**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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| **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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| **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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| **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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| **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 |  |  |  |  |  |