wording your emails. Use of emoticons might be helpful in some cases.
- Use standard fonts.
- Do not send large attachments without permission.
- Special formatting such as centering, audio messages, tables, html, etc. should be avoided unless necessary to complete an assignment or other communication.
- Respect the privacy of other class members

Discussions:

- Review the discussion threads thoroughly before entering the discussion. Be a lurker then a discussant.
- Try to maintain threads by using the "Reply" button rather starting a new topic.
- Do not make insulting or inflammatory statements to other members of the discussion group. Be respectful of other's ideas.
- Be patient and read the comments of other group members thoroughly before entering your remarks.
- Be cooperative with group leaders in completing assigned tasks.
- Be positive and constructive in group discussions.
- Respond in a thoughtful and timely manner.

Library:

The [Tennessee Virtual Library](#) is available to all students enrolled in TN eCampus programs

and courses. Links to library materials (such as electronic journals, databases, interlibrary loans, digital reserves, dictionaries, encyclopedias, maps, and librarian support) and Internet resources needed by learners to complete online assignments and as background reading will be included within the course modules. To access the Virtual Library, go to the course homepage and select the ***Virtual Library*** link under Course Resources.

Students with Disabilities:

Qualified students with disabilities will be provided reasonable and necessary academic accommodations if determined eligible by the appropriate disability services staff at their home institution. Prior to granting disability accommodations in this course, the instructor must receive written verification of a student's eligibility for specific accommodations from the disability services staff at the home institution. It is the student's responsibility to initiate contact with their home institution's disability services staff and to follow the established procedures for having the accommodation notice sent to the instructor.

Syllabus Changes:

The instructor reserves the right to make changes as necessary to this syllabus. If changes are necessitated during the term of the course, the instructor will immediately notify students of such changes both by individual email communication and posting both notification and nature of change(s) on the course bulletin board.

Disclaimer

The information contained in this syllabus is for general information purposes only. While we endeavor to keep this information up-to-date and accurate, there may be some discrepancies between this syllabus and the one found in your online course. The syllabus of record is the one found in your online course. Please make sure you read the syllabus in your course at the beginning of the semester. Questions regarding course content should be directed to your instructor.