MATH 009: BUSINESS CALCULUS

Originator

mflora

Justification / Rationale

We are adding the online modality and updating the course objectives and methods of instruction/assessment. We are lowering the maximum class size to match more appropriate sizes for student success and those used at other community colleges for calculus-level courses.

Effective Term

Fall 2022

Credit Status

Credit - Degree Applicable

Subject

MATH - Mathematics

Course Number

009

Full Course Title

Business Calculus

Short Title

BUSINESS CALCULUS

Discipline

Disciplines List
Mathematics

Modality

Face-to-Face
100% Online
Hybrid

Catalog Description

Presents a study of the techniques of calculus with emphasis placed on the application of these concepts to business and management-related problems. The applications of derivatives and integrals of functions including polynomials, rational, exponential and logarithmic functions are studied. Students in STEM majors are advised to take MATH 001A and MATH 001B instead.

Schedule Description

Presents a study of the techniques of calculus with emphasis placed on the application of these concepts to business and management related problems. Students in STEM majors are advised to take MATH 001A and MATH 001B instead.
Prerequisite: MATH 010 or MATH 012
Advisory: ENG 001A
IGETC: 2A

Lecture Units

3
Lecture Semester Hours

54

Lab Units

1
Lab Semester Hours

54

In-class Hours

108

Out-of-class Hours

108

Total Course Units

4

Total Semester Hours

216

Prerequisite Course(s)

MATH 010 or MATH 012
Advisory: ENG 001A

Required Text and Other Instructional Materials

Resource Type

Book

Open Educational Resource

No

Author

Barnett, R., A., Ziegler, M., R., Byleen, K., E.

Title

Calculus for Business, Economics, Life Sciences and Social Sciences

Edition

13

Publisher

Pearson

Year

2015

College Level

Yes

Flesch-Kincaid Level

8.8

ISBN #

0321869834

Resource Type

Book

Open Educational Resource

Yes

Author

Shana Calaway, Dale Hoffman, David Lippman

Title

Applied Calculus

Edition

1

City
San Francisco

Publisher
The OpenTextBookStore

Year
2014

College Level
Yes

Flesch-Kincaid Level
8.9

ISBN #
none

Resource Type
Web/Other
Open Educational Resource
No

Year
n/a

Description
Pearson MyLab and Mastering may be used with the Pearson textbook

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Resource Type
Web/Other
Open Educational Resource
Yes

Year
n/a

Description
MyOpenMath may be used with either textbook

For Text greater than five years old, list rationale:
Applied Calculus is a good option for an open textbook. The license allows for "remixing", so if we find any errors or needs for updates, we can make those edits for our students.

Class Size Maximum
30

Entrance Skills
Analyze and investigate properties of functions.

Requisite Course Objectives
MATH 010-Analyze and investigate properties of functions; Represent a function graphically, numerically, and analytically and synthesize information from these representations.
MATH 012-Analyze polynomial functions in one variable using methods such as end behavior analysis, the factor theorem, the remainder theorem, the theorem on rational zeros, Descartes' rule of signs, the intermediate value theorem, division algorithms, conjugate zeros and the fundamental theorem of algebra.
MATH 012-Analyze rational functions in one variable by analyzing the polynomials in the numerator and denominator and interpreting these to find domain, range, intercepts, and asymptotes and visualizing these through the construction of a graph.

MATH 012-Analyze exponential and logarithmic functions by finding an exponential expression based on essential characteristics such as the growth factor and in terms of domain, concavity, intercepts, asymptotes, transformations, and by visualizing these in the construction of a graph for the function.

Entrance Skills

Synthesize results from the graphs and/or equations of functions.

Requisite Course Objectives

MATH 010-Analyze and investigate properties of functions; Represent a function graphically, numerically, and analytically and synthesize information from these representations.
MATH 012-Analyze rational functions in one variable by analyzing the polynomials in the numerator and denominator and interpreting these to find domain, range, intercepts, and asymptotes and visualizing these through the construction of a graph.
MATH 012-Analyze exponential and logarithmic functions by finding an exponential expression based on essential characteristics such as the growth factor and in terms of domain, concavity, intercepts, asymptotes, transformations, and by visualizing these in the construction of a graph for the function.

Entrance Skills

Recognize the behavior of polynomial, rational, exponential, and logarithmic functions by applying transformations to the graphs of functions.

Requisite Course Objectives

MATH 010-Recognize the behavior of polynomial, rational, exponential, and logarithmic functions; Use transformations to graph polynomial, rational, exponential, and logarithmic functions.

Entrance Skills

Recognize the relationship between functions and their inverses graphically and algebraically.

Requisite Course Objectives

MATH 010-Demonstrate an understanding of function notation and operations including inverses and compositions of functions; Recognize the relationship between functions and their inverses graphically and algebraically

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Entrance Skills

Solve and apply rational, linear, polynomial, radical, absolute value, exponential, and logarithmic equations and solve linear, nonlinear, and absolute value inequalities.

Requisite Course Objectives

MATH 010-Recognize, graph and solve equations involving polynomial, rational, exponential, root, and logarithmic functions; Solve linear, nonlinear and absolute value inequalities.

Entrance Skills

Apply techniques for finding zeros of polynomials and roots of equations including , factoring, polynomial division, the remainder theorem, and factor theorem.

Requisite Course Objectives

MATH 010-Apply techniques for finding zeros of polynomials and roots of equations including , factoring, polynomial division, the remainder theorem, and factor theorem
MATH 012-Analyze polynomial functions in one variable using methods such as end behavior analysis, the factor theorem, the remainder theorem, the theorem on rational zeros, Descartes' rule of signs, the intermediate value theorem, division algorithms, conjugate zeros and the fundamental theorem of algebra.

Entrance Skills

Employ functions and other algebraic techniques to model application problems.

Requisite Course Objectives

MATH 010-Use linear, exponential and logarithmic equations and equations of conics to model application problems in STEM fields, Business and Economics.

Entrance Skills

Use formulas to find sums of finite and infinite series.

Requisite Course Objectives

MATH 010-Use formulas to find sums of finite and infinite series.

Entrance Skills

Apply studied principles and skills to new situations in addition to situations that mirror those on the homework and those shown in class.

Requisite Course Objectives

MATH 010-Apply studied principles and skills to new situations in addition to situations that mirror those on the homework and those shown in class
MATH 012-Use Polya's problem solving strategies to solve problems, with an emphasis on the algebraic method with appropriate applications of polynomial, rational, root, exponential, logarithmic, trigonometric and inverse trigonometric expressions.

Entrance Skills

ADVISORY SKILLS:
Use functions to model applications in a variety of different contexts including STEM fields, Business and Economics.

Requisite Course Objectives

ENG 001A-Find, read, analyze, evaluate, interpret, and synthesize outside sources, including online information.
ENG 001A-Read, analyze, and interpret varied texts (i.e. literature, digital forms, visual).

Entrance Skills

Summarize information contained in books, websites, and other sources and apply it to new contexts.

Requisite Course Objectives

ENG 001A-Find, read, analyze, evaluate, interpret, and synthesize outside sources, including online information.

Course Content
1. A review of functions and their graphs, including exponential and logarithmic functions;
2. Limits of functions;
3. Limit definition of derivative;
4. Increments, tangent lines & their relation to secant lines, and rate of change;
5. Properties of differentiation including sum, product, and quotient properties;
6. The chain rule;
7. Implicit differentiation;
8. Applications of differentiation in business and economics such as marginal analysis, optimization;
9. Curve sketching;
10. Antiderivatives, indefinite and definite integrals;
11. Multiple techniques of integration including substitution and integration by parts;
12. Area between curves;
13. Summation notation and approximating the definite integral as a sum; and
14. Applications of integration in business and economics such as probability density functions, consumer & producer surplus, and continuous income stream.

Lab Content
1. Determine the derivatives of polynomial, rational, exponential, and logarithmic functions and evaluate one's own and classmates' work;
2. Discuss and determine the derivatives of functions using properties;
3. Sketch the graphs of functions using a variety of tools and evaluate one's own and classmates' graphs;
4. Describe the relationship between the graph of a function and the graphs of its first and second derivatives;
5. Explore inequalities involving first and second derivatives and use their solutions to identify intervals where a function is increasing and decreasing, the location of maximum and minimum values, intervals of concavity, and points of inflection;

6. Analyze the marginal cost, profit, and revenue when given an appropriate function;
7. Explore optimization problems using the derivative;
8. Use derivatives to determine rates of change and tangent lines;
9. Use calculus to analyze revenue, cost, and profit;
10. Describe the relationship between the derivative and the integral as expressed by the Fundamental Theorem of Calculus;
11. Determine definite and indefinite integrals and evaluate one's own and classmates' work;
12. Use integration to explore business and economics applications;
13. Explore applications that involve combinations of multiple topics from lecture; and
14. Demonstrate mathematical reasoning in either written work or oral presentations.

Course Objectives

	Objectives
Objective 1	Describe the limit of a function intuitively.
Objective 2	Evaluate limits of functions and difference quotients.
Objective 3	Determine the derivative of constant, linear, and quadratic functions using limits.
Objective 4	Justify properties of derivatives using limits.
Objective 5	Construct derivatives of polynomial, rational, exponential, and logarithmic functions from applications of differentiation rules.
Objective 6	Determine the derivatives of constant multiples, sums, differences, products and quotients of functions and apply the Chain rule.
Objective 7	Sketch graphs of functions using horizontal and vertical asymptotes, intercepts, and first and second derivatives.
Objective 8	Describe the relationship between the graphs of a function, its first derivative, and its second derivative.
Objective 9	Solve inequalities involving first and second derivatives to identify intervals where a function is increasing and decreasing, maximum and minimum values and their locations, intervals of concavity, and points of inflection.
Objective 10	Determine maxima and minima in optimization problems using the derivative.
Objective 11	Apply derivatives to calculate rates of change and produce equations of tangent lines.
Objective 12	Analyze revenue, cost, marginal cost, and profit using calculus.
Objective 13	Describe the relationship between the derivative and the integral as expressed by the Fundamental Theorem of Calculus.
Objective 14	Apply the Fundamental Theorem of Calculus to evaluate definite integrals.
Objective 15	Determine definite and indefinite integrals using general integral formulas, integration by substitution, integration by parts, and other integration techniques.
Objective 16	Employ integration to business and economics applications such as probability density functions, consumer & producer surplus, and continuous income stream.

Student Learning Outcomes

	Upon satisfactory completion of this course, students will be able to:
Outcome 1	Define the concept of limit of a function as the behavior of a function when the input variable gets arbitrarily close to a certain value or its magnitude becomes arbitrarily small or arbitrarily large.
Outcome 2	Define the concept of the derivative of a function as the limiting behavior of the rate of change of a function's value with respect to the input variable.
Outcome 3	Use the concept of the derivative (in conjunction with general skills from arithmetic, algebra, and geometry) to model and solve application problems in business and economics that involve rates of change.
Outcome 4	Use the concept of integration to model and solve application problems in business and economics.

Methods of Instruction

Method	**Please provide a description or examples of how each instructional method will be used in this course.**
Lecture	Professor will present and explain course topics.
Laboratory	Students will participate in individual and group exploration of course topics. Professor and students will discuss and group exploration of course topics.

Discussion	Students and the professor will discuss course topics and evaluate each others' explanations and solutions.
Technology-based instruction	Students will submit assignments and receive feedback (automated and/or from professor) on assignments.
Technology-based instruction	Students will read, watch, and/or listen to material presented and explained through various media.

Methods of Evaluation

Method	Please provide a description or examples of how each evaluation method will be used in this course.	Type of Assignment
Written homework	Students will complete homework assignments consisting of exercises that range in challenge level. They will receive feedback on their answers and explanations. This will typically require 2-3 hours per week.	Out of Class Only
Computational/problem-solving evaluations	Students will solve problems that require the applications of concepts learned in lecture and lab assignments (see Student participation/contribution). They will receive feedback on their answers and explanations from the professor. This will typically require 2-3 hours per week.	In and Out of Class
Student participation/contribution	Students will participate in discussions and lab activities that require students to apply material learned in class and previous assignments. These assignments may be individual and/or group activities. Students may be required to turn in summaries of their work in addition to write-ups of the problems they solved and questions they answered. They will receive feedback on their answers and explanations from the professor.	In Class Only
Mid-term and final evaluations	Unit tests and final examinations will consist of "essay" type questions. Preparing for exams may require 1-2 hours of study per week. These examinations may have take-home components.	In and Out of Class
Tests/Quizzes/Examinations	Students may take short quizzes for grade and/or for self- evaluation purposes.	In and Out of Class

Assignments

Other In-class Assignments

1. Students will attend classroom lectures and take notes.
2. Students will participate in classroom discussions to review, analyze, and evaluate various methods of solution used in homework assignments.
3. Students will complete laboratory assignments using appropriate mathematical tools. These assignments may be individual and/or group activities.
4. Students will take examinations involving problems that apply studied principles to new situations.

Other Out-of-class Assignments

1. Students will read textbooks, watch videos, and complete other supplementary research assignments.
2. Students will complete assigned homework and other assignments that involve problem-solving, writing up solutions to exercises that improve skills and mathematical understanding, and other forms of mathematical practice.
3. Students will complete take-home examinations involving problems that apply studied principles to new situations.

Grade Methods

Letter Grade Only

Distance Education Checklist

Include the percentage of online and on-campus instruction you anticipate.

Online %
100
On-campus %
0

What will you be doing in the face-to-face sections of your course that necessitates a hybrid delivery vs a fully online delivery?
Although the course can be offered entirely online, it may also be offered hybrid to take advantage of collaboration activities that are more suited to in-person interaction.
Examinations can be given in a controlled location.

Lab Courses

How will the lab component of your course be differentiated from the lecture component of the course?
Lab assignments involve more interaction. For example, they may require students collaborate with a classmate, utilize a tutoring resource, or interview someone who is not part of the course.

From the COR list, what activities are specified as lab, and how will those be monitored by the instructor?
Lab activities are discussions and assignments that involve solving problems or exploring concepts with other students, with people not part of the course, or under the guidance of the professor or instructional support assistant. Discussions and other assignments that are completed in Canvas are monitored and evaluated by the professor. Assignments that do not take place in Canvas are evaluated by the professor based on write-ups (which may include summaries and feedback from the participants). Anonymous and non-anonymous feedback opportunities will be available to students to allow the professor further monitor effectiveness and appropriateness of activities that take place somewhere other than on the course LMS.

How will you assess the online delivery of lab activities?
Reports and other forms of write-ups will be submitted on the course LMS for evaluation and feedback.

Instructional Materials and Resources

If you use any other technologies in addition to the college LMS, what other technologies will you use and how are you ensuring student data security?
Depending on the textbook used, the professor may choose to use Pearson MyLab and Mastering, WebAssign, or MyOpenMath. All of these are considered to be safe for use in education for both faculty and students. All can also be integrated with the college LMS (Canvas), which decreases the amount of times students will need to sign-in-and-out of accounts and open them up to data breaches.

If used, explain how specific materials and resources outside the LMS will be used to enhance student learning.
Professors who choose to use Pearson MyLab and Mastering, WebAssign, or MyOpenMath do so in order to assign pre-written or instructor-created problems that are more complicated than those that can be created in Canvas while still receiving instantaneous feedback.

Effective Student/Faculty Contact

Which of the following methods of regular, timely, and effective student/faculty contact will be used in this course?

Within Course Management System:

Discussion forums with substantive instructor participation
Online quizzes and examinations
Private messages
Regular virtual office hours
Timely feedback and return of student work as specified in the syllabus
Weekly announcements

External to Course Management System:

Direct e-mail
Posted audio/video (including YouTube, 3cmediasolutions, etc.)
Synchronous audio/video
Telephone contact/voicemail

For hybrid courses:
Scheduled Face-to-Face group or individual meetings

Briefly discuss how the selected strategies above will be used to maintain Regular Effective Contact in the course.
Faculty will regularly contact students individually and as a group through Canvas messages and/or COD email. Students will also receive regular announcements with information about the course, COD as a whole, or other relevant information.
In discussions and through other lab assignments, students will communicate with each other and their professor regularly and frequently.

If interacting with students outside the LMS, explain how additional interactions with students outside the LMS will enhance student learning.
Students may prefer to contact their professor via email or on the phone, which allows for an improved experience for those who communicate better in those contexts. The professor may direct students to access free supplemental resources as well.

Other Information

Comparable Transfer Course Information
University System
CSU
Campus
CSU San Bernardino

Course Number
MATH 1601
Course Title
Modeling with Calculus

Catalog Year
2021

Rationale
The course description contains similar material. It follows the course that aligns with MATH-010 at COD.

University System
UC
Campus
UC Riverside

Course Number
MATH 022
Course Title
Calculus for Business

Catalog Year
2021

Rationale
The course description is similar to the description of this course. The prerequisites are similar to MATH-012 or MATH-010 at COD.

COD GE
C4.B - Language and Rationality - Communication and Analytical Thinking

CSU GE
B4 - Mathematics

IGETC GE
2A - Mathematical Concepts & Quantitative Reasoning

MIS Course Data

CIP Code
27.0101 - Mathematics, General.

TOP Code
170100 - Mathematics, General

SAM Code
E - Non-Occupational

Basic Skills Status
Not Basic Skills

Prior College Level
Not applicable

Cooperative Work Experience
Not a Coop Course

Course Classification Status
Credit Course

Approved Special Class
Not special class

Noncredit Category
Not Applicable, Credit Course

Funding Agency Category
Not Applicable

Program Status
Program Applicable

Transfer Status
Transfer CSU, limited UC

General Education Status
B = Mathematics/Quantitative Reasoning/Analytical Thinking

Support Course Status
N = Course is not a support course

C-ID
MATH 140

Allow Audit
No

Repeatability
No

Materials Fee
No

Additional Fees?
No

Approvals

Curriculum Committee Approval Date
11/18/2021

Academic Senate Approval Date
12/09/2021

Board of Trustees Approval Date
01/21/2022

Course Control Number
CCC000570136

Programs referencing this course
Liberal Arts: Math and Science AA Degree (http://catalog.collegeofthedesert.eduundefined/?key=29)
Business Administration AS-T Degree (http://catalog.collegeofthedesert.eduundefined/?key=34)
Business Administration 2.0 AS-T Degree (http://catalog.collegeofthedesert.eduundefined/?key=355)