# El Camino College

**COURSE OUTLINE OF RECORD - Official**

## I. GENERAL COURSE INFORMATION

**Subject and Number:** **Mathematics 190**
**Descriptive Title:** **Single Variable Calculus and Analytic Geometry I**

**Course Disciplines:** **Mathematics**

**Division:** **Mathematical Sciences**

**Catalog Description:** In this course students will be introduced to topics such limits, continuity, derivatives and antiderivatives of algebraic and transcendental functions; definite integrals of algebraic and transcendental functions with and without the fundamental theorem of calculus; linear approximations; relating features of a function's graph to its derivatives; and application problems using derivatives as well as implicit differentiation. Problem solving using computer software is also addressed.

The maximun UC credit allowed for calculus is one course from either Math 165 or Math 160 or 161 or Math 190 or 191.

**Conditions of Enrollment:**

**Prerequisite**

Mathematics 180
with a minimum grade of C
or

qualification by testing (El Camino College Mathematics Placement Test) and assessment

**Course Length:** [X] **Full Term** [ ] **Other (Specify number of weeks):**
**Hours Lecture:** **5.00 hours per week** [ ] **TBA**
**Hours Laboratory:** **0 hours per week** [ ] **TBA**
**Course Units:** **5.00**

**Grading Method:** **Letter**
**Credit Status** **Associate Degree Credit**

**Transfer CSU:** [X] **Effective Date: Prior to July 1992**
**Transfer UC:** [X] **Effective Date: Prior to July 1992**

**General Education:**
**El Camino College:**

**4B – Language and Rationality – Communication and Analytical Thinking**

Term: Other: Approved

**6 – Mathematics Competency**

Term: Other: Approved

**CSU GE:**

**B4 - Mathematics/Quantitative Thinking**

Term: Fall 2001 Other:

**IGETC:**

**2A - Mathematical Concepts and Quantitative Reasoning**

Term: Fall 2001 Other:

## II. OUTCOMES AND OBJECTIVES

### A. COURSE STUDENT LEARNING OUTCOMES (The course student learning outcomes are listed below, along with a representative assessment method for each. Student learning outcomes are not subject to review, revision or approval by the College Curriculum Committee)

1. UNDERSTANDING CONCEPTS Students will explain and demonstrate the idea of the limit, the derivative and the integral.
2. SOLVING PROBLEMS Students will solve problems, including problems involving velocity and acceleration, by using derivatives and integrals.
3. GRAPHS Students will use techniques of calculus to determine maxima, minima, and points of inflection on the graph of a function.
4. PROOFS Students will analyze and construct proofs involving limits, derivatives and integrals.

The above SLOs were the most recent available SLOs at the time of course review. For the most current SLO statements, visit the El Camino College SLO webpage at http://www.elcamino.edu/academics/slo/.

### B. Course Student Learning Objectives (The major learning objective for students enrolled in this course are listed below, along with a representative assessment method for each)

1. Evaluate limits of functions symbolically, graphically, and numerically, and describe the continuity/discontinuity of a function.

   Objective Exams
2. Calculate derivatives of algebraic and transcendental functions symbolically using rules and using the definition of the derivative, as well as estimating derivatives graphically and numerically.

   Objective Exams
3. Use linearization and Newton's Method to make approximations of functions.

   Laboratory reports
4. Relate features of a function (increasing/decreasing, extrema, concavity, inflection points) to its derivatives.

   Objective Exams
5. Solve application problems using differential calculus.

   Objective Exams
6. Estimate definite integrals using Riemann sums.

   Quizzes

7. Calculate definite integrals, both using evaluating the limit of Riemann sums and using the Fundamental Theorem of Calculus.

   Objective Exams

8. Anti-differentiate functions, using the method of substitution when appropriate.

   Objective Exams

9. Use computing software to solve calculus problems.

   Homework Problems

**III. OUTLINE OF SUBJECT MATTER (Topics are detailed enough to enable a qualified instructor to determine the major areas that should be covered as well as ensure consistency from instructor to instructor and semester to semester.)**

| Lecture or Lab | Approximate Hours | Topic Number | Major Topic |
|---|---|---|---|
| Lecture | 15 | I | LIMITS<br>A. Definition of limits, including the delta epsilon version<br>B. One-sided and two-sided limits<br>C. Limit laws<br>D. Infinite limits and limits at infinity<br>E. Continuity<br>F. Intermediate Value Theorem and its applications<br>G. Indeterminate Forms and L'Hopital's Rule, including indeterminate quotients, products, differences and powers. |
| Lecture | 20 | II | DERIVATIVES<br>A. Definition of the derivative<br>B. Differentiation rules (power, product, quotient, chain)<br>C. Derivatives of trigonometric functions and their inverses<br>D. Derivatives of exponential and logarithmic functions<br>E. Derivatives of inverse functions<br>F. Implicit Differentiation<br>G. Hyperbolic sine and cosine functions |
| Lecture | 15 | III | APPLICATIONS OF THE DERIVATIVE<br>A. Tangent Lines<br>B. Related Rates<br>C. Linear Approximations<br>D. Differentials<br>E. Newton's Method<br>F. Optimization<br>G. Velocity and Acceleration |
| Lecture | 15 | IV | GRAPHING<br>A. Absolute and local extrema<br>B. Extreme Value Theorem and its applications<br>C. Mean Value Theorem and its applications<br>D. Relation between the first derivative function and the regions of increasing and decreasing on the graph of a function |

| | | | |
|---|---|---|---|
| | | | E. First derivative test<br>F. Relation between the second derivative and regions of concavity on the graph of a function<br>G. Second derivative test<br>H. Curve sketching techniques |
| Lecture | 20 | V | ANTI-DIFFERENTIATION, INTEGRATION AND THE FUNDAMENTAL THEOREM OF CALCULUS<br>A. Anti-differentiation and the indefinite integral<br>B. Riemann sums and the formal definition of the definite integral<br>C. The definite integral and its properties<br>D. The Fundamental Theorem of Calculus<br>E. The substitution rule for anti-differentiation<br>F. Area under curves application problems<br>G. Applications of the Net Change Theorem |
| Lecture | 5 | VI | PROBLEM SOLVING USING COMPUTING SOFTWARE |
| **Total Lecture Hours** | | 90 | |
| **Total Laboratory Hours** | | 0 | |
| **Total Hours** | | 90 | |

## IV. PRIMARY METHOD OF EVALUATION AND SAMPLE ASSIGNMENTS

A. **PRIMARY METHOD OF EVALUATION:**

Problem solving demonstrations (computational or non-computational)

B. **TYPICAL ASSIGNMENT USING PRIMARY METHOD OF EVALUATION:**

Use the limit definition of the derivative to find the derivative of

f(x)=sqrt(5x+2)``

C. **COLLEGE-LEVEL CRITICAL THINKING ASSIGNMENTS:**

1. A box with a square base and no top must have a volume of four cubic feet. Calculate the dimensions of the box that minimize the amount of material required.
2. Use computing software and Newton's method to find all real zeros of $f(x) = x^3 - 6x + 1$, correct to 8 decimal places.

D. **OTHER TYPICAL ASSESSMENT AND EVALUATION METHODS:**

Objective Exams

Other exams

Quizzes

Written homework

Homework Problems

Other (specify):

Computer assisted problem assignments

## V. INSTRUCTIONAL METHODS

Demonstration
Discussion
Lecture
Other (please specify)
Computing software demonstrations

**Note: In compliance with Board Policies 1600 and 3410, Title 5 California Code of Regulations, the Rehabilitation Act of 1973, and Sections 504 and 508 of the Americans with Disabilities Act, instruction delivery shall provide access, full inclusion, and effective communication for students with disabilities.**

## VI. WORK OUTSIDE OF CLASS

Study
Answer questions
Skill practice
Required reading
Problem solving activities
Written work
Observation of or participation in an activity related to course content
Other (specify)
Problem solving using computer software

**Estimated Independent Study Hours per Week:** 10

## VII. TEXTS AND MATERIALS

A. **UP-TO-DATE REPRESENTATIVE TEXTBOOKS**
James Stewart. Calculus, Early Transcendentals. 8th ed. Brooks/Cole, 2015.

B. **ALTERNATIVE TEXTBOOKS**

C. **REQUIRED SUPPLEMENTARY READINGS**

D. **OTHER REQUIRED MATERIALS**

## VIII. CONDITIONS OF ENROLLMENT

**A. Requisites (Course and Non-Course Prerequisites and Corequisites)**

| Requisites | Category and Justification |
|---|---|

| | |
|---|---|
| Course Prerequisite Mathematics-180 or | Sequential |
| Non-Course Prerequisite | The material is sequential. If they can't demonstrate on a placement test that they know the material from Precalculus and Trigonometry, then they will not be prepared. |

### B. Requisite Skills

| Requisite Skills |
|---|
| Solve algebraic, exponential, logarithmic and trigonometric equations, and equations with absolute value. MATH 180 - Solve equations involving polynomial, rational, exponential, logarithmic, trigonometric functions. |
| Graph algebraic, exponential, logarithmic and trigonometric functions. MATH 180 - Graph relations (including polynomial, rational, exponential, logarithmic, trigonometric functions and conics), using transformations (shifting, stretching, reflection). |
| Evaluate algebraic, exponential, and logarithmic functions, as well as trigonometric functions and their inverses. MATH 180 - Analyze functions (including polynomial, algebraic, rational, exponential, logarithmic, trigonometric) for critical features, including: intercepts, asymptotes, domain, range, and average rate of change. MATH 180 - Determine the inverse of a function (polynomial, algebraic, rational, exponential, logarithmic, trigonometric) and analyze it in terms of critical features. |

### C. Recommended Preparations (Course and Non-Course)

| Recommended Preparation | Category and Justification |
|---|---|

### D. Recommended Skills

| Recommended Skills |
|---|

### E. Enrollment Limitations

| Enrollment Limitations and Category | Enrollment Limitations Impact |
|---|---|

**Course created by V. Skinner on 01/31/2015.**

**BOARD APPROVAL DATE:**

**LAST BOARD APPROVAL DATE: 12/18/2017**

**Last Reviewed and/or Revised by Gregory Fry on 01/31/2015**

20015