MATH M16A: APPLIED CALCULUS I

Originator
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College
Moorpark College

Discipline (CB01A)
MATH - Mathematics

Course Number (CB01B)
M16A

Course Title (CB02)
Applied Calculus I

Banner/Short Title
Applied Calculus I

Credit Type
Credit

Start Term
Fall 2020

Catalog Course Description
Covers limits, continuity, and differentiation. Applies differential calculus to problems in business, economics, social and biological sciences. Introduces anti-differentiation and its applications in business and economics.

Additional Catalog Notes
Course Credit Limitation: MC, CSU and UC - MATH M16A, MATH M25A and M25AH combined: maximum credit, one course.

Taxonomy of Programs (TOP) Code (CB03)
1701.00 - Mathematics, General

Course Credit Status (CB04)
D (Credit - Degree Applicable)

Course Transfer Status (CB05) (select one only)
A (Transferable to both UC and CSU)

Course Basic Skills Status (CB08)
N - The Course is Not a Basic Skills Course

SAM Priority Code (CB09)
E - Non-Occupational

Course Cooperative Work Experience Education Status (CB10)
N - Is Not Part of a Cooperative Work Experience Education Program

Course Classification Status (CB11)
Y - Credit Course

Educational Assistance Class Instruction (Approved Special Class) (CB13)
N - The Course is Not an Approved Special Class

Course Prior to Transfer Level (CB21)
Y - Not Applicable

Course Noncredit Category (CB22)
Y - Credit Course

Funding Agency Category (CB23)
Y - Not Applicable (Funding Not Used)

Course Program Status (CB24)
1 - Program Applicable

General Education Status (CB25)
Y - Not Applicable

Support Course Status (CB26)
N - Course is not a support course

Field trips
Will not be required

Grading method
Letter Graded

Alternate grading methods
Student Option- Letter/Pass
Pass/No Pass Grading

Does this course require an instructional materials fee?
No

Repeatable for Credit
No

Is this course part of a family?
No

Units and Hours

Carnegie Unit Override
No

In-Class

Lecture
Minimum Contact/In-Class Lecture Hours
52.5
Maximum Contact/In-Class Lecture Hours
52.5

Activity

Laboratory

Total in-Class

Total in-Class
Total Minimum Contact/In-Class Hours
52.5
Total Maximum Contact/In-Class Hours
52.5

Outside-of-Class

Internship/Cooperative Work Experience

Paid

Unpaid

Total Outside-of-Class

Total Outside-of-Class
Minimum Outside-of-Class Hours
105.0
Maximum Outside-of-Class Hours
105.0

Total Student Learning

Total Student Learning
Total Minimum Student Learning Hours
157.5
Total Maximum Student Learning Hours
157.5

Minimum Units (CB07)
3
Maximum Units (CB06)
3

Prerequisites
MATH M05 or MATH M07 or MATH M11 or placement as determined by college's multiple measures assessment process

Entrance Skills

Prerequisite Course Objectives
MATH M05-state and apply the definition of a function and use the vertical line test.
MATH M05-evaluate functions at both numerical and algebraic domain values.
MATH M05-determine the domain and range of a relation or function given its equation or its graph.
MATH M05-form a new function from original functions using the functional operations of addition, subtraction, multiplication, division, and composition.
MATH M05-use the horizontal line test and the definition of an inverse function to determine whether a pair of functions are inverses.
MATH M05-graph the functions which yield the parabola, the absolute value, the cubic, the square root, the cube root, and ones defined piecewise; solve linear and radical equations, and absolute value equalities and inequalities.
MATH M05-test equations of graphs for symmetries about the x-axis, the y-axis, and the origin.
MATH M05-graph a function whose equation yields a translation and/or reflection of a known graph.
MATH M05-graph a parabola given by a quadratic function.
MATH M05-give a rough sketch of the graph of a polynomial function of degree three or larger given its factored form.
MATH M05-determine the domain and range as well as the horizontal and vertical asymptotes of a rational function and use that information to graph it; be able to solve rational equations.
MATH M05-graph exponential and logarithmic functions.
MATH M05-convert equations back and forth from exponential to logarithmic form.

MATH M05-apply the rules of logarithms involving logarithms of products, quotients, powers, and change of base and solve logarithmic functions.

MATH M05-solve exponential equations which have the same base on both sides and ones that do not have the same base on both sides of the equation by using logarithms.

MATH M05-use the following theorems (over the complex numbers): Remainder, Factor, Fundamental Theorem of Algebra, Rational Roots (with synthetic division), and Conjugate Roots to solve polynomial equations.

MATH M05-solve systems of linear equations using substitution and addition (elimination) with two and three variables and determine consistency and dependency as germane.

MATH M05-solve systems of nonlinear equations and linear and non-linear systems of inequalities.

MATH M07-graph functions and relations in rectangular coordinates and polar coordinates.

MATH M07-analyze and identify the features of the graphs and/or the equations of functions and relations.

MATH M07-apply transformations to the graphs of functions and relations.

MATH M07-recognize the relationship between functions and their inverses graphically and algebraically.

MATH M07-solve and apply equations including rational, linear, polynomial, exponential, absolute value, radical, and logarithmic, and solve linear, nonlinear, and absolute value inequalities.

MATH M07-solve systems of equations and inequalities.

MATH M07-apply functions to model real world applications.

MATH M07-write the standard form of a circle given the general equation.

MATH M07-graph plane curves described by parametric equations.

MATH M11-state and apply the definition of a function and identify whether a relation is a function.

MATH M11-determine the domain and range of a function, and evaluate the function at a numerical or algebraic value.

MATH M11-perform basic operations on functions, including addition, subtraction, multiplication, division and composition of functions, and determining the inverse of a one-to-one function.

MATH M11- identify transformations of functions, in comparison to basic function graphs, including shape change, reflection, horizontal and vertical shift, and sketch graph.

MATH M11-identify features of the graph of a function, including intercepts, vertices, maximum and minimum values, asymptotes and symmetry.

MATH M11-solve equations and determine roots of various functions, including linear, quadratic, polynomial and rational functions.

MATH M11-solve inequalities, including linear, quadratic, polynomial and rational inequalities, stating answer in set notation or interval notation.

MATH M11-perform division of polynomials, including use of synthetic division to determine roots of higher order polynomials.

MATH M11-sketch the graph of a polynomial of degree three or higher, using the roots of the polynomial and its factored form.

MATH M11-sketch the graph of a rational function, using the roots, asymptotes and intervals where function is positive or negative.

MATH M11-sketch the graph of basic exponential and logarithmic graphs.

MATH M11-use properties of logarithms to simplify logarithmic expressions.

MATH M11- solve exponential equations using properties of exponents, logarithms, and the change of base formula to find numerical solutions to equations that may or may not have a common base on both sides of an equation.

MATH M11-solve logarithmic equations using properties of logarithms.

MATH M11-use the techniques of solving exponential and logarithmic equations to solve application problems in biology, economics or other scientific fields.

MATH M11-solve systems of linear equations involving two variables, using substitution or elimination, and stating whether system is independent, dependent or inconsistent.

MATH M11-solve systems of linear equations involving three variables, using substitution or elimination, and stating whether system is independent, dependent or inconsistent.

Requisite Justification

Requisite Type

Prerequisite

Requisite

MATH M05 or MATH M11 or MATH M07

Requisite Description

Course in a sequence

Level of Scrutiny/Justification

Content review

Student Learning Outcomes (CSLOs)

	Upon satisfactory completion of the course, students will be able to:
1	find the area between two curves.
2	find a (linear) marginal cost function and interpret it.
3	compute the derivative of an algebraic function.
4	find a limit of a function graphically.

Course Objectives

	Upon satisfactory completion of the course, students will be able to:
1	evaluate the limit of a function, including one-sided and two-sided, using numerical and algebraic techniques and the properties of limits, including continuity.
2	calculate the derivative of an algebraic function using the formal definition of the derivative.
3	explain the concept of derivative as an "instantaneous rate of change" and the slope of the tangent line; find derivatives of functions using the constant, power, sum, difference, product, quotient, and chain rules, and using implicit differentiation.
4	find the derivative of algebraic, exponential, and logarithmic functions.
5	determine maxima and minima in optimization problems using the derivative.
6	sketch the graph of functions using the first and second derivatives to determine intervals where the functions are decreasing and increasing, maximum and minimum values, intervals of concavity and points of inflection.
7	solve applied problems involving tangent lines, rates of change, and related rates.
8	apply the concept of derivative to solve applied problems involving marginal cost, profit and revenue, and exponential growth and decay problems.
9	find definite and indefinite integrals by using general integral formulas, integration by substitution, and other integration techniques.
10	use integration techniques to find the area under a curve and the area between two curves.
11	use integration in business and economic applications, such as to analyze revenue, cost and profit.

Course Content

Lecture/Course Content

35% - A. Differentiation
  • Limits, evaluation of limits, and continuity
  • Average rates of change
  • Differentiation using limits
  • Instantaneous rates of change and tangent line
  • Differentiation rules: sum, product, quotient, and the chain rule
  • Differentiation of polynomial, rational, radical, exponential, and logarithmic functions
  • Implicit differentiation

25% - B. Applications of Differentiation
  • Using first derivatives to find maxima, minima and intervals where function is increasing or decreasing.
  • Using second derivatives to find maxima, minima, inflection points, interval of concavity, and to sketch graphs
  • Graph sketching: asymptotes and rational functions
  • Optimization
  • Marginal cost, profit, and revenue analysis
  • Implicit differentiation and related rates

25% - C. Applications of Integration
  • Finding the area under a curve
  • Finding the area between curves
  • Application in business and economics

15% - D. Integration
  • The anti-derivative
  • Indefinite and definite integrals
  • Approximating the definite integral as a finite sum
  • General integration formulas

- Integration by substitution
- Integral tables

Laboratory or Activity Content

not applicable.

Methods of Evaluation

Which of these methods will students use to demonstrate proficiency in the subject matter of this course? (Check all that apply):

Problem solving exercises
Written expression

Methods of Evaluation may include, but are not limited to, the following typical classroom assessment techniques/required assignments (check as many as are deemed appropriate):

Classroom Discussion
Essay exams
Objective exams
Problem-solving exams
Participation
Quizzes

Instructional Methodology

Specify the methods of instruction that may be employed in this course

Audio-visual presentations
Computer-aided presentations
Collaborative group work
Class activities
Class discussions
Distance Education
Demonstrations
Group discussions
Instructor-guided interpretation and analysis
Instructor-guided use of technology
Lecture
Practica

Describe specific examples of the methods the instructor will use:

1. Demonstration of mathematical concepts on a whiteboard or overhead camera.
2. Discussion of concepts, involving student questioning and answering in class.
3. Employing student exploration of concepts, and practice in problem solving through group work.

Representative Course Assignments

Writing Assignments

1. Homework problems selected from the applied calculus textbook where answers require a written explanation of the solution, such as problems involving exponential growth and decay.
2. Short answer problems on exams, such as stating the meaning of marginal functions.
3. Graded assignments: in-class and/or homework assignments requiring complete solutions using both written English and symbolic mathematical language.

Critical Thinking Assignments

1. Describe and apply the algorithmic steps for obtaining the solution to a mathematical problem, such as using derivatives to sketch the graph of a function.
2. Compare and contrast methods of solution to mathematical problems, such as evaluating limits using more than one method.
3. Apply analytic techniques for solving mathematical and application problems, such as using the derivative to solve optimization problems.

Reading Assignments

1. Reading introductory theory from textbook, such as the basic idea of a mathematical limit, or the meaning of an instantaneous rate of change.

2. Reading instructor prepared material, such as explanations of basic Calculus topics in the words of an instructor.
3. Reading reference materials from the library, including applications of derivatives in rates of change in the sciences or economics.

Skills Demonstrations
1. Demonstration of computational skills such as the computation of a derivative.
2. Demonstration of graphing skills, such as curve sketching using first and second derivative tests.
3. Demonstration of the understanding of the use of derivative in economics, such as determining marginal cost, marginal revenue and marginal profit.

Outside Assignments

Representative Outside Assignments

group or individual applied calculus projects.

graded problem solving assignments, such as computing marginal cost, marginal revenue, and marginal profit for a business application problem.

additional problem sets provided by the instructor, such as practice exercises on using the chain rule to find derivatives.

Articulation

C-ID Descriptor Number
MATH 140

Status
Approved

Equivalent Courses at 4 year institutions

University	Course ID	Course Title	Units
UC San Diego	MATH 10A	Calculus I	4
CSU Long Beach	MATH 119A	Survey of Calculus I	4
CSU Chico	MATH 109	Survey of Calculus	3
CSU Channel Islands	MATH 140	Calculus for Business Applications	3

Comparable Courses within the VCCCD
MATH R106 - Business Calculus

Equivalent Courses at other CCCs

College	Course ID	Course Title	Units
Coastline Communinty College	MATH C140	Business Calculus	4

District General Education

A. Natural Sciences

B. Social and Behavioral Sciences

C. Humanities

D. Language and Rationality

D2. Communication/Analytical Thinking
Approved

E. Health and Physical Education/Kinesiology

F. Ethnic Studies/Gender Studies

Course is CSU transferable
Yes

CSU Baccalaureate List effective term:
FALL 1995

CSU GE-Breadth

Area A: English Language Communication and Critical Thinking

Area B: Scientific Inquiry and Quantitative Reasoning

B4 Mathematical/Quantitative Reasoning
Approved

Area C: Arts and Humanities

Area D: Social Sciences

Area E: Lifelong Learning and Self-Development

CSU Graduation Requirement in U.S. History, Constitution and American Ideals:

UC TCA

UC TCA
Approved

IGETC

Area 1: English Communication

Area 2A: Mathematical Concepts & Quantitative Reasoning

Area 2A: Mathematical Concepts & Quantitative Reasoning
Approved

Area 3: Arts and Humanities

Area 4: Social and Behavioral Sciences

Area 5: Physical and Biological Sciences

Area 6: Languages Other than English (LOTE)

Textbooks and Lab Manuals

Resource Type
Textbook

Description
Tan, S. T. (2016). *Applied calculus for the managerial, life, and social sciences,*(10th ed.). Brooks Cole.

Resource Type
Textbook

Description
Lial, M., Greenwell, R., and Ritchey, N. (2016).*Calculus with application*s, (11th ed).Pearson.

Resource Type
Textbook

Description

Bittinger, M., Ellenbogen, D., Surgent, S., and Kramer, G. (2020). *Calculus and its applications; Expanded version; Media update*, (2nd ed.). Pearson.

Library Resources

Assignments requiring library resources

Use of textbooks on reserve. Use the Library's print and online resources, including other calculus texts and periodical articles, to supplement application problems such as maximizing profit and minimizing cost.

Sufficient Library Resources exist

Yes

Example of Assignments Requiring Library Resources

Using library resources to look up current interest rates to apply to exponential and logarithmic computations on current value, future value, and principle in loan, mortgage and bank account computations and other applications to business and economics.

Distance Education Addendum

Definitions

Distance Education Modalities

Hybrid (51−99% online)
Hybrid (1−50% online)
100% Online

Faculty Certifications

Faculty assigned to teach Hybrid or Fully Online sections of this course will receive training in how to satisfy the Federal and state regulations governing regular effective/substantive contact for distance education. The training will include common elements in the district-supported learning management system (LMS), online teaching methods, regular effective/substantive contact, and best practices.

Yes

Faculty assigned to teach Hybrid or Fully Online sections of this course will meet with the EAC Alternate Media Specialist to ensure that the course content meets the required Federal and state accessibility standards for access by students with disabilities. Common areas for discussion include accessibility of PDF files, images, captioning of videos, Power Point presentations, math and scientific notation, and ensuring the use of style mark-up in Word documents.

Yes

Regular Effective/Substantive Contact

Hybrid (1%−50% online) Modality:

Method of Instruction	Document typical activities or assignments for each method of instruction
Asynchronous Dialog (e.g., discussion board)	Use of student discussion boards to discuss concepts from the material, solutions to homework problems, general discussion of techniques in solving problems, study skills, or arranging study groups.
E-mail	Responding to student queries about material, grade information, course policies and procedures, scheduling and due dates, submitting homework assignments, or making general announcements to the class.
Face to Face (by student request; cannot be required)	Students requesting to speak to instructor in person for personal help on material, grade information, or discussion of policies and procedures.
Other DE (e.g., recorded lectures)	Posting of recorded lectures either by the instructor, recorded lessons available through campus resources, or use of public online resources available on the internet.
Synchronous Dialog (e.g., online chat)	Active live discussion with the instructor on material concepts, techniques for problem solving, feedback on solutions to problems, general chat on study skills, or answers to homework problems, quizzes or tests.

Hybrid (51%–99% online) Modality:

Method of Instruction	Document typical activities or assignments for each method of instruction
Asynchronous Dialog (e.g., discussion board)	Use of student discussion boards to discuss concepts from the material, solutions to homework problems, general discussion of techniques in solving problems, study skills, or arranging study groups.
E-mail	Responding to student queries about material, grade information, course policies and procedures, scheduling and due dates, submitting homework assignments, or making general announcements to the class.
Face to Face (by student request; cannot be required)	Students requesting to speak to instructor in person for personal help on material, grade information, or discussion of policies and procedures.
Other DE (e.g., recorded lectures)	Posting of recorded lectures either by the instructor, recorded lessons available through campus resources, or use of public online resources available on the internet.
Synchronous Dialog (e.g., online chat)	Active live discussion with the instructor on material concepts, techniques for problem solving, feedback on solutions to problems, general chat on study skills, or answers to homework problems, quizzes or tests.

100% online Modality:

Method of Instruction	Document typical activities or assignments for each method of instruction
Asynchronous Dialog (e.g., discussion board)	Use of student discussion boards to discuss concepts from the material, solutions to homework problems, general discussion of techniques in solving problems, study skills, or arranging study groups.
E-mail	Responding to student queries about material, grade information, course policies and procedures, scheduling and due dates, submitting homework assignments, or making general announcements to the class.
Other DE (e.g., recorded lectures)	Posting of recorded lectures either by the instructor, recorded lessons available through campus resources, or use of public online resources available on the internet.
Synchronous Dialog (e.g., online chat)	Active live discussion with the instructor on material concepts, techniques for problem solving, feedback on solutions to problems, general chat on study skills, or answers to homework problems, quizzes or tests.

Examinations

Hybrid (1%–50% online) Modality
On campus

Hybrid (51%–99% online) Modality
On campus

Primary Minimum Qualification
MATHEMATICS

Review and Approval Dates

Department Chair
09/05/2019

Dean
09/17/2019

Technical Review
09/19/2019

Curriculum Committee
10/01/2019

DTRW-I
MM/DD/YYYY

Curriculum Committee
MM/DD/YYYY

Board
MM/DD/YYYY

CCCCO
10/07/2019

Control Number
CCC000429536

DOE/accreditation approval date
MM/DD/YYYY