

Calculus - Enhanced

MAT1300

Course Description

Calculus is an advanced high school mathematics course. It builds on principles of Geometry, Algebra and other prior mathematics courses to take students into the world of limits, derivatives, special computational techniques such as the Power Rule, and differentiation. Calculus also explores topics related to sequences, series, and the fundamental theorem of calculus. Finally, the mathematics of physics is presented through vector calculus. This is a course that is an important prerequisite for many educational programs in engineering and science.

Rationale

Students are required more and more to have a higher level background in mathematics before beginning a program of study for engineering and sciences (including medicine). Calculus gives them this edge on being prepared for the more difficult college level courses. It is a logical follow up course after Pre-Calculus and Trigonometry.

Prerequisite

Pre-Calculus or Trigonometry

Biblical Integration Outcomes

- A. The student will learn about the fascinating universe that God created and how mathematics displays His power and glory through mathematical principles that govern the natural laws of the universe.
- B. The student will explore how mathematical principles and ideas such as Fibonacci's Number, Euler's Law, and the Golden Ratio are all synchronous with God's handiwork in plant life, building design and other areas of science and math.

Measurable Learning Outcomes

- A. The student will investigate and explore Calculus topics including limits, derivatives, integrals, differentiation, sequences and series.
- B. The student will perform computations using the Power Rule, Product and Quotient Rules, and the Chain Rule.
- C. The student will evaluate limits, rates of change, derivatives and other calculations using proven Calculus principles and skills.

- D. The student will investigate a variety of functions including exponential and logarithmic functions.
- E. The student will use derivatives to find velocity, rates of change, slopes of tangent lines, equations of tangent lines, reciprocal functions, and square root functions.
- F. The student will evaluate and graph trigonometric functions, exponential functions, and logarithmic functions.
- G. The student will explore topics related to higher-order derivatives, linear approximation, and curve sketching.
- H. The student will investigate the basics of integration including the fundamental theorem of Calculus, antiderivatives, and practical applications in real life.
- I. The student will have the opportunity to explore paradoxes and special sequences in Calculus including Zeno's Paradox, Fibonacci's Number, and the Golden Ratio.

Enhanced Courses

LUOA Enhanced Courses provide additional student support through increased interaction and communication with the course instructor. Interaction takes place through:

- Weekly live teaching sessions
- Q&A conference with teacher before each test
- Discussion boards

Participation Grade

Students are given a participation grade based on attendance during the teacher live sessions and participation in discussion boards. For full year courses, there are 20 teacher live sessions and four discussion boards. Semester courses have 10 live sessions and two discussion boards. Participation grades are given at the end of each semester and count as a Tier 3 assignment.

Semester Grade Participation:

Grade	Participation
A	Attended 8–10 teacher live sessions, participated in two discussion boards
B	Attended 6–7 teacher live sessions, participated in two discussion boards
C	Attended 5 teacher live sessions, participated in two discussion boards
D	Attended 3–4 teacher live sessions, participated in one discussion board
F	Attended 0–3 live teacher sessions, participated in zero discussion boards

Late Policy

In order to take full advantage of our Enhanced courses, it is important that students stay on track with their scheduled assignments so that they benefit from the discussions with their teacher and classmates. Meeting deadlines is a skill that will aid students in their high school classes and beyond. Enhanced courses offer LUOA students help in developing this skill by requiring assignments to be turned in by the due date in order to receive full-credit. For each

day the assignment is not submitted, 5 percent will be deducted from the assignment grade with a maximum deduction of 20 percent.

** Exceptions to this late policy may be considered in cases of illness, travel, or unforeseen events. Students will need to contact their teacher to seek approval for any exception.*

Semester and Final Exams Proctored

The proctoring of the semester and/or final exam by a parent/guardian or other adult is required for Enhanced Courses. A form is provided in the course that the proctor will sign and complete. The student will then upload the form into an assignment before being able to begin the exam.

Course Materials

See LUOA's [Systems Requirements](#) for computer specifications necessary to operate LUOA curriculum. Also view [Digital Literacy Requirements](#) for LUOA's expectation of users' digital literacy.

This course makes use of third-party digital resources to enhance the learning experience. LUOA staff and faculty have curated these resources. Students can safely access them to complete coursework. Please ensure that internet browser settings, pop-up blockers, and other filtering tools allow for these resources to be accessed. See Technologies and Resources Used in this Course below for a specific list.

Note: Embedded YouTube videos may be utilized to supplement LUOA curriculum. YouTube videos are the property of the respective content creator, licensed to YouTube for distribution and user access. As a non-profit educational institution, LUOA is able to use YouTube video content under the YouTube Terms of Service. For additional information on copyright, please contact the [Jerry Falwell Library](#).

Materials Required for Purchase

The following materials are required in this course:

- Graphing calculator, or utilize an online version such as Desmos at <https://www.desmos.com/calculator>

Technologies and Resources Used in this Course

The following resource(s) are used throughout this course:

- Thinkwell

Course Grading Policies

The student's grades will be determined according to the following grading scale and assignment weights. The final letter grade for the course is determined by a 10-point scale. Assignments are weighted according to a tier system, which can be referenced on the Grades Page in Canvas. Each tier is weighted according to the table below. Items that do not affect the student's grade are found in Tier 0.

Grading Scale

A	90-100%
B	80-89%
C	70-79%
D	60-69%
F	0-59%

Assignment Weights

Tier 0	0%
Tier 1	25%
Tier 2	35%
Tier 3	40%

In order for students to receive credit for a course, the following conditions have to be met:

1. All semester exams and module tests have to be completed,
2. All Tier 3 projects or papers have to be completed, and
3. Fewer than 10 zeros exist in the gradebook for blank submissions in a full credit course and 5 zeros for blank submissions in a semester course.

Course Policies

Students are accountable for *all* information in the Student Handbook. Below are a few policies that have been highlighted from the Student Handbook.

Types of Assessments

To simplify and clearly identify which policies apply to which assessment, each assessment has been categorized into one of four categories: Lesson, Assignment, Quiz, or Test. Each applicable item on the course Modules page has been designated with an identifier chosen from among these categories. Thus, a Quiz on the American Revolution may be designated by the title, "1.2.W Quiz: The American Revolution." These identifiers were placed on the Modules page to help students understand which Honor Code and Resubmission policies apply to that assessment (see the Honor Code and Resubmission policies on the pages that follow for further details).

- **Lesson:** *Any item on the Modules page designated as a "Lesson"*
These include instructional content and sometimes an assessment of that content. Typically, a Lesson will be the day-to-day work that a student completes.
- **Assignment:** *Any item on the Modules page designated as an "Assignment"*
Typical examples of Assignments include, but are not limited to, papers, book reports, projects, labs, and speeches. Assignments are usually something that the student should do his or her best work on the first time.
- **Quiz:** *Any item on the Modules page designated as a "Quiz"*
This usually takes the form of a traditional assessment where the student will answer questions to demonstrate knowledge of the subject. Quizzes cover a smaller amount of material than Tests.
- **Test:** *Any item on the Modules page designated as a "Test"*
This usually takes the form of a traditional assessment where the student will answer questions to demonstrate knowledge of the subject. Tests cover a larger amount of material than Quizzes.

Resubmission Policy

Students are expected to submit their best work on the first submission for every Lesson, Assignment, Quiz, and Test. However, resubmissions may be permitted in the following circumstances:

- **Lesson:** Students are automatically permitted two attempts on a Lesson. Students may freely resubmit for their first two attempts without the need for teacher approval.
- **Assignment:** Students should do their best work the first time on all Assignments. However, any resubmissions must be completed before the student moves more than one module ahead of that Assignment. For example, a student may resubmit an Assignment from Module 3 while in Module 4, but not an Assignment from Modules 1 or 2. High School students may not resubmit an Assignment without expressed written permission from the teacher in a comment.
- **Quiz:** Students may NOT resubmit for an increased grade.
- **Test:** Students may NOT resubmit for an increased grade.

If a student feels that he or she deserves a resubmission on a Lesson, Assignment, Quiz, or Test due to a technical issue such as a computer malfunction, the student should message his or her teacher to make the request, and that request will need to be approved by a Department Chair.

Consequences for Violations to the Honor Code

Every time a student violates the Honor Code, the teacher will submit an Honor Code Incident Report. The Student Support Coordinator will review the incident and allocate the appropriate consequences. Consequences, which are determined by the number of student offenses, are outlined below:

- **Warning:** This ONLY applies to high school Lessons and elementary/middle school Assignments and Lessons. Students should view these actions as learning opportunities.
 - **Lessons:** A zero will be assigned for the question only.
 - **Elementary/Middle School Assignment:** The student must redo his or her work; however, the student may retain his or her original grade.
- **1st Offense:**
 - **Lesson, Quiz, or Test:** The student will receive a 0% on the entire assessment.
 - **Assignment:** The student will either:
 - Receive a 0% on the original assignment
 - Complete the Plagiarism Workshop
 - Retry the assignment for a maximum grade of 80%
- **2nd Offense:** The student will receive a 0% and be placed on academic probation.
- **3rd Offense:** The student will receive a 0% and the Faculty Chair will determine the consequences that should follow, possibly including withdrawal from the course or expulsion from the academy.

Scope and Sequence

Calculus

Module 1: A Review of Pre-Calculus and a Basic Overview of Calculus

Week 1: Overview and Review
Week 2: Limits and Continuity
Week 3: Limits and the Derivative
Week 4: Using the Limit Definition of the Derivative

Module 2: Derivative Rules, Functions, and Differentiation

Week 5: Derivative Rules
Week 6: Trigonometric and Exponential Functions
Week 7: Exponential and Logarithmic Functions
Week 8: Implicit Differentiation

Module 3: Applications of Differentiation, Optimization, Rates and Curve Sketching

Week 9: Applications of Differentiation
Week 10: Optimization, Related Rates, and Curve Sketching
Week 11: Curve Sketching
Week 12: More Curve Sketching

Module 4: Integration Basics and Applications

Week 13: Integration Basics
Week 14: Integration
Week 15: Applications of Integration
Week 16: Integrating with Respect

Module 5: L'Hôpital's Rule and Semester Exam

Week 17: L'Hôpital's Rule
Week 18: Semester Review and Exam

Module 6: Inverse Functions and Integration

Week 19: Inverse Functions
Week 20: Inverse Trigonometric Functions, Partial Fractions, and Long Division
Week 21: Integration by Parts
Week 22: Numerical Integration and Improper Integrals

Module 7: Average Value, Sequences, and Series

Week 23: Average Value, Cross-Sectional Volume, and Disk Method
Week 24: Washers, Arc Length, and Sequences
Week 25: Sequences and Infinite Series
Week 26: Convergence, Divergence, and the Integral Test

Module 8: Convergence, Intervals and Power Series

Week 27: Convergence Tests
Week 28: Absolute Convergence, Ratio Test, and Taylor and Maclaurin Polynomials
Week 29: Taylor and Power Series
Week 30: Interval and Radius of Convergence and Finding Power Series

(Continued on the next page)

Module 9: Differentiation, Parametric Equations and the Polar Coordinate System

Week 31: Differential Equations

Week 32: Logistic Growth and Parametric Equations

Week 33: Arc Length of a Parameterized Curve and Polar Coordinates

Week 34: Polar Functions and Area

Module 10: Vectors and Three Dimensional Coordinate Geometry

Week 35: Vector Functions

Week 36: Semester Review and Exam