MATH 222: CALCULUS WITH BUSINESS APPLICATIONS

Description: An introduction to single-variable differential and integral calculus of algebraic, exponential, and logarithmic functions with emphasis on business applications.

Prerequisite: Placement level 5 – or – Math 122 with a grade of C or above and Placement level 4 – or – Math 122 with a grade of C or above and 114A with a grade of C or above.

Restrictions: Students who have received credit for Math 232 are not eligible to take this course for credit.

O. Pre-calculus concepts needed throughout this course

Student will demonstrate capacity to:

- determine the equation of a line given two points or point and slope using various forms (such as point-slope form or standard form).
- Graph basic linear, quadratic and exponential equations.
- interpret graph features, such as slope and intercepts, in terms of real world phenomena.
- use function notation and determine domain and range (when range may be determined algebraically)
- form sums, differences, products, and quotients of functions
- form the compositions of functions and determine the inverse function, when one exists.

These capacities will be developed in the context of functions and concepts which model business applications, such as: cost, revenue, profit, demand and supply, and equilibrium quantity and price.

I. *Foundations*

Regarding functions pertinent to business applications, student will demonstrate:

- understanding of the definition and properties of exponential functions, particularly base e,
- capacity to solve basic problems arising from business applications modeled by exponentials, such as problems relating to continuous compounding of interest,
- understanding of the definition and properties of logarithmic functions, particularly base e,
- capacity to use properties to logarithms to solve basic problems arising from business applications,
- understanding of the inverse function relationship between exponentials and logarithms.

Regarding limits, student will demonstrate capacity to:

- understand the definition of limit and continuity from an intuitive perspective,
- evaluate limits using limit laws and properties, including limits at infinity and infinite limits,
- evaluate limits given the graph of a function, including limits at infinity and infinite limits,
- identify and evaluate limits yielding indeterminant forms,
- evaluate one-sided limits, using limit laws or the graph of a function, particularly for piecewise functions,
- determine horizontal and vertical asymptotes.

II. *Derivative*

Regarding the definition, student will demonstrate:

- an intuitive understanding of the definition of derivative,
- capacity to determine average rate of change of a function over an interval, and interpret as a secant line slope,
- understanding of the relationship between average and instantaneous rates of change,
- capacity to determine instantaneous rate of change of a function at a point, using an appropriate limit, and interpret as a tangent line slope,
- capacity to compute the derivative of a given function, from the definition of derivative.

Regarding computation, student will demonstrate capacity to:

- compute the derivative of a function using standard rules for differentiation; particularly for functions pertinent to business applications,
- compute the equation of the tangent line to the graph of a function at a point,
- evaluate function behaviors identified by derivatives including: intervals of increasing or decreasing values, concavity, local extrema and inflection points, absolute extrema on a domain.

Regarding applications, student will demonstrate capacity to:

- compute instantaneous velocity and acceleration,
- compute and interpret marginal cost, revenue and profit,
- compute and interpret marginal average cost,
- compute elasticity of demand, given a demand function,
- use aforementioned applications of differentiation to analyze business applications,
- solve optimization problems that arise in business application such as: determining maximal/minimal state of profit, cost and revenue functions; and inventory control.

III. ***Integration***

Regarding the definition, student will demonstrate:

- understanding of and capacity to compute the general antiderivative function; particularly for functions pertinent to business applications,
- capacity to use a Riemann sum, with function values at either left, right, or midpoints of subintervals, to estimate the definite integral of a function over a specified interval,
- intuitive understanding of the definition of the definite integral as a limit of Riemann sums,
- familiarity with the statement of the Fundamental Theorem of Calculus and intuitive understanding of the connection between the definite and the indefinite integrals.

Regarding computation, student will demonstrate capacity to:

- compute definite and indefinite integrals using standard rules and techniques of integration; including algebraic substitutions and parts, with particular attention given to e^x and $\ln x$,
- solve Initial Value Problems,
- compute the average value of a continuous function over an interval,
- compute the area under the graph of a non-negative function above an interval on the *x*-axis; and compute the area between two curves,
- compute the net change in a continuous function throughout an interval.

Regarding applications, student will demonstrate capacity to:

- compute consumer and producer surplus ,
- compute future value of a continuous income stream,
- compute present value of a continuous annuity,
- compute probabilities associated with continuous random variables,
- compute expected value and variance for continuous random variables (Optional item).