2022 - 2023, HS, Calculus

The following Practice Standards and Literacy Skills will be used throughout the course:

Standards for Mathematical Practice	***Literacy Skills for Mathematical Proficiency***
1. Make sense of problems and persevere in solving them.	*1. Use multiple reading strategies.*
2. Reason abstractly and quantitatively.	*2. Understand and use correct mathematical vocabulary.*
3. Construct viable arguments and critique the reasoning of others.	*3. Discuss and articulate mathematical ideas.*
4. Model with mathematics.	*4. Write mathematical arguments.*
5. Use appropriate tools strategically.	
6. Attend to precision.	
7. Look for and make use of structure.	
8. Look for and express regularity in repeated reasoning.	

Quarter 1

Standards	Student Friendly "I Can" Statements
C.WCE.1 Sketch the graph of an equation, find the intercepts of a graph, test a graph and/or a function for symmetry, and find the points of intersection of two functions.	I can sketch the graph of a function and write an equation for a graph. I can locate x- and y-intercepts and determine any symmetry about the y-axis or the origin. I can use substitution or elimination techniques to determine points of intersection of two graphs.
C.WCE.2 Calculate slope between two points, write the equation of a line using Point-Slope form, and understand that slope is a ratio or a rate of change in a real-life application.	I can use the slope formula, write the equation of a line in point-slope form and/or slope intercept form. I can describe the rate of change of an event based on the slope of the line.
C.WCE.3 Use interval notation, find the domain and range of a function, identify function transformations, recognize the composition of functions.	I can use interval notation. I can determine the domain and range of a function and write it in interval notation. I can identify the vertical and horizontal shifts, stretches, and compressions associated with transformations. I can recognize nested functions and evaluate them algebraically.

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Standards	Student Friendly "I Can" Statements
C.F.LF.A.1 Calculate limits (including limits at infinity) using algebra.	I can determine limits at a point and at infinity through algebraic methods of removing discontinuities. I can describe the concept of a limit in my own words. I can describe how a limit can fail to exist. I can evaluate a limit using the following approaches: ● numerical ● graphical ● direct substitution ● factor reduction ● rationalization ● complex fraction simplification
C.F.LF.A.2 Estimate limits of functions (including one-sided limits) from graphs or tables of data. Apply the definition of a limit to a variety of functions, including piecewise functions.	I can determine limits from graphs and tables as well and can apply these techniques to piecewise functions, among others. I can describe the difference between a one-sided limit and a two-sided limit. I can determine the limit of a piecewise function.
C.F.LF.A.3 Draw a sketch that illustrates the definition of the limit; develop multiple real-world scenarios that illustrate the definition of the limit.	I can sketch different kinds of limits and describe real-world applications of limits.
C.F.BF.A.1 Describe asymptotic behavior (analytically and graphically) in terms of infinite limits and limits at infinity.	I can evaluate infinite limits and use them to define vertical asymptotes. I can use limits involving infinity to describe end behavior.
C.F.BF.A.2 Discuss the various types of end behavior of functions; identify prototypical functions for each type of end behavior.	I can describe in writing and by graphing different end behavior of functions.
C.F.C.A.1 Define continuity at a point using limits; define continuous functions.	I can investigate continuity at a point and identify the continuity of a function.
C.F.C.A.2 Determine whether a given function is continuous at a specific point.	I can determine whether a given function is continuous at a specific point.

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Standards	Student Friendly "I Can" Statements
	I can describe common discontinuities in a function.
C.F.C.A.3 Determine and define different types of discontinuity (point, jump, infinite) in terms of limits.	I can identify removable and non-removable discontinuities.
C.F.C.A.4 Apply the Intermediate Value Theorem and Extreme Value Theorem to continuous functions.	I can determine if a function is continuous, and then apply the Intermediate Value Theorem and Extreme Value Theorem to it.
C.D.CD.A.1 Represent and interpret the derivative of a function graphically, numerically, and analytically.	I can describe the derivative of a function given the graph of that function, its equation, or a table of values.
C.D.CD.A.2 Interpret the derivative as an instantaneous rate of change.	I can describe the concept of a numerical derivative as an instantaneous rate of change.
C.D.CD.A.3 Define the derivative as the limit of the difference quotient; illustrate with the sketch of a graph.	I can use limits to find derivatives analytically. I can find a derivative using the limit definition of the derivative. I can describe common types of non-differentiability in the graph of a function.
C.CD.A.4 Demonstrate the relationship between differentiability and continuity.	I can define differentiability at a point. I can explain that differentiability implies continuity with examples and counterexamples.
C.D.CD.B.5 Interpret the derivative as the slope of a curve (which could be a line) at a point, including points at which there are vertical tangents and points at which there are no tangents (i.e., where a function is not locally linear).	I can discuss slope at a point, including vertical slopes and points which have no slope.
C.D.CD.B.6 Approximate both the instantaneous rate of change and the average rate of change given a graph or table of values.	I can use derivatives to describe the rate of change at a point and compare it to the average rate of change between two points.
C.D.AD.C.17 Use differentiation to solve problems involving velocity, speed, and acceleration.	I can describe the connection among position, velocity, and acceleration
C.D.CD.B.7 Write the equation of the line tangent to a curve at a given point.	I can find the equation of the tangent line to a curve at a specific point.
C.D.AD.A.1 Describe in detail how the basic derivative rules are used to differentiate a function; discuss the difference between using the limit definition of the derivative and using the derivative rules.	I can differentiate basic functions, including polynomial and trigonometric functions not only using the limit definition of the derivative, but also using derivative rules.
C.D.AD.A.2 Calculate the derivative of basic functions (power, exponential,	I can compute derivatives of transcendental functions (power,

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logarithmic, and trigonometric).	exponential, logarithmic, and trigonometric). [Note: this may be a 3rd quarter topic depending on the textbook and/or the teacher.]
C.D.AD.A.3 Calculate the derivatives of sums, products, and quotients of basic functions.	I can differentiate functions involving sums, products, and quotients.
C.WCE.4 (AD) Calculate higher-order derivatives.	I can find higher-order derivatives.
C.D.AD.A.4 Apply the chain rule to find the derivative of a composite function.	I can perform the Chain Rule to differentiate a composite function.

Quarter 2

Standards	Student Friendly "I Can" Statements
C.D.AD.A.5 Implicitly differentiate an equation in two or more variables.	I can find the derivative of a function defined implicitly.
C.D.AD.A.6 Use implicit differentiation to find the derivative of the inverse of a function.	I can find the derivative of the inverse of a function.
C.D.AD.C.15 Model rates of change, including related rates problems. In each case, include a discussion of units.	I can find related rates. I can use related rates to solve real-life problems.
C.D.AD.B.7 Relate the increasing and decreasing behavior of f to the sign of f' both analytically and graphically.	I can predict when a function is increasing or decreasing from the sign of f'.
C.D.AD.B.8 Use the first derivative to find extrema (local and global).	I can find absolute and relative extreme values of a function.
C.D.AD.B.9 Analytically locate the intervals on which a function is increasing, decreasing or neither.	I can analyze the first derivative of a function to find the intervals of increase and decrease.
C.D.CD.B.8 Apply the Mean Value Theorem.	I can apply the Mean Value Theorem to a function to predict a particular slope over an interval.
C.D.CD.B.9 Understand Rolle's Theorem as a special case of the Mean Value Theorem.	I can apply Rolle's Theorem to a function to predict a zero slope over a closed interval.
C.D.AD.B.10 Relate the concavity of f to the sign of f' both analytically and graphically.	I can use the 2nd derivative of a function to describe the concavity in the graph of the function.
C.D.AD.B.11 Use the second derivative to find points of inflection as points where concavity changes.	I can locate points of inflection in the graph of a function.
C.D.AD.B.12 Analytically locate intervals on which a function is concave up, concave down or neither.	I can use the second derivative to determine intervals of concavity.
C.D.AD.B.13 Relate corresponding characteristics of the graphs of f, f', and f''.	I can determine and describe the original function by analyzing its first and second derivatives.
C.D.AD.B.14 Translate verbal descriptions into equations involving derivatives and vice versa.	I can set up and solve word problems involving derivatives.
C.D.AD.C.16 Solve optimization problems to find a desired maximum or minimum value.	I can use extrema to solve real-life optimization problems.
C.D.AD.C.17 Use differentiation to solve problems involving velocity, speed, and acceleration.	I can use derivatives to solve problems involving velocity, speed, and acceleration.
C.D.AD.C.18 Use tangent lines to approximate function values and changes in function values when inputs change (linearization).	I can find the tangent line approximation of a function at a given x value.

Quarter 3

Standards	Student Friendly "I Can" Statements
C.I.UI.A.1 Define the definite integral as the limit of Riemann sums and as the net accumulation of change.	I can explain how a definite integral is the limit of a Riemann sum. I understand that the area under a curve is an accumulation of change.
C.I.UI.A.2 Correctly write a Riemann sum that represents the definition of a definite integral.	I can write a Riemann sum equivalent to a definite integral.
C.I.UI.A.3 Use Riemann sums (left, right, and midpoint evaluation points) and trapezoid sums to approximate definite integrals of functions represented graphically, numerically, and by tables of values.	I can use Riemann sums and trapezoids to approximate area and definite integrals. I can describe the relationship between area and definite integrals over an interval.
C.I.UI.B.4 Recognize differentiation and antidifferentiation as inverse operations.	I can use the $\int dx$ operator notation to define integration in terms of antidifferentiation.
C.I.UI.B.5 Evaluate definite integrals using the Fundamental Theorem of Calculus.	I can use the Fundamental Theorem of Calculus to evaluate definite integrals.
C.I.UI.B.6 Use the Fundamental Theorem of Calculus to represent a particular antiderivative of a function and to understand when the antiderivative so represented is continuous and differentiable.	I can use the Second Fundamental Theorem of Calculus to differentiate an integral function.
C.I.UI.B.7 Apply basic properties of definite integrals (e.g. additive, constant multiple, translations).	I can integrate basic functions.
C.I.AI.A.1 Develop facility with finding antiderivatives that follow directly from derivatives of basic functions (power, exponential, logarithmic, and trigonometric).	I can integrate using basic antiderivatives, including those involving the power rule and trigonometric functions. I can find integrals involving exponential functions. I can use logarithms to evaluate integrals in the form $\int(1/u)du$. I can find integrals involving inverse trigonometric functions.

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Standards	Student Friendly "I Can" Statements
C.I.AI.A.2 Use substitution of variables to calculate antiderivatives (including changing limits for definite integrals).	I can use a change of variables (*u*-substitution) to evaluate integrals.
C.I.AI.A.3 Find specific antiderivatives using initial conditions.	I can evaluate definite and indefinite integrals and incorporate initial conditions to evaluate the constant of integration.

Quarter 4

Standards	Student Friendly "I Can" Statements
C.I.AI.B.4 Use a definite integral to find the area of a region.	I can find the area bounded between two curves.
C.I.AI.B.5 Use a definite integral to find the volume of a solid formed by rotating a region around a given axis.	I can calculate the volume of solids of revolutions using the washer method.
C.I.AI.B.6 Use integrals to solve a variety of problems (e.g., distance traveled by a particle along a line, exponential growth/decay).	I can solve differential equations (initial value problems) using integration. I can use integration to solve a variety of problems (distance traveled, exponential growth/decay, volume, etc.) I can use initial conditions to find particular solutions of differential equations.