

**CALCULUS (C)**

Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	Grades 9-12
									<p><b>MA.912.C.1</b> Develop an understanding for limits and continuity. Determine limits and continuity.</p> <p><b>MA.912.C.1.1</b> Demonstrate understanding of the concept of a limit and estimate limits from graphs and tables of values.</p> <p><b>MA.912.C.1.2</b> Determine the value of a limit if it exists algebraically using limits of sums, differences, products, quotients and compositions of continuous functions.</p> <p><b>MA.912.C.1.3</b> Find limits of rational functions that are undefined at a point.</p> <p><b>MA.912.C.1.4</b> Find one-sided limits.</p> <p><b>MA.912.C.1.5</b> Find limits at infinity.</p> <p><b>MA.912.C.1.6</b> Decide when a limit is infinite and use limits involving infinity to describe asymptotic behavior.</p> <p><b>MA.912.C.1.7</b> Find special limits by using the Squeeze Theorem or algebraic manipulation.</p> <p><b>MA.912.C.1.8</b> Find limits of indeterminate forms using L'Hôpital's Rule.</p> <p><b>MA.912.C.1.9</b> Define continuity in terms of limits.</p> <p><b>MA.912.C.1.10</b> Given the graph of a function, identify whether a function is continuous at a point, if not, identify the type of discontinuity for the given function.</p> <p><b>MA.912.C.1.11</b> Apply the Intermediate Value Theorem and the Extreme Value Theorem.</p>
									<p><b>MA.912.C.2</b> Develop an understanding for and determine derivatives.</p> <p><b>MA.912.C.2.1</b> State, understand and apply the definition of derivative. Apply and interpret derivatives geometrically and numerically.</p> <p><b>MA.912.C.2.2</b> Interpret the derivative as an instantaneous rate of change or as the slope of the tangent line.</p> <p><b>MA.912.C.2.3</b> Prove the rules for finding derivatives of constants, sums, products, quotients and the Chain Rule.</p> <p><b>MA.912.C.2.4</b> Apply the rules for finding derivatives of constants, sums, products, quotients and the Chain Rule to solve problems with functions limited to algebraic, trigonometric, inverse trigonometric, logarithmic and exponential.</p> <p><b>MA.912.C.2.5</b> Find the derivatives of implicitly defined functions.</p> <p><b>MA.912.C.2.6</b> Find derivatives of inverse functions.</p> <p><b>MA.912.C.2.7</b> Find second derivatives and derivatives of higher order.</p> <p><b>MA.912.C.2.8</b> Find derivatives using logarithmic differentiation.</p> <p><b>MA.912.C.2.9</b> Demonstrate and use the relationship between differentiability and continuity.</p> <p><b>MA.912.C.2.10</b> Apply the Mean Value Theorem.</p>

**MA.912.C.3**  
Apply derivatives to solve problems.

**MA.912.C.3.1**  
Find the slope of a curve at a point, including points at which there are vertical tangent lines.

**MA.912.C.3.2**  
Find an equation for the tangent line to a curve at a point and use it to make local linear approximation.

**MA.912.C.3.3**  
Determine where a function is decreasing and increasing using its derivative.

**MA.912.C.3.4**  
Find local and absolute maximum and minimum points of a function.

**MA.912.C.3.5**  
Determine the concavity and points of inflection of a function using its second derivative.

**MA.912.C.3.6**  
Sketch graphs by using first and second derivatives. Compare the corresponding characteristics of the graphs of  $f$ ,  $f'$  and  $f''$ .

**MA.912.C.3.7**  
Solve optimization problems using derivatives.

**MA.912.C.3.8**  
Find average and instantaneous rates of change. Explain the instantaneous rate of change as the limit of the average rate of change. Interpret a derivative as a rate of change in applications, including velocity, speed and acceleration.

**MA.912.C.3.9**  
Find the velocity and acceleration of a particle moving in a straight line.

**MA.912.C.3.10**  
Model and solve problems involving rates of change, including related rates.

**MA.912.C.4**  
Develop an understanding for and determine integrals.

**MA.912.C.4.1**  
Interpret a definite integral as a limit of Riemann sums. Calculate the values of Riemann sums over equal subdivisions using left, right and midpoint evaluation points.

**MA.912.C.4.2**  
Apply Riemann sums, the Trapezoidal Rule and technology to approximate definite integrals of functions represented algebraically, geometrically and by tables of values.

**MA.912.C.4.3**  
Interpret a definite integral of the rate of change of a quantity over an interval as the change of the quantity over the interval.

**MA.912.C.4.4**  
Evaluate definite integrals by using the Fundamental Theorem of Calculus.

**MA.912.C.4.5**  
Analyze function graphs by using derivative graphs and the Fundamental Theorem of Calculus.

**MA.912.C.4.6**  
Evaluate or solve problems using the properties of definite integrals. Properties are limited to the following...

**MA.912.C.4.7**  
Evaluate definite and indefinite integrals by using integration by substitution.

**MA.912.C.5**  
Apply integrals to solve problems.

**MA.912.C.5.1**  
Find specific antiderivatives using initial conditions, including finding velocity functions from acceleration functions, finding position functions from velocity functions and solving applications related to motion along a line.

**MA.912.C.5.2**  
Solve separable differential equations.

**MA.912.C.5.3**  
Solve differential equations of the form  $dy/dt=ky$  as applied to growth and decay problems.

**MA.912.C.5.4**  
Display a graphic representation of the solution to a differential equation by using slope fields, and locate particular solutions to the equation.

**MA.912.C.5.5**  
Find the area between a curve and the x-axis or between two curves by using definite integrals.

**MA.912.C.5.6**  
Find the average value of a function over a closed interval by using definite integrals.

**MA.912.C.5.7**  
Find the volume of a figure with known cross-sectional area, including figures of revolution, by using definite integrals.