Calculus Honors (#1202300)   2022 – 2023 Course Description

Course Title:	Calculus Honors
Course Number:	1202300
Course Information:	**In Calculus Honors, instructional time will emphasize four areas:** (1) developing understanding of limits and continuity of functions; (2) finding derivatives and applying them to motions, slopes, related rates and optimizations; (3) applying limits and derivatives to graph and analyze functions and (4) evaluating integrals and applying them to areas, volumes, average values and differential equations. *All clarifications stated, whether general or specific to Calculus Honors, are expectations for instruction of that benchmark.* Curricular content for all subjects must integrate critical-thinking, problem-solving, and workforce-literacy skills; communication, reading, and writing skills; mathematics skills; collaboration skills; contextual and applied-learning skills; technology-literacy skills; information and media-literacy skills; and civic-engagement skills.
General Notes:	**Honors and Accelerated Level Course Note:** Accelerated courses require a greater demand on students through increased academic rigor. Academic rigor is obtained through the application, analysis, evaluation, and creation of complex ideas that are often abstract and multi-faceted. Students are challenged to think and collaborate critically on the content they are learning. Honors level rigor will be achieved by increasing text complexity through text selection, focus on high-level qualitative measures, and complexity of task. Instruction will be structured to give students a deeper understanding of conceptual themes and organization within and across disciplines. Academic rigor is more than simply assigning to students a greater quantity of work. **Florida's Benchmarks for Excellent Student Thinking (B.E.S.T.) Standards** This course includes Florida's B.E.S.T. ELA Expectations (EE) and Mathematical Thinking and Reasoning Standards (MTRs) for students. Florida educators should intentionally embed these standards within the content and their instruction as applicable. For guidance on the implementation of the EEs and MTRs, please visit and select the appropriate B.E.S.T. Standards package. **English Language Development ELD Standards Special Notes Section:** Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Mathematics. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates

performance definitions and descriptors, please click on the following link: https://cpalmsmediaprod.blob.core.windows.net/uploads/docs/standards/eld/ma.pdf

Florida's Benchmarks for Excellent Student Thinking (B.E.S.T.) Standards: 7 Mathematical Thinking and Reasoning Standards, 45 Mathematics Benchmarks, 6 English Language Arts Benchmarks and 1 English Language Development Benchmark

7 Mathematical Thinking and Reasoning Standards		Textbook Section
MA.K12.MTR.1.1:	Mathematicians who participate in effortful learning both individually and with others: ● Analyze the problem in a way that makes sense given the task. ● Ask questions that will help with solving the task. ● Build perseverance by modifying methods as needed while solving a challenging task. ● Stay engaged and maintain a positive mindset when working to solve tasks. ● Help and support each other when attempting a new method or approach. Clarifications: Teachers who encourage students to participate actively in effortful learning both individually and with others: ● Cultivate a community of growth mindset learners. ● Foster perseverance in students by choosing tasks that are challenging. ● Develop students' ability to analyze and problem solve. ● Recognize students' effort when solving challenging problems.	Incorporated Throughout
MA.K12.MTR.2.1:	Demonstrate understanding by representing problems in multiple ways. Mathematicians who demonstrate understanding by representing problems in multiple ways: ● Build understanding through modeling and using manipulatives. ● Represent solutions to problems in multiple ways using objects, drawings, tables, graphs and equations. ● Progress from modeling problems with objects and drawings to using algorithms and equations. ● Express connections between concepts and representations. ● Choose a representation based on the given context or purpose. Clarifications: Teachers who encourage students to demonstrate understanding by representing problems in multiple ways: ● Help students make connections between concepts and representations. ● Provide opportunities for students to use manipulatives when investigating concepts. ● Guide students from concrete to pictorial to abstract representations as understanding progresses. ● Show students that various representations can have different purposes and can be useful in different situations.	Incorporated Throughout
MA.K12.MTR.3.1:	Complete tasks with mathematical fluency. Mathematicians who complete tasks with mathematical fluency: ● Select efficient and appropriate methods for solving problems within the given context.	Incorporated Throughout

	● Maintain flexibility and accuracy while performing procedures and mental calculations.
	● Complete tasks accurately and with confidence.
	● Adapt procedures to apply them to a new context.
	● Use feedback to improve efficiency when performing calculations.
	Clarifications:
	Teachers who encourage students to complete tasks with mathematical fluency:
	    ● Provide students with the flexibility to solve problems by selecting a procedure that allows them to solve efficiently and accurately.
	    ● Offer multiple opportunities for students to practice efficient and generalizable methods.
	    ● Provide opportunities for students to reflect on the method they used and determine if a more efficient method could have been used.	

MA.K12.MTR.4.1:	Engage in discussions that reflect on the mathematical thinking of self and others.
	Mathematicians who engage in discussions that reflect on the mathematical thinking of self and others:
	    ● Communicate mathematical ideas, vocabulary and methods effectively.
	    ● Analyze the mathematical thinking of others.
	    ● Compare the efficiency of a method to those expressed by others.
	    ● Recognize errors and suggest how to correctly solve the task.
	    ● Justify results by explaining methods and processes.
	    ● Construct possible arguments based on evidence.
	Clarifications:
	Teachers who encourage students to engage in discussions that reflect on the mathematical thinking of self and others:
	    ● Establish a culture in which students ask questions of the teacher and their peers, and error is an opportunity for learning.
	    ● Create opportunities for students to discuss their thinking with peers.
	    ● Select, sequence and present student work to advance and deepen understanding of correct and increasingly efficient methods.
	    ● Develop students' ability to justify methods and compare their responses to the responses of their peers.
		Incorporated Throughout

MA.K12.MTR.5.1:	Use patterns and structure to help understand and connect mathematical concepts.
	Mathematicians who use patterns and structure to help understand and connect mathematical concepts:
	    ● Focus on relevant details within a problem.
	    ● Create plans and procedures to logically order events, steps or ideas to solve problems.
	    ● Decompose a complex problem into manageable parts.
	    ● Relate previously learned concepts to new concepts.
	    ● Look for similarities among problems.
	    ● Connect solutions of problems to more complicated large-scale situations.
		Incorporated Throughout

	Clarifications: Teachers who encourage students to use patterns and structure to help understand and connect mathematical concepts: ● Help students recognize the patterns in the world around them and connect these patterns to mathematical concepts. ● Support students to develop generalizations based on the similarities found among problems. ● Provide opportunities for students to create plans and procedures to solve problems. ● Develop students' ability to construct relationships between their current understanding and more sophisticated ways of thinking.	
MA.K12.MTR.6.1:	Assess the reasonableness of solutions. Mathematicians who assess the reasonableness of solutions: ● Estimate to discover possible solutions. ● Use benchmark quantities to determine if a solution makes sense. ● Check calculations when solving problems. ● Verify possible solutions by explaining the methods used. ● Evaluate results based on the given context. Clarifications: Teachers who encourage students to assess the reasonableness of solutions: ● Have students estimate or predict solutions prior to solving. ● Prompt students to continually ask, "Does this solution make sense? How do you know?" ● Reinforce that students check their work as they progress within and after a task. ● Strengthen students' ability to verify solutions through justifications.	Incorporated Throughout
MA.K12.MTR.7.1:	Apply mathematics to real-world contexts. Mathematicians who apply mathematics to real-world contexts: ● Connect mathematical concepts to everyday experiences. ● Use models and methods to understand, represent and solve problems. ● Perform investigations to gather data or determine if a method is appropriate. • Redesign models and methods to improve accuracy or efficiency. Clarifications: Teachers who encourage students to apply mathematics to real-world contexts: ● Provide opportunities for students to create models, both concrete and abstract, and perform investigations. ● Challenge students to question the accuracy of their models and methods. ● Support students as they validate conclusions by comparing them to the given situation. ● Indicate how various concepts can be applied to other disciplines.	Incorporated Throughout

45 B.E.S.T. Mathematics Benchmarks		Textbook Section
MA.912.C.1.1:	Demonstrate understanding of the concept of a limit and estimate limits from graphs and tables of values.	1.1
MA.912.C.1.2:	Determine the value of a limit if it exists algebraically using limits of sums, differences, products, quotients and compositions of continuous functions.	1.1, 1.2, 1.3, 1.4
MA.912.C.1.3:	Find limits of rational functions that are undefined at a point.	1.1, 1.2
MA.912.C.1.4:	Find one-sided limits.	1.1
MA.912.C.1.5:	Find limits at infinity.	1.2
MA.912.C.1.6:	Decide when a limit is infinite and use limits involving infinity to describe asymptotic behavior.	1.2
MA.912.C.1.7:	Find special limits by using the Squeeze Theorem or algebraic manipulation.	1.1, 1.2
MA.912.C.1.8:	Find limits of indeterminate forms using L'Hôpital's Rule.	8.2
MA.912.C.1.9:	Define continuity in terms of limits.	1.3, 2.2
MA.912.C.1.10:	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.	1.3
MA.912.C.1.11:	Apply the Intermediate Value Theorem and the Extreme Value Theorem.	2.2, 4.1
MA.912.C.2.1:	State, understand and apply the definition of derivative. Apply and interpret derivatives geometrically and numerically.	2.1, 2.2
MA.912.C.2.2:	Interpret the derivative as an instantaneous rate of change or as the slope of the tangent line.	1.1, 1.4, 2.1, 2.2, 2.4, 2.5
MA.912.C.2.3:	Prove the rules for finding derivatives of constants, sums, products, quotients and the Chain Rule. **Clarifications:** *Clarification 1*: Special cases of rules include a constant multiple of a function and the power of a function.	2.3, 3.1
MA.912.C.2.4:	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. **Clarifications:** *Clarification 1*: Special cases of rules include a constant multiple of a function and the power of a function.	2.5, 3.3, 3.4
MA.912.C.2.5:	Find the derivatives of implicitly defined functions.	3.2
MA.912.C.2.6:	Find derivatives of inverse functions.	3.3
MA.912.C.2.7:	Find second derivatives and derivatives of higher order.	2.3

MA.912.C.2.8:	Find derivatives using logarithmic differentiation.	3.4
MA.912.C.2.9:	Demonstrate and use the relationship between differentiability and continuity.	2.2
MA.912.C.2.10:	Apply the Mean Value Theorem.	4.2, 5.3
MA.912.C.3.1:	Find the slope of a curve at a point, including points at which there are vertical tangent lines.	4.5
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.	4.5, 7.4
MA.912.C.3.3:	Determine where a function is decreasing and increasing using its derivative.	4.2, 11.3
MA.912.C.3.4:	Find local and absolute maximum and minimum points of a function.	4.1, 4.3
MA.912.C.3.5:	Determine the concavity and points of inflection of a function using its second derivative.	4.3
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''.	4.3
MA.912.C.3.7:	Solve optimization problems using derivatives.	4.4
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.	P.1, 1.1
MA.912.C.3.9:	Find the velocity and acceleration of a particle moving in a straight line.	P.1, 2.4
MA.912.C.3.10:	Model and solve problems involving rates of change, including related rates.	2.4, 4.6
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.	5.2, 7.1, 7.2
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.	5.2, 5.5
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. **Clarifications:** *Clarification 1*: Instruction focuses on the relationship which $\int_a^b f'(x)dx = f(b) - f(a)$ is the fundamental theorem of calculus.	5.2, 5.3, 5.4, 6.2, 6.3, 7.1, 7.2
MA.912.C.4.4:	Evaluate definite integrals by using the Fundamental Theorem of Calculus.	5.4

MA.912.C.4.5:	Analyze function graphs by using derivative graphs and the Fundamental Theorem of Calculus.	5.4
MA.912.C.4.6:	Evaluate or solve problems using the properties of definite integrals. Properties are limited to the following: • $\int_a^b [f(x) + g(x)]dx = \int_a^b f(x)dx + \int_a^b g(x)dx$ • $\int_a^b k \cdot f(x)dx = k \int_a^b f(x)dx$ • $\int_a^a f(x)dx = 0$ • $\int_a^b f(x)dx = -\int_b^a f(x)dx$ • $\int_a^b f(x)dx + \int_b^c f(x)dx = \int_a^c f(x)dx$ • If $f(x) \leq g(x)$ on $[a,b]$, then $\int_a^b f(x)dx \leq \int_a^b g(x)dx$.	5.3, 6.2, 6.3
MA.912.C.4.7:	Evaluate definite and indefinite integrals by using integration by substitution.	6.2, 6.3
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.	7.1
MA.912.C.5.2:	Solve separable differential equations.	6.1
MA.912.C.5.3:	Solve differential equations of the form $\frac{dy}{dt} = ky$ as applied to growth and decay problems.	6.4
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.	6.1
MA.912.C.5.5:	Find the area between a curve and the x-axis or between two curves by using definite integrals.	7.2
MA.912.C.5.6:	Find the average value of a function over a closed interval by using definite integrals.	5.3
MA.912.C.5.7:	Find the volume of a figure with known cross-sectional area, including figures of revolution, by using definite integrals.	7.3

6 English Language Arts Benchmarks and 1 English Language Development Benchmark		Textbook Section
ELA.K12.EE.1.1:	Cite evidence to explain and justify reasoning. **Clarifications:** 9-12 Students continue with previous skills and should be aware of existing style guides and the ways in which they differ.	Incorporated Throughout
ELA.K12.EE.2.1:	Read and comprehend grade-level complex texts proficiently. **Clarifications:** See Text Complexity for grade-level complexity bands and a text complexity rubric.	Incorporated Throughout

ELA.K12.EE.3.1:	Make inferences to support comprehension. **Clarifications:** Students will make inferences before the words infer or inference are introduced. Kindergarten students will answer questions like "Why is the girl smiling?" or make predictions about what will happen based on the title page. Students will use the terms and apply them in 2nd grade and beyond.	Incorporated Throughout
ELA.K12.EE.4.1:	Use appropriate collaborative techniques and active listening skills when engaging in discussions in a variety of situations. **Clarifications:** In grades 3-12, students engage in academic conversations discussing claims and justifying their reasoning, refining and applying skills. Students build on ideas, propel the conversation, and support claims and counterclaims with evidence.	Incorporated Throughout
ELA.K12.EE.5.1:	Use the accepted rules governing a specific format to create quality work. **Clarifications:** Students will incorporate skills learned into work products to produce quality work. For students to incorporate these skills appropriately, they must receive instruction. A 3rd grade student creating a poster board display must have instruction in how to effectively present information to do quality work.	Incorporated Throughout
ELA.K12.EE.6.1:	Use appropriate voice and tone when speaking or writing. **Clarifications:** In kindergarten and 1st grade, students learn the difference between formal and informal language. For example, the way we talk to our friends differs from the way we speak to adults. In 2nd grade and beyond, students practice appropriate social and academic language to discuss texts.	Incorporated Throughout
ELD.K12.ELL.MA.1:	English language learners communicate information, ideas and concepts necessary for academic success in the content area of Mathematics.	Incorporated Throughout