COLLEGE OF THE DESERT

Course Code MATH-009

Course Outline of Record

1. Course Code: MATH-009
2. a. Long Course Title: Business Calculus
   b. Short Course Title: BUSINESS CALCULUS
3. a. Catalog Course 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.
   b. Class Schedule Course 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.
   c. Semester Cycle (*if applicable*): Every Semester
   d. Name of Approved Program(s):
   - BUSINESS ADMINISTRATION Associate in Science for Transfer Degree (AS-T)
4. Total Units: 4.00 Total Semester Hrs: 108.00
   Lecture Units: 3 Semester Lecture Hrs: 54.00
   Lab Units: 1 Semester Lab Hrs: 54.00
   Class Size Maximum: 35 Allow Audit: No
   Repeatability No Repeats Allowed
   Justification 0
5. Prerequisite or Corequisite Courses or Advisories:
   Course with requisite(s) and/or advisory is required to complete Content Review Matrix (CCForm1-A)
   Prerequisite: MATH 010 or
   Prerequisite: MATH 012
   Advisory: ENG 001A
6. Textbooks, Required Reading or Software: *(List in APA or MLA format.)*
   a. Barnett, R., A., Ziegler, M., R., Byleen, K., E. (2015). *Calculus for Business, Economics, Life Sciences and Social Sciences* (13/e). Pearson. ISBN: 0321869834
   College Level: Yes
   Flesch-Kincaid reading level: 12
7. Entrance Skills: *Before entering the course students must be able:*
   a.
   Analyze and investigate properties of functions;

   - 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.

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

- 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.

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

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

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

- 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

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

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

f.
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.
- MATH 010 - Apply techniques for finding zeros of polynomials and roots of equations including , factoring, polynomial division, the remainder theorem, and factor theorem

g.
Apply functions and other algebraic techniques to model real world applications;

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

h.
Use formulas to find sums of finite and infinite series; and

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

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

- 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 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.

j.

Use functions to model applications in a veriety of different contexts including STEM fields, Business and Economics.

- 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).

8. Course Content and Scope:

Lecture:

1. A review of functions and their graphs, including exponential and logarithmic functions;
2. Limits of functions and intuitive limit definition of derivative;
3. Increments, tangent lines, and rate of change; the relationship between the secant line and the tangent line;
4. Rules of differentiation including sum, product, quotient, and the chain rule;
5. Implicit differentiation;
6. Applications of differentiation in Business and Economics such as marginal analysis, optimization, and curve sketching;
7. Antiderivatives, indefinite and definite integrals;
8. Multiple techniques of integration including substitution and integration by parts;
9. Area between curves;
10. Approximating definite integral as a sum; and
11. Applications of integration in business and economics.

Lab: *(if the "Lab Hours" is greater than zero this is required)*

1. Determine the derivatives of polynomial, rational, exponential, and logarithmic functions using the rules of differentiation;
2. Determine the derivatives of functions involving constants, sums, differences, products, quotients, and the chain rule;
3. Sketch the graphs of functions using horizontal and vertical asymptotes, intercepts, and first and second derivatives to determine intervals where a function is increasing and decreasing, maximum and minimum values, intervals of concavity and points of inflection;
4. Describe the relationship between the graph of a function and the graphs of its first and second derivatives;
5. Solve inequalities involving first and second derivatives 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. Determine maxima and minima in 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; Use the Fundamental Theorem of Calculus to evaluate definite integrals;
11. Determine definite and indefinite integrals by using the general integral formulas, integration by substitution, integration by parts, and other integration techniques;
12. Use integration in 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.

9. Course Student Learning Outcomes:

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.

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 and use of a variety of methods of finding derivatives of functions, including the definition of the derivative.

3.
Use the concept of derivative (in conjunction with general skills from arithmetic, algebra and geometry) to model and solve application problems in Business and Economics that involve, directly or indirectly, rates of change.

4.
Develop critical and logical thinking by frequent use of deductive reasoning in mathematics, in the context of differential and integral calculus.

10. Course Objectives: *Upon completion of this course, students will be able to:*

a. Determine the derivatives of polynomial, rational, exponential, and logarithmic functions using the rules of differentiation;
b. Determine the derivatives of polynomial, rational, exponential, and logarithmic functions using the rules of differentiation;
c. Sketch the graphs of functions using horizontal and vertical asymptotes, intercepts, and first and second derivatives to determine intervals where a function is increasing and decreasing, maximum and minimum values, intervals of concavity and points of inflection;
d. Describe the relationship between the graph of a function and the graphs of its first and second derivatives;
e. Solve inequalities involving first and second derivatives to identify intervals where a function is increasing and decreasing, the location of maximum and minimum values, intervals of concavity and points of inflection;
f. Analyze the marginal cost, profit and revenue when given an appropriate function;
g. Determine maxima and minima in optimization problems using the derivative;
h. Use derivatives to determine rates of change and tangent lines;
i. Use calculus to analyze revenue, cost, and profit;
j. Describe the relationship between the derivative and the integral as expressed by the Fundamental Theorem of Calculus; Use the Fundamental Theorem of Calculus to evaluate definite integrals;
k. Determine definite and indefinite integrals by using the general integral formulas, integration by substitution, integration by parts, and other integration techniques; and
l. Use integration in business and economics applications.

11. Methods of Instruction: *(Integration: Elements should validate parallel course outline elements)*
    a. Discussion
    b. Laboratory
    c. Lecture
    d. Technology-based instruction

12. Assignments: *(List samples of specific activities/assignments students are expected to complete both in and outside of class.)*
In Class Hours: 108.00
Outside Class Hours: 108.00
    a. In-class Assignments
        1. Attend classroom lectures and take notes.

2. Participate in classroom discussions to review, analyze, diagnose, and evaluate various methods of solution used in homework assignments.
3. Complete laboratory assignments using appropriate mathematical tools.
4. Complete examinations involving problems that apply studied principles to new situations.

b. Out-of-class Assignments

1. Read textbooks and supplementary assignments.
2. Complete assigned homework including problem solving, exercises to improve skills and mathematical understanding.

13. Methods of Evaluating Student Progress: *The student will demonstrate proficiency by:*
    - Written homework
    - Mid-term and final evaluations
      Chapter tests and final examinations will consist of in class essay type questions.
    - Student participation/contribution
    - Oral and practical examination

14. Methods of Evaluating: Additional Assessment Information:

15. Need/Purpose/Rationale -- *All courses must meet one or more CCC missions.*
    IGETC Area 2: Mathematical Concepts and Quantitative Reasoning
    A: Mathematic
    CSU GE Area B: Physical and its Life Forms(mark all that apply)
    B4 - Mathematics/Quantitative Thinking
    PO-GE C4.b - Language & Rationality (Communication & Analytical Thinking)
    Gather, assess, and interpret relevant information.
    Apply logical and critical thinking to solve problems; explain conclusions; and evaluate, support, or critique the thinking of others.
    IO - Scientific Inquiry
    Analyze quantitative and qualitative information to make decisions, judgments, and pose questions.
    IO - Global Citizenship - Scientific & Technological Literacy
    Utilize quantitative expression in a variety of contexts. These would include units of measurement, visual representations, and scales and distributions.
    Synthesize, interpret, and infer, utilizing information, data, and experience to solve problems, innovate, and explore solutions.

16. Comparable Transfer Course

University System	Campus	Course Number	Course Title	Catalog Year
CSU	CSU San Bernardino	MATH 192	Brief Applied Calculus	2015
UC	UC Riverside	MATH 022	Calculus for Business	2015

17. Special Materials and/or Equipment Required of Students:

18. Materials Fees: ☐ Required Material?

Material or Item	Cost Per Unit	Total Cost

19. Provide Reasons for the Substantial Modifications or New Course:

Change number of SLO's to match number of units

20. a. Cross-Listed Course *(Enter Course Code)*: *N/A*
    b. Replacement Course *(Enter original Course Code)*: *N/A*

21. Grading Method *(choose one)*: Letter Grade Only

22. MIS Course Data Elements
    a. Course Control Number [CB00]: CCC000570136
    b. T.O.P. Code [CB03]: 170100.00 - Mathematics, General
    c. Credit Status [CB04]: D - Credit - Degree Applicable
    d. Course Transfer Status [CB05]: D = *Transfer to CSU, limited to UC/see counselor
    e. Basic Skills Status [CB08]: 2N = Not basic skills course
    f. Vocational Status [CB09]: Not Occupational
    g. Course Classification [CB11]: Y - Credit Course
    h. Special Class Status [CB13]: N - Not Special
    i. Course CAN Code [CB14]: *N/A*
    j. Course Prior to College Level [CB21]: Y = Not Applicable
    k. Course Noncredit Category [CB22]: Y - Not Applicable
    l. Funding Agency Category [CB23]: Y = Not Applicable
    m. Program Status [CB24]: 1 = Program Applicable

    Name of Approved Program *(if program-applicable)*: BUSINESS ADMINISTRATION
    Attach listings of Degree and/or Certificate Programs showing this course as a required or a restricted elective.)

23. Enrollment - Estimate Enrollment
    First Year: 70
    Third Year: 100

24. Resources - Faculty - Discipline and Other Qualifications:
    a. Sufficient Faculty Resources: No
    b. If No, list number of FTE needed to offer this course: 0.6700

25. Additional Equipment and/or Supplies Needed and Source of Funding.
    N/A

26. Additional Construction or Modification of Existing Classroom Space Needed. *(Explain:)*
    N/A

27. FOR NEW OR SUBSTANTIALLY MODIFIED COURSES
    Library and/or Learning Resources Present in the Collection are Sufficient to Meet the Need of the Students Enrolled in the Course: Yes
    N/A

28. Originator John Learned Origination Date 10/18/17