AP Calculus C

Course Description

Calculus C is a continuation of Calculus B and is designed to provide the student with the prerequisite skills necessary for the Advanced Placement (Calculus BC) exam. A strong background in Calculus A and B (first year calculus) is necessary in order to be successful in this course. The major topics explored in this course include derivatives of vector-valued and parametrically defined functions, integration by partial fractions, improper integrals, series convergence (Taylor and Maclaurin). L'Hopitals Rule, and numerous applications

Course Materials

The following is required of all Calculus C students:

- Textbook: CALCULUS 7th edition by Larson, Hostetler, and Edwards
- Online resource: TDLC online resource (go to www.tdlc.com for subscription orders) for above text (optional)
- Barron's AP Calculus Advanced Placement Examination: Review of Calculus AB and Calculus BC 6th edition, by Hockett
- Graphing Calculator: A TI-83 or TI-84. Check with your instructor for other options.
- Other Items: Access to a computer with internet access, regular and graph paper, pencils and a notebook for hardcopy organization.

Learning Outcomes

At the completion of Calculus C, the student will be able to:

1. Use and apply integration by parts
2. Evaluate trigonometric integrals
3. Apply trigonometric substitution
4. Apply partial fractions to evaluating integrals
5. Apply L'Hopitals Rule and recognize indeterminant forms.
6. Understand the differences and similarities between a sequence and series
7. Know the Integral Test and p-Series
8. Recognize different types of series
9. Apply the Ratio and Root Tests
10. Determine Taylor polynomials and approximations
11. Use Power Series to represent functions
12. Determine Taylor and Maclaurin Series.
13. Apply parametric equations to calculus concepts

14. Apply polar coordinates to calculus concepts
15. Determine area and arc length in polar coordinates
16. Apply vectors to calculus concepts
17. Apply Euler's Method

Course Outline-*Calculus C*

The following is an overview of Calculus C course content. Students are encouraged to print this document for reference and pacing throughout the course.

Unit One

LEARNING OUTCOMES (Unit One)
At the end of unit one, students will be able to:

- Review basic integration rules
- Find antiderivatives by integration by parts (with tabular methods)
- Solve trigonometric integrals
- Use trigonometric substitution
- Apply trigonometric integrals to real life situations

REQUIRED READING (Unit One)
The following is required reading for the first unit.

section	*title*
7.1	Basic Integration Rules
7.2	Integration by Parts
7.3	Trigonometric Integrals
7.4	Trigonometric Substitution

TOPIC LECTURES (Unit One)

In addition to the required reading, topic lectures are provided to support different learning styles through guided examples, simulation, animation and editable graphs. These can be accessed by students with a subscription at the following address: www.tdlc.com

For unit one, students will access the guided examples, simulations, animations and edible graphs for the sections covered in the required reading. Students are then asked to try each section quiz (will not be graded) to check for understanding.

ASSIGNMENTS (Unit One)

- Exercises from the book (see "week one exercises" for a detailed list)

CHATS (Unit One)
Students are required to attend one chat per unit (5 points each). Bring any questions or comments.

DISCUSSION BOARD (Unit One)|
Answer two of the following:

1. Introduce yourself. Why are you taking an online course?
2. Describe how you plan to be successful in Calculus C.
3. Write the fraction 1/6 as the sum of two fractions.
4. Make up your own example of an integration problem that requires the technique of partial fractions. Show your solution.
5. What two trigonometric identities play an important role in section 7.2?

TEST (Unit One)
Learning Outcomes Assessment

STANDARDS ADDRESSED (Unit One)
Referring to the syllabus, the following NCTM Standards are addressed during week three: 1, 2, 6, 9. The following California State Board of Education Standards are addressed during week three: 17.0

Unit Two

LEARNING OUTCOMES (Unit Two)

- At the end of week one, students will be able to:
- Use and apply partial fraction decomposition.
- Understand indeterminate forms for limits
- Apply L'Hopital's Rule for indeterminant forms
- Evaluate integrals with infinite limits of integration.
- Evaluate a limit containing asymptotic discontinuities.
- List the terms of a sequence
- Determine if a sequence converges or diverges
- Write formulas for sequences
- Recognize monotonic and bounded sequences

REQUIRED READING (Unit Two)
The following is required reading for the second unit.

section	*title*
7.5	Partial Fractions
7.7	Indeterminate Forms and L'Hopital's Rule
7.8	Improper Integrals
8.1	Sequences

TOPIC LECTURES (Unit Two)

In addition to the required reading, topic lectures are provided to support different learning styles through guided examples, simulation, animation and editable graphs. These can be accessed by students with a subscription at the following address: www.tdlc.com

For unit two, students will access the guided examples, simulations, animations and edible graphs for the sections covered in the required reading. Students are then asked to try each section quiz (will not be graded) to check for understanding.

ASSIGNMENTS (Unit Two)

- Exercises from the textbook (see "Unit Two Assignments")
- Consider project options; decide on which project you would like to begin.

CHATS (Unit Two)
Students are required to attend one chat per unit (5 points each). Bring any questions or comments.

DISCUSSION BOARD (Unit Two)
Answer two of the following:

1. The process of partial fractions is the reverse process of….Give an example.
2. A circle has center (1,0) and radius 3. What is the area of the region bounded by the circle and the lines x = -1 and x = 2. Round your answer to the nearest hundredth.
3. In your own words, explain why zero divided by zero is indeterminate (has no real number value).
4. Give an example of a limit question where applying L'Hopital's rule twice is necessary in determining the limit.
5. Can L'Hopital's Rule be applied to limits that do not exist? Explain.

TEST (Unit Two)
Unit Two Test

STANDARDS ADDRESSED (Unit Two)
Referring to the syllabus, the following NCTM Standards are addressed during week three: 1, 2, 6. The following California State Board of Education Standards are addressed during week three: 8.0, 17.0, 20.0

Unit Three

LEARNING OUTCOMES (Unit Three)
At the end of unit one, students will be able to:

- Know the definition for a convergent infinite series
- Know all properties for an infinite geometric series and the nth-term test.
- Use the Integral Test for convergence
- Know properties of p-series and harmonic series
- Know the Direct Comparison and Limit Comparison Tests for convergence and divergence.
- Use the Alternating Series Test
- Classify a convergent series as absolutely or conditionally convergent.
- Rearrange an infinite series to obtain different results

REQUIRED READING (Unit Three)
The following is required reading for the third unit.

section	*title*
8.2	Series and Convergence
8.3	The Integral Test and the p-Series
8.4	Comparisons of Series
8.5	Alternating Series

TOPIC LECTURES (Unit Three)
In addition to the required reading, topic lectures are provided to support different learning styles through guided examples, simulation, animation and editable graphs. These can be accessed by students with a subscription at the following address: www.tdlc.com

For unit three, students will access the guided examples, simulations, animations and edible graphs for the sections covered in the required reading. Students are then asked to try each section quiz (will not be graded) to check for understanding.

ASSIGNMENTS (Unit Three)

- Exercises from the textbook (see "Unit Two Assignments")
- Work on projects

CHATS (Unit Three)
Students are required to attend one chat per unit (5 points each). Bring any questions or comments.

DISCUSSION BOARD (Unit Three)
Answer two of the following:

1. In your own words, state the difference between a geometric series and an arithmetic series.
2. Give a real-life example of a(n):

- o Infinite sequenc

- o A geometric series

3. What kind of series relates mostly to music? Give an example.
4. What is the difference between a sequence and a series? Give an example of each.
5. In your own words, what is meant by “conditional convergence”. Give an example.

TEST (Unit Three)
Unit Three Test

STANDARDS ADDRESSED (Unit Three)
Referring to the syllabus, the following NCTM Standards are addressed during week three: 1, 2, 4, 6, 7. The following California State Board of Education Standards are addressed during unit three: 23.0

Unit Four

LEARNING OUTCOMES (Unit Four)
At the end of unit four, students will be able to:

- Use the Ratio and Root Tests to determine if a series converges or diverges.
- Find polynomial approximations of parent functions.
- Find Taylor and Maclaurin polynomial approximations of functions.
- Use the remainder of a Taylor polynomial.
- Define power series.
- Find the radius and interval of convergence of a power series.
- Find the endpoint convergence of a power series.
- Differentiate and integrate a power series.
- Find a geometric power series for a given function.
- Construct a power series using operations

REQUIRED READING (Unit Four)
The following is required reading for the fourth unit.

section	*Title*
8.6	The Ratio and Root Tests
8.7	Taylor Polynomials and Approximations
8.8	Power Series
8.9	Representations of Functions by Power Series

TOPIC LECTURES (Unit Four)
In addition to the required reading, topic lectures are provided to support different learning styles through guided examples, simulation, animation and editable graphs. These can be accessed by students with a subscription at the following address: www.tdlc.com

For unit four, students will access the guided examples, simulations, animations and edible graphs for the sections covered in the required reading. Students are then asked to try each section quiz (will not be graded) to check for understanding.

ASSIGNMENTS (Unit Four)

- Exercises from the textbook (see "Unit four Assignments")
- Work on projects

CHATS (Unit Four)
Students are required to attend one chat per unit (5 points each). Bring any questions or comments.

DISCUSSION BOARD (Unit Four)
Answer two of the following:

1. Describe the condition(s) of convergence for a geometric series. Give a specific example.
2. Describe the condition(s) of convergence for a telescoping series. Give a specific example.
3. Give an example of an infinite series that A) converges and B) diverges.
4. Give a very brief biographical description of the mathematician Brook Taylor.
5. Give an example of a series whose radius of convergence is R = 1.

TEST (Unit Four)
Unit Four Test

STANDARDS ADDRESSED (Unit Four)
Referring to the syllabus, the following NCTM Standards are addressed during unit four: 1, 2, 4, 6. The following California State Board of Education Standards are addressed during unit four: 23.0, 24.0, 25.0, 26.0.

Unit Five

LEARNING OUTCOMES (Unit Five)
At the end of unit five, students will be able to:

- Find a Taylor and Maclaurin Series

- Find a Binomial Series
- Graph parametric equations
- Eliminate the parameter, given a pair of parametric equations
- Find the slope of a tangent line to a curve given in parametric equations
- Find arc length and surface area given a pair of parametric equations
- Graph an equation given in polar coordinates
- Differentiate between polar and rectangular forms
- Find the slope of a tangent line for an equation given in polar form
- Identify classic polar graphs

REQUIRED READING (Unit Five)
The following is required reading for the fifth unit.

section	*title*
8.10	Taylor and Maclaurin series
9.2	Plane Curves and Parametric Equations
9.3	Parametric Equations and Calculus
9.4	Polar Coordinates and Polar Graphs

TOPIC LECTURES (Unit Five)
In addition to the required reading, topic lectures are provided to support different learning styles through guided examples, simulation, animation and editable graphs. These can be accessed by students with a subscription at the following address: www.tdlc.com

For unit five, students will access the guided examples, simulations, animations and edible graphs for the sections covered in the required reading. Students are then asked to try each section quiz (will not be graded) to check for understanding.

ASSIGNMENTS (Unit Five)

- Exercises from the textbook (see "Unit Five Assignments")
- Work on projects

CHATS (Unit Five)
Students are required to attend one chat per unit (5 points each). Bring any questions or comments.

DISCUSSION BOARD (Unit Five)
Answer two of the following:

1. How are the projects going? Any suggestions or input regarding the projects?

2. Give a brief biography for Colin Maclaurin. Include dates and contributions to mathematics.
3. What is a transcendental function? Give an example of a function that is transcendental and one that is not transcendental.
4. In discussing parametric equations, what variable is referred to as the parameter? How are parametric equations applied in real life situations?
5. What two mathematicians are most likely responsible for the creation of polar coordinates? How are polar coordinates applied in real life situations?

TEST (Unit Five)
Unit Five Test

STANDARDS ADDRESSED (Unit Five)
Referring to the syllabus, the following NCTM Standards are addressed during week five: 1, 2, 3, 4, 7, 9. The following California State Board of Education Standards are addressed during unit five: 26.0

Unit Six

LEARNING OUTCOMES (Unit Six)
At the end of unit six, students will be able to:

- Find the area of a region defined in polar coordinates
- Find the arclength of a polar graph
- Find the area of surface revolution defined in polar coordinates
- Perform all vector operations and comprehend vectors geometrically
- Use vectors in problem solving
- Understand space coordinates and space vectors
- Problem solve using space vectors
- Determine angles between two vectors using dot products

REQUIRED READING (Unit Six)
The following is required reading for the sixth unit.

section	*title*
9.5	Area and Arc Length in Polar Coordinates
10.1	Vectors in the Plane
10.2	Space Coordinates and Vectors in the Plane
10.3	The Dot Product of Two Vectors

TOPIC LECTURES (Unit Six)
In addition to the required reading, topic lectures are provided to support different learning styles through guided examples, simulation, animation and editable graphs.

These can be accessed by students with a subscription at the following address: www.tdlc.com

For unit six, students will access the guided examples, simulations, animations and edible graphs for the sections covered in the required reading. Students are then asked to try each section quiz (will not be graded) to check for understanding.

ASSIGNMENTS (Unit Six)

- Unit Six Assignments
- Work on projects

CHATS (Unit Six)
Students are required to attend one chat per unit (5 points each). Bring any questions or comments.

DISCUSSION BOARD (Unit Six)
Answer two of the following:

1. Use your graphing calculator to graph the line segment defined parametrically by x = 2T and y = -3T (made sure you are in parametric mode in your calculator). What is the length of the line segment whose endpoints are T = 2.5 and T = 6.1? Round your answer to two decimal places. Explain your method.
2. Find the area of the polar region r = 4 using two different methods. Give your answer and explain those methods to the class.
3. In your own words, explain Kepler's First Law of Planetary motion. Do you think this Law is in any related to the four seasons we have on planet earth?
4. Give some specific contributions and a brief biography of the mathematician Emmy Noether.
5. Give two real life examples of two vectors that are orthogonal.

TEST (Unit Six)
Unit Six Test

STANDARDS ADDRESSED (Unit Six)
Referring to the syllabus, the following NCTM Standards are addressed during week six: 1, 2, 3, 4, 8, 9. The following California State Board of Education Standards are addressed during unit six: 16.0, 20.0

Unit Seven

LEARNING OUTCOMES (Unit Seven)
At the end of unit seven, students will be able to:

- Find the cross-product of two vectors in space and use the triple scalar product.
- Draw and analyze a space curve given in vector-valued terms.

- Extend single-variable calculus concepts to vector calculus.
- Differentiate and integrate vector-valued functions.
- Describe velocity and acceleration of vector-valued functions.
- Analyze projectile motion

REQUIRED READING (Unit Seven)
The following is required reading for the seventh unit.

section	*title*
10.4	The Cross Product of Two Vectors in Space
11.1	Vector Valued Functions
11.2	Differentiation and Integration of Vector-Valued Functions
11.3	Velocity and Acceleration

TOPIC LECTURES (Unit Seven)
In addition to the required reading, topic lectures are provided to support different learning styles through guided examples, simulation, animation and editable graphs. These can be accessed by students with a subscription at the following address: www.tdlc.com

For unit seven, students will access the guided examples, simulations, animations and edible graphs for the sections covered in the required reading. Students are then asked to try each section quiz (will not be graded) to check for understanding.

ASSIGNMENTS (Unit Seven)

- Unit seven assignments
- Work on projects

CHATS (Unit Seven)
Students are required to attend one chat per unit (5 points each). Bring any questions or comments.

DISCUSSION BOARD (Unit Seven)
Answer two of the following:

1. Is the cross-product of two vectors commutative? Give and example or a counterexample to illustrate your point.
2. Give three examples of how torque is used in real life situations.
3. Give your own example of a vector valued function in space that has the following domain: “ALL REAL NUMBERS GREATER THAN ZERO”.

4. Give a vector-valued equation for a circle. Give a vector-valued equation of a sphere.
5. In your own words, explain how vector calculus differs from calculus of a single variable (this is the calculus found in 1st and 2nd semester calculus).

TEST (Unit Seven)
Unit Seven Test

STANDARDS ADDRESSED (Unit Seven)
Referring to the syllabus, the following NCTM Standards are addressed during week seven: 1, 2, 3, 4, 6, 7, 8, 9 . The following California State Board of Education Standards are addressed during unit seven: 6.0

Unit Eight

LEARNING OUTCOMES (Unit Eight)
At the end of unit eight, students will be able to:

- Make connections between projects and learning outcomes for this course.
- Demonstrate knowledge of trigonometry sufficient for placement in higher mathematics.
- Understand and apply Euler's Method

REQUIRED READING (Unit Eight)
Students are asked to review prior readings in preparation for the final exam. Students should carefully read and re-read Euler's method on page A3 in the text. Students should also visit the recommended websites for Euler's Method (see Topic Lectures for week 8)

TOPIC LECTURES (Unit Eight)
In addition to the required reading, topic lectures are provided to support different learning styles through guided examples, simulation, animation and editable graphs. These can be accessed by students with a subscription at the following address: www.tdlc.com

For unit eight, students will access the guided examples, simulations, animations and edible graphs for the sections covered in the required reading. Students are then asked to try each section quiz (will not be graded) to check for understanding.

ASSIGNMENTS (Unit Eight)

- Review exercises
- Complete and turn in projects to the instructor.

CHATS (Unit Eight)
Students are required to attend one chat per unit (5 points each). Bring any questions or comments.

TEST (Unit Eight)
Final Exam

DISCUSSION BOARD (Unit Eight)
Answer two of the following:

1. What areas do I need to focus on the most in order to prepare for the final exam?
2. Describe Euler's method in your own words. In what situation might a person have to use Euler's Method?
3. Have I completed and turned in my projects?
4. What formulas do I need to be familiar with before I take the final exam?
5. Do I plan to take the AP Calculus BC Exam? How am I going to prepare? What additional resources are available for practice?

STANDARDS ADDRESSED (Unit Eight)
Referring to the syllabus, the following NCTM Standards are addressed during week eight: 1, 2, 3, 4, 8. The following California State Board of Education Standards are addressed during unit eight: 20.0, 27.0

To Parents

Parents are encouraged to monitor student progress wherever appropriate and to be proactive in their child's learning. Parents can obtain a copy of the course outline on the course website. Parents will be contacted throughout the course to update student progress. Parents are also encouraged to communicate with the instructor should any questions or concerns arise.

To Be Successful in this Class

Being proactive about your progress and learning in this course is your key to success! You are the one who needs to be in charge of your learning. Successful students will do all the following:

- Do the required reading.
- Carefully read and retry the examples/exercises from the text.
- Visit all teacher recommended websites and do all of the activities suggested in the topic lectures for each week.
- Ask questions wherever possible. Be assertive about your learning!
- Be involved with online chats and discussions.
- Submit all assignments, projects, and tests on time.
- Pace yourself! Budget and plan your time carefully.
- Start your projects when suggested.

Assessment

Both formal and informal assessments methods will be employed. Informal assessment will include an evaluation of participation in unit chats and discussions and grading rubrics for projects and assignments. Formal assessment will be employed for tests and the final examinations.

Total point values for all categories are as follows:

ASSIGNMENTS	160 points	Unit assignments are worth 20 points and should be submitted to the instructor.
TESTS	300 points	There will be a total of 6 tests (Units 2 to 7 only), 50 points each. Tests should be taken after assignments for the unit have been completed.
CHATS	40 points	There will be a total of 8 chats, 5 points each.
DISCUSSIONS	80 points	There will be a total of 8 discussions, 10 points each. Answers to be posted on DISCUSSION BOARD
PROJECTS	200 points	There will be two projects, 100 points each. Submit projects electronically.
FINAL EXAM	100 points	The final exam should be taken at the end of the 8th unit.

Grading Scale

This course is worth a total of 880 points. Your final grade will be determined according to the following:

POINTS	GRADE
818-880	A
787-817	A-
774-786	B+
730-773	B
699-729	B-
686-698	C+
642-685	C
612-641	C-
528-611	D
< 528	F

Time Management

Since this full semester course is completed in eight- sixteen weeks, you should expect to spend 12-15 hours per week on the assignments, discussions, chats, tests, and projects.

Using the Equation Editor

Equation Editor, available on Microsoft Word, allows students and teachers to write mathematical expressions and equations directly onto a Word document. This option is especially useful with online math courses because it is easy to use with Blackboard and email. The following instructions will help to make Equation Editor accessible on your toolbar.

Begin by opening a blank Word document. Go to **View**, then to **Toolbars**, then to **Customize**. Under "categories", click on **Insert**. Under "commands", find **Equation Editor**. Drag **Equation Editor** up to your toolbar (anywhere on the toolbar will be fine). The button on your toolbar will look like a square root symbol.

You should now practice using **Equation Editor** on a blank Word document until you can use it comfortably.

Standards Addressed

Both National Council of Teachers of Mathematics (NCTM) and California State Board of Education Mathematics Content Standards are addressed throughout this course.

A summary of NCTM standards are listed as follows. Detailed learning expectations for each of the following can be viewed on the NCTM website.

1. Number and Operations
2. Algebra
3. Geometry
4. Measurement
5. Data Analysis and Probability
6. Problem Solving
7. Reasoning and Proof
8. Communication
9. Representation

California State Board of Education Standards for Mathematics can be viewed at:

http://www.cde.ca.gov/be/st/ss/mthtrig.asp