MATH 188 – CALCULUS | 4 CREDITS

SYLLABUS

CATALOG DESCRIPTION

Instructs the student in the methods of differential calculus. Topics include elementary algebraic and transcendental functions, limits, continuity, differentiation and optimization. Other topics include L'Hôpital's rule, Newton's method, Riemann sums, indefinite and definite integration, and the fundamental theorem of calculus. Mathematical software will be utilized throughout the course to expose students to computer algebra systems.

Prerequisites: MATH 170 and MATH 180 with a grade of "C" or better.

Semester Offered: Fall, Spring and Summer

Common Student Learning Outcomes

Upon successful completion of San Juan College programs and degrees, the student will demonstrate competency in…

BROAD AND SPECIALIZED LEARNING

Students will actively and independently acquire, apply, and adapt skills and knowledge with an awareness of global contexts.

CRITICAL THINKING

Students will think analytically and creatively to explore ideas, make connections, draw conclusions and solve problems.

CULTURAL AND CIVIC ENGAGEMENT

Students will act purposefully, reflectively, and ethically in diverse and complex environments.

EFFECTIVE COMMUNICATION

Students will exchange ideas and information with clarity in multiple contexts.

INFORMATION LITERACY

Students will be able to recognize when information is needed and have the ability to locate, evaluate, and use it effectively.

INTEGRATING TECHNOLOGIES

Students will demonstrate fluency in the application and use of technologies in multiple contexts.

Student work from this class may be randomly selected and used anonymously for assessment of course, program, and/or institutional learning outcomes. For more information, please refer to the Dean of the appropriate School.

General Learning Outcomes

Upon successful completion of the course, the student will be able to…

A. Functions and their representations.
B. Limits and Continuity.
C. The Derivative as a Difference Quotient.
D. Techniques of Differentiation.
E. Applications of Differentiation.
F. The Definite & Indefinite Integral.
G. Technology

Specific Learning Outcomes

Upon successful completion of the course, the student will be able to…

A. Review of Functions & Their Representations

A1. Understand the fundamental aspects of functions including: functional notation, domain and range.

A2. Be able to perform elementary arithmetic operations on functions as well as

A3. Understand the criteria for existence of an inverse function and the relationship between the graph of a function and its inverse.

A4. Be able to use trigonometric functions and their inverses.

A5. Be able to use exponential and logarithmic functions.

B. Limits & Continuity

B1. Be able to give a general description or definition of Calculus.

B2. Understand the concept of the limit of a function.

B3. Be able to recognize the existence or nonexistence of limits.

B3. Understand the formal definition of the limit. (bonus)

B4. Understand the basic properties of limits.

B5. Be able to evaluate limits using graphs and tables of functions.

B6. Be able to use algebraic methods to compute and find limits, including limits of

B7. Be able to determine whether a function is continuous or discontinuous using the

B8. Be able to use the Intermediate Value Theorem.

C. The Derivative as a Difference Quotient

C1. Be able to identify tangent lines and find the equation of the tangent line to the graph at a point.

C2. Understand the concept of the difference quotient and be able to compute the difference quotient.

C3. Understand the concept of the derivative as a rate of change, slope of a tangent line, and velocity, and recognize the graphical representation of the derivative.

C4. Know the definition of the derivative and be able to compute the derivative of a function using the definition (i.e. using the limit of the difference quotient.)

D. Techniques of Differentiation

D1. Be able to find the derivative of constant and power functions, use the properties of derivatives, find derivatives of products and quotients, and find higher order derivatives.

D2. Be able to recognize the relationship between the graph of a function and the graph of its first and second derivative.

D3. Be able to find the derivatives of the sine, the cosine, and other trigonometric functions.

D4. Be able to find the derivatives of exponential and logarithmic functions.

D5. Be able to find the derivatives of inverse trigonometric functions.

D6. Be able to find the derivatives of hyperbolic trigonometric functions.

D7. Be able to recognize and distinguish between average & instantaneous rate of change.

D8. Understand and be able to use the Chain Rule.

D9. Understand and be able to find derivatives of implicitly defined functions.

E. Applications of Differentiation

E1. Be able to use calculus to model application problems involving rates of change.
E2. Be able to use linearization or the tangent line to approximate a curve near a point.
E3. Understand and be able to compute differentials.
E4. Be able to describe the following concepts and their relationship to the first and second derivatives:
    Maxima and Minima
    Concavity
    Inflection Points
E5. Be able to use the first and second derivative tests to find local/relative extrema.
E6. Be able to find the absolute extrema of a function on an interval.
E7. Describe the Mean Value Theorem and Rolle's Theorem.
E8. Be able to use calculus to find intervals where a function is increasing or decreasing.
E9. Be able to find intervals of concavity and determine points of inflection using second derivatives
E10. Understand the concept of a limit at infinity.
E11. Be able to find limits at infinity and both horizontal and vertical asymptotes of a function.
E12. Be able to use calculus to model various optimization applications (in Physical Science, Engineering, Business, Economics, Life Sciences).
E13. Be able to identify indeterminate forms of limits and use L'Hôpital's Rule to evaluate limits, where appropriate.
E14. Be able to use Newton's Method for approximating the zeros of a function.

F. The Definite & Indefinite Integral

F1. Be able to compute Right-Hand and Left-Hand Riemann Sums.
F2. Be able to interpret the limit of Riemann sums as the area of regions, etc.
F3. Know when the Riemann sum is an overestimate and an underestimate of areas.
F4. Understand the definition of a definite integral as the limit of Riemann sums and be able to compute area or a definite integral using this definition.
F5. Be able to use the Fundamental Theorem of Calculus to evaluate definite integrals.
F6. Be able to recognize and use the Second Fundamental Theorem of Calculus.
F7. Be able to compute anti-derivatives and indefinite integrals.
F8. Be able to evaluate basic integrals of polynomials, rational functions, trigonometric functions, exponential functions, inverse trigonometric functions, and hyperbolic trigonometric functions.
F9. Be able to use the substitution method of integration for definite and indefinite integrals.
F10. Be able to use the Mean Value Theorem for Integrals and find average value.

G. Technology

G1. Be able to use technology to aid in the solution of calculus problems.
G2. Be able to use a computer algebra system to make calculations and graph functions.
G3. Be able to describe the limitation of technology in finding the exact solution.

Other Requirements:

The TI-82, TI-83, TI-84, TI-85 or TI-86 graphing calculator is required for the course (TI-Nspire calculators that are equivalent to these are acceptable). A **TI-83 Plus or TI-84 Plus Graphing Calculator** is strongly recommended. Graphing calculators capable of symbolic manipulation (such as TI-89, TI-92, TI-Nspire CAS systems and other such calculators) will not be allowed on examinations, the final exam and where the instructor sees fit.