

Calculus 3113

Course description:

Calculus is an advanced mathematics course that uses meaningful problems and appropriate technology to develop concepts and applications related to continuity and discontinuity of functions and differentiation, and integration.

Standard 1.0: Functions

Students will expand the concept of functions to include the analysis and interpretation of both continuous and discontinuous functions in problem situations and the development of the concept of limit.

Learning Expectations:

Students will:

- 1.1 demonstrate an understanding of the concepts and applications related to a variety of continuous functions;
- 1.2 calculate and estimate limits;
- 1.3 represent a variety of functions graphically;
- 1.4 use graphical representations to demonstrate an understanding of asymptotes;
- 1.5 use a variety of methods to analyze and interpret functions;
- 1.6 apply functions in problem situations.

Student Performance Indicators:

- analyze the graphs of polynomial, rational, radical, and transcendental functions using appropriate technology;
- predict and explain the observed local and global behavior of a function;
- calculate limits using algebra;
- estimate limits from graphs or tables of data.
- demonstrate an understanding of asymptotes in terms of graphical behavior;
- describe asymptotic behavior in terms of infinite limits and limits at infinity;
- compare relative magnitudes of functions and their rates of change.
- demonstrate an understanding continuity in terms of limits;
- demonstrate a geometric understanding of graphs of continuous functions.

Standard 2.0: Derivatives

Students will extend the concept of slope of a line to develop the concept of derivative.

Learning Expectations:

The student will:

- 2.1 define, represent and interpret the concept of derivative;
- 2.2 use the derivative of a function to characterize the function and vice versa;
- 2.1 connect the relationships among a function and its first and second derivative;
- 2.2 apply basic rules for differentiation;
- 2.3 apply derivatives in problem situations.

Student Performance Indicators:

- represent the concept of the derivative geometrically, numerically, and analytically;
- interpret the derivative as an instantaneous rate of change;
- define the derivative as the limit of the difference quotient;
- articulate the relationship between differentiability and continuity.

articulate corresponding characteristics of graphs of f and f' ;
communicate the relationship between the increasing and decreasing behavior f and the sign of f' ;
demonstrate an understanding of the Mean Value Theorem and its geometric consequence;
translate verbal descriptions into equations involving derivatives and vice versa.
articulate corresponding characteristics of the graphs of f , f' , and f'' ;
communicate the relationship between the concavity of f and the sign of f'' ;
identify points of inflection;
analyze curves using the notions of monotonicity and concavity;
optimization, both absolute (global) and relative (local) extrema;
model rates of change, including related rates problems;
use implicit differentiation to find the derivative of an inverse function;
interpret the derivative as a rate of change in varied applied contexts;
apply basic rules for the derivative of basic functions and their sum, product, and quotient;
use the chain rule and implicit differentiation.

Standard 3.0: Integrals

Students will develop the concepts of integrals and their applications.

Learning Expectations:

The student will:

- 3.1 define and apply basic properties of definite integrals;
- 3.2 evaluate or approximate definite integrals;
- 3.3 apply techniques of antidifferentiation.

Student Performance Indicators:

communicate the relationship between a Riemann sum and a definite integral;
apply basic properties of definite integrals;
evaluate definite integrals using the Fundamental Theorem;
apply techniques of antidifferentiation;
find specific antiderivatives using initial conditions, including applications to motion along a line;
use separable differential equations in modeling;
use Riemann sums and the Trapezoidal Rule to approximate definite integrals of functions represented algebraically, geometrically, and by tables of values.