**COMMUNITY COLLEGE COURSE COMPETENCIES**

***CHECKLIST*:** ***College Calculus***

|  |  |  |
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| **Standard** | **Dates Taught** | **Notes** |
| **Course Competencies** |
| ***Upon completion of the course, the student should be able to:*** |
| 1. Simplify and analyze functions of all types, including trigonometric functions, and be able to graphically represent them using graphing calculator technology.
 |  |  |  |  |  |
| 1. Evaluate the limit of a function at a point both algebraically and graphically.
 |  |  |  |  |  |
| 1. Evaluate the limit of a function at infinity both algebraically and graphically.
 |  |  |  |  |  |
| 1. Use the definition of a limit to verify a value for the limit of a function.
 |  |  |  |  |  |
| 1. Use the limit to determine the continuity of a function.
 |  |  |  |  |  |
| 1. Apply the Intermediate-Value Theorem.
 |  |  |  |  |  |
| 1. Use the limit to determine differentiability of a function.
 |  |  |  |  |  |
| 1. Use the limiting process to find the derivative of a function.
 |  |  |  |  |  |
| 1. Find derivatives involving powers, exponents, and sums.
 |  |  |  |  |  |
| 1. Find derivatives involving products and quotients.
 |  |  |  |  |  |
| 1. Find derivatives involving the chain rule.
 |  |  |  |  |  |
| 1. Find derivatives involving exponential, logarithmic, and trigonometric functions.
 |  |  |  |  |  |
| 1. Find derivatives involving implicit differentiation.
 |  |  |  |  |  |
| 1. Use the first derivative to find critical points.
 |  |  |  |  |  |
| 1. Apply the Mean-Value Theorem for derivatives.
 |  |  |  |  |  |
| 1. Determine the behavior of a function using the first derivative.
 |  |  |  |  |  |
| 1. Use the second derivative to find inflection points.
 |  |  |  |  |  |
| 1. Determine the concavity of a function using the second derivative.
 |  |  |  |  |  |
| 1. Sketch the graph of the function using information gathered from the first and second derivatives.
 |  |  |  |  |  |
| 1. Interpret graphs of functions.
 |  |  |  |  |  |

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***CHECKLIST*:** ***College Calculus***

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| **Standard** | **Dates Taught** | **Notes** |
| **Course Competencies (cont.)** |
| ***Upon completion of the course, the student should be able to:*** |
| 1. Apply L’Hopital’s Rule to limits.
 |  |  |  |  |  |
| 1. Use the derivative to find velocity, acceleration, and other rates of change.
 |  |  |  |  |  |
| 1. Use the derivative to find the equation of a line tangent to a curve at a given point.
 |  |  |  |  |  |
| 1. Use optimization techniques in areas such as economics, the life sciences, the physical sciences, and geometry.
 |  |  |  |  |  |
| 1. Solve related rates problems.
 |  |  |  |  |  |
| 1. Use Newton’s Method.
 |  |  |  |  |  |
| 1. Use differentials to estimate change.
 |  |  |  |  |  |
| 1. Find area using Riemann sums and integrals.
 |  |  |  |  |  |
| 1. Express the limit of a Riemann sum as a definite integral.
 |  |  |  |  |  |
| 1. Evaluate the definite integral using geometry.
 |  |  |  |  |  |
| 1. Integrate algebraic, exponential, and trigonometric functions.
 |  |  |  |  |  |
| 1. Evaluate definite integrals using the Fundamental Theorem of Calculus.
 |  |  |  |  |  |
| 1. Apply the Mean-Value Theorem for integrals.
 |  |  |  |  |  |
| 1. Integrate indefinite integrals.
 |  |  |  |  |  |
| 1. Integrate using substitution.
 |  |  |  |  |  |
| 1. Approximate integrals using Simpson’s Rule and the Trapezoidal Rule.
 |  |  |  |  |  |
| 1. Use definite integrals to find the area between two curves.
 |  |  |  |  |  |
| 1. Use definite integrals to find volumes by the disk method, shell method, and by use of cylindrical shells.
 |  |  |  |  |  |



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| **Standard** | **Dates Taught** | **Notes** |
| **Course Content** |
| ***Functions*** |
| 1. Functions
 |  |  |  |  |  |
| 1. Graphs of Functions and operations
 |  |  |  |  |  |
| 1. Combining Functions
 |  |  |  |  |  |
| 1. Trigonometric Functions
 |  |  |  |  |  |
| 1. Graphing Skills
 |  |  |  |  |  |
| 1. Shifting Graphs
 |  |  |  |  |  |
| 1. Scaling Graphs
 |  |  |  |  |  |
| 1. Graphing with Calculators or Computers
 |  |  |  |  |  |
| 1. Exponential Functions
 |  |  |  |  |  |
| 1. Inverse Functions
 |  |  |  |  |  |
| 1. Algebraic
 |  |  |  |  |  |
| 1. Trigonometric
 |  |  |  |  |  |
| 1. Logarithmic
 |  |  |  |  |  |
| ***Limits and Continuity*** |
| 1. Rates of Change
 |  |  |  |  |  |
| 1. Tangents to Curves
 |  |  |  |  |  |
| 1. Graphically
 |  |  |  |  |  |
| 1. By Definition
 |  |  |  |  |  |
| 1. Limits to Function
 |  |  |  |  |  |
| 1. Limits to Law
 |  |  |  |  |  |
| 1. Rigorous Definition of a Limits (precisely, as it relates to calculus).
 |  |  |  |  |  |
| 1. One-Sided Limits
 |  |  |  |  |  |
| 1. Two-Sided Limits
 |  |  |  |  |  |
| 1. Continuity
 |  |  |  |  |  |
| 1. By Definition
 |  |  |  |  |  |
| 1. Use of the Intermediate Value Theorem
 |  |  |  |  |  |
| 1. Composite Functions and General Limits
 |  |  |  |  |  |
| 1. Limits that involve Infinity
 |  |  |  |  |  |
| 1. Asymptotes of Graphs
 |  |  |  |  |  |

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***CHECKLIST*:** ***College Calculus***

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| **Standard** | **Dates Taught** | **Notes** |
| **Course Content (cont.)** |
| ***Differentiation*** |
| 1. Tangents and the Derivative at a Point
 |  |  |  |  |  |
| 1. The Derivative as a Function
 |  |  |  |  |  |
| 1. Differentiation Rules
 |  |  |  |  |  |
| 1. Constant and Exponential Functions
 |  |  |  |  |  |
| 1. Power Rule
 |  |  |  |  |  |
| 1. Product Rule
 |  |  |  |  |  |
| 1. Quotient Rule
 |  |  |  |  |  |
| 1. The Derivative as a Rate of Change
 |  |  |  |  |  |
| 1. Instantaneous Rate of Change
 |  |  |  |  |  |
| 1. Velocity/Acceleration
 |  |  |  |  |  |
| 1. Application Physics-Type Problems
 |  |  |  |  |  |
| 1. Derivatives of Trigonometric Functions with Applications
 |  |  |  |  |  |
| 1. Derivatives Utilizing Chain Rules and Applications
 |  |  |  |  |  |
| 1. Implicit Differentiation
 |  |  |  |  |  |
| 1. Derivatives of Inverse Functions and Logarithms
 |  |  |  |  |  |
| 1. Logarithmic Differentiation
 |  |  |  |  |  |
| 1. Inverse Functions/ Logarithms/Exponentials
 |  |  |  |  |  |
| 1. Inverse Trigonometric Functions
 |  |  |  |  |  |
| 1. Derivatives
 |  |  |  |  |  |
| 1. Limits
 |  |  |  |  |  |
| 1. Applications
 |  |  |  |  |  |
| 1. Related Rates (applications)
 |  |  |  |  |  |
| 1. Linearization and Differentials
 |  |  |  |  |  |

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***CHECKLIST*:** ***College Calculus***

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| --- | --- | --- |
| **Standard** | **Dates Taught** | **Notes** |
| **Course Content (cont.)** |
| ***Applications of Derivatives*** |
| 1. Extreme Values of Functions
 |  |  |  |  |  |
| 1. The Extreme Value Theorem
 |  |  |  |  |  |
| 1. Local Maximums/Minimums
 |  |  |  |  |  |
| 1. Critical Points of all Types
 |  |  |  |  |  |
| 1. The Mean Value theorem for Derivatives and its Applications
 |  |  |  |  |  |
| 1. Monotonic Functions
 |  |  |  |  |  |
| 1. Increasing/Decreasing Functions
 |  |  |  |  |  |
| 1. First Derivative Test
 |  |  |  |  |  |
| 1. Techniques for Identifying Local Extrema
 |  |  |  |  |  |
| 1. Concavity
 |  |  |  |  |  |
| 1. Identifying Inflection Points
 |  |  |  |  |  |
| 1. Second Derivative Test
 |  |  |  |  |  |
| 1. More Advanced Curve Sketching Techniques
 |  |  |  |  |  |
| 1. Indeterminate Forms and L’Hopital’s Rule for Indeterminate Forms
 |  |  |  |  |  |
| 1. Applied Optimization
 |  |  |  |  |  |
| 1. Newton’s Method and Application
 |  |  |  |  |  |
| 1. Introduction of Indefinite Integrals (Antiderivatives)
 |  |  |  |  |  |
| 1. General Antiderivatives by Basic Rules
 |  |  |  |  |  |
| 1. Initial Value Problems
 |  |  |  |  |  |
| 1. Antiderivatives and Motion
 |  |  |  |  |  |

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***CHECKLIST*:** ***College Calculus***

|  |  |  |
| --- | --- | --- |
| **Standard** | **Dates Taught** | **Notes** |
| **Course Content (cont.)** |
| ***Integration*** |
| 1. Area and Estimating Area with Finite Sums
 |  |  |  |  |  |
| 1. Riemann Sums and Partitions
 |  |  |  |  |  |
| 1. Trapezoidal Rule
 |  |  |  |  |  |
| 1. Simpson’s (Parabolic) Rule
 |  |  |  |  |  |
| 1. Distance Traveled Versus Displacement
 |  |  |  |  |  |
| 1. Average Value Techniques
 |  |  |  |  |  |
| 1. Sigma Notation
 |  |  |  |  |  |
| 1. Limits and Values of Finite Sums
 |  |  |  |  |  |
| 1. The Definite Integral
 |  |  |  |  |  |
| 1. Integrable and Nonintegrable Functions
 |  |  |  |  |  |
| 1. Rules of Definite Integrals
 |  |  |  |  |  |
| 1. Area Under a Curve
 |  |  |  |  |  |
| 1. Average Value Over an Interval
 |  |  |  |  |  |
| 1. The Fundamental Theorem of Calculus (FTC)
 |  |  |  |  |  |
| 1. Mean Value Theorem for Definite Integrals
 |  |  |  |  |  |
| 1. The Fundamental Theorem of Calculus Part 1 and Part 2
 |  |  |  |  |  |
| 1. Total Area
 |  |  |  |  |  |
| 1. Techniques for Finding Area with FTC
 |  |  |  |  |  |
| 1. Indefinite integrals and the Substitution Method
 |  |  |  |  |  |
| 1. Techniques Explored
 |  |  |  |  |  |
| 1. Change of Limits Rule
 |  |  |  |  |  |
| 1. Substitution and Finding Area
 |  |  |  |  |  |
| 1. Area Between Curves with Respect to X
 |  |  |  |  |  |
| 1. Area Between Curves with Respect to Y
 |  |  |  |  |  |

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| **Standard** | **Dates Taught** | **Notes** |
| **Course Content (cont.)** |
| ***Applications of Integration*** |
| 1. Volumes using Cross-Sections
 |  |  |  |  |  |
| 1. Volumes by Disks
 |  |  |  |  |  |
| 1. Volumes by Washers
 |  |  |  |  |  |
| 1. Volumes by Cylindrical Shells
 |  |  |  |  |  |
| 1. As time Permits – Arc Length
 |  |  |  |  |  |
| 1. As time Permits – Areas of Surface of Revolution
 |  |  |  |  |  |
| 1. As time Permits –Derivatives and Integrals of Exponential and Logarithmic Functions with Base other than *e* (Euler’s number) for the Natural Exponential and Natural Logarithmic Functions
 |  |  |  |  |  |
| 1. As time Permits – Other Applications to Work, Fluid Force, Moments and Center of Mass
 |  |  |  |  |  |