Georgia's K-12 Mathematics Standards Curriculum Map

Implementation beginning Fall 2023

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CURRICULUM MAP

Georgia's K-12 Mathematics Standards
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SEMESTER 1			SEMESTER 2		
Unit 1	**Unit 2**	**Unit 3**	**Unit 4**	**Unit 5**	**Unit 6**
Exploring Limits and Continuity	Establishing and Using the Derivative	Applications of Derivatives	Fundamental Theorem of Calculus in Action	Applications of Integrals	Culminating Capstone Unit
Traditional Schedule					
3 – 4 weeks	**4 – 5 weeks**	**6 – 7 weeks**	**6 – 7 weeks**	**6 – 7 weeks**	**1 – 2 weeks**
Block Schedule					
9 – 12 days	**12 – 15 days**	**18 – 21 days**	**18 – 21 days**	**18 – 21 days**	**2 – 4 days**
C.FGR.2 C.MM.1 C.MP.1-8	C.FGR.3 C.MM.1 C.MP.1-8	C.FGR.4 C.MM.1 C.MP.1-8	C.GSR.5 C.MM.1 C.MP.1-8	C.PAR.6 C.MM.1 C.MP.1-8	ALL STANDARDS C.MP.1-8

Ongoing interdisciplinary learning to impact the community and to explain real-life phenomena

The concepts presented in each unit are presented based on a logical, mathematical progression. Each unique unit in sequence builds upon the previous unit.

The Framework for Statistical Reasoning, Mathematical Modeling Framework, and the K-12 Mathematical Practices should be taught throughout the units.

Mathematical Practices (C.MP.1- 8) should be evidenced at some point throughout each unit depending on the tasks that are explored. It is important to note that MPs 1, 3 and 6 should support the learning in every lesson.

Key for Course Standards: MP: Mathematical Practices, MM: Mathematical Modeling, FGR: Functional & Graphical Reasoning, GSR: Geometric & Spatial Reasoning, PAR: Patterning & Algebraic Reasoning

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Year-At-A-Glance			
Semester 1			
Pacing Suggestion	**Unit**	**Content Standards**	**Learning Objectives**
Traditional **3 – 4 weeks** Block **9 – 12 days**	**Unit 1: Exploring Limits and Continuity** *Students will investigate limits graphically, numerically, and analytically using both abstract and quantitative reasoning. Students will attend to precision in thinking while solving problems and demonstrate notational fluency when expressing ideas with limits and continuity. Students will use limit properties to find a requested limit and represent asymptotic behavior using limits. Continuity at a point will be defined as well as categorization of discontinuities. Students will understand the conditions of the Intermediate Value Theorem and apply it to a function over a closed interval.*	C.FGR.2 C.MM.1 C.MP.1-8	C.FGR.2.1 C.FGR.2.2 C.FGR.2.3 C.FGR.2.4 C.FGR.2.5 C.FGR.2.6 C.MM.1.1 C.MM.1.2 C.MM.1.3 C.MM.1.4
Traditional **4 – 5 weeks** Block **12 – 15 days**	**Unit 2: Establishing and Using the Derivative** *Students will develop the derivative as a two-sided limit of an average rate of change. Students will reason abstractly and quantitatively and make sense of problems when applying the relationship between differentiability and continuity. Investigation of the concept of the derivative will occur geometrically, numerically, and analytically. Rules of differentiation will be developed for functions and implicitly defined curves. Students will also calculate higher order derivatives and apply the derivative to a variety of modeling situations.*	C.FGR.3 C.MM.1 C.MP.1-8	C.FGR.3.1 C.FGR.3.2 C.FGR.3.3 C.FGR.3.4 C.FGR.3.5 C.FGR.3.6 C.MM.1.1 C.MM.1.2 C.MM.1.3 C.MM.1.4
Traditional **6 – 7 weeks** Block **18 – 21 days**	**Unit 3: Applications of Derivatives** *Students will make sense of problems and apply the derivative to a variety of contexts to model with mathematics. Students will calculate the derivative at a point and construct the local linearization of a function at a point. Local linear functions will be used to approximate values of a function near the point of tangency. The relationship between f and f' will be developed to identify intervals of increase and decrease as well as relative extrema on f. The relationship between f, f,' and f" will be developed to identify intervals of concave up and down as well as points of inflection on f. The relationship between f, f,' and f" will be explored graphically, numerically, analytically, and with technology. Students will understand the conditions of Mean Value Theorem and Extreme Value Theorem and apply these tools appropriately to solve problems. Local and absolute extrema on a function will be found using various tools in modeling problems. Related rates as well as one-dimensional motion will be analyzed using rates of change in applied situations.*	C.FGR.4 C.MM.1 C.MP.1-8	C.FGR.4.1 C.FGR.4.2 C.FGR.4.3 C.FGR.4.4 C.FGR.4.5 C.FGR.4.6 C.FGR.4.7 C.FGR.4.8 C.FGR.4.9 C.MM.1.1 C.MM.1.2 C.MM.1.3 C.MM.1.4

Mathematical Practices (C.MP.1- 8) should be evidenced at some point throughout each unit depending on the tasks that are explored. It is important to note that MPs 1, 3 and 6 should support the learning in every lesson.

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Year-At-A-Glance			
Semester 2			
Pacing Suggestion	**Unit**	**Content Standards**	**Learning Objectives**
Traditional **6 – 7 weeks** Block **18 – 21 days**	**Unit 4: Fundamental Theorem of Calculus in Action** *Students will use Riemann sums to approximate values of definite integrals based on known geometric shapes with both equal and unequal subdivisions. The definite integral will be developed as a limit of Riemann sums. Students will use geometric formulas on the coordinate plane to find the exact value of a definite integral. Properties of integrals will be used to make sense of problems and attend to precision. The Fundamental Theorem will be developed as arising from geometric accumulation and can be interpreted as the equivalence of the accumulation in the rate of change of a function and the change in its antiderivative on the interval. FTC will be applied to indefinite integrals. Integration using substitution will be applied to definite and indefinite integrals.*	C.GSR.5 C.MM.1 C.MP.1-8	C.GSR.5.1 C.GSR.5.7 C.GSR.5.2 C.MM.1.1 C.GSR.5.3 C.MM.1.2 C.GSR.5.4 C.MM.1.3 C.GSR.5.5 C.MM.1.4 C.GSR.5.6
Traditional **6 – 7 weeks** Block **18 – 21 days**	**Unit 5: Applications of Integrals** *Students will extend their study of integrals to find a particular solution of a differential equation using an initial condition. Students will make sense of problems and persevere in solving separable differential equations. Students will apply the solving of differential equations to modeling problems. Applications of the definite integral will also be applied to find the area between two curves and find the average value of a function. Students will reason abstractly and quantitatively as they apply the definite integral to contextual situations.*	C.PAR.6 C.MM.1 C.MP.1-8	C.PAR.6.1 C.MM 1.1 C.PAR.6.2 C.MM.1.2 C.PAR.6.3 C.MM.1.3 C.PAR.6.4 C.MM.1.4
Traditional **1 – 2 weeks** Block **2 – 4 days**	**Unit 6: Culminating Capstone Unit** ***(applying concepts in real-life contexts through a culminating interdisciplinary unit)*** *The capstone unit applies content that has already been learned in previous interdisciplinary PBLs and units throughout the school year. The capstone unit is an interdisciplinary unit that allows students to create a presentation, report, or demonstration that could include their models used to answer an overarching driving question. (e.g., Students can present their solution(s), findings, project, or answer to the driving question to a larger audience during the culminating capstone unit.)*	ALL STANDARDS C.MP.1-8	ALL ASSOCIATED LEARNING OBJECTIVES

Mathematical Practices (C.MP.1- 8) should be evidenced at some point throughout each unit depending on the tasks that are explored. It is important to note that MPs 1, 3 and 6 should support the learning in every lesson.

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Semester 1

Unit 1: Exploring Limits and Continuity (3 – 4 weeks)

Big Ideas: Functional & Graphical Reasoning and Mathematical Modeling

Standards Addressed in this Unit:

C.FGR.2: Apply limit notation and characteristics of continuity to analyze behaviors of functions.

C.MM.1: Apply mathematics to real-life situations; model real-life phenomena using mathematics.

Learning Objectives		***Evidence of Student Learning***
C.FGR.2.1	Estimate limits from graphs and tables of values.	Fundamentals • Include both two-sided and one-sided limit notation.
C.FGR.2.2	Find limits of sums, differences, products, and quotients using substitution.	
C.FGR.2.3	Represent asymptotic behavior using limits.	Relevance and Application • Include vertical and horizontal asymptotes.
C.FGR.2.4	Find limits of rational functions using algebraic techniques.	
C.FGR.2.5	Demonstrate continuity at a point using the definition and limit notation.	Fundamentals • Include discontinuities of point, jump, and infinite.
C.FGR.2.6	Apply the Intermediate Value Theorem to a function over a closed interval.	Relevance and Application • Include the existence of roots of polynomials.
C.MM.1.1	Explain contextual, mathematical problems using a mathematical model.	Fundamentals • Students should be provided with opportunities to learn mathematics in the context of real-life problems. • Contextual, mathematical problems are mathematical problems presented in context where the context makes sense, realistically and mathematically, and allows for students to make decisions about how to solve the problem (model with mathematics).
C.MM.1.2	Create mathematical models to explain phenomena that exist in the natural sciences, social sciences, liberal arts, fine and performing arts, and/or humanities contexts.	Fundamentals • Students should be able to use the content learned in this course to create a mathematical model to explain real-life phenomena.

C.MM.1.3	Using abstract and quantitative reasoning, make decisions about information and data from a contextual situation.	
C.MM.1.4	Use various mathematical representations and structures with this information to represent and solve real-life problems.	

Mathematical Practices (C.MP.1- 8) should be evidenced at some point throughout each unit depending on the tasks that are explored. It is important to note that MPs 1, 3 and 6 should support the learning in every lesson.

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Unit 2: Establishing and Using the Derivative (4 – 5 weeks)		
Big Ideas: Functional & Graphical Reasoning and Mathematical Modeling		
Standards Addressed in this Unit: ***C.FGR.3: Relate limits and continuity to the derivative as a rate of change and apply it to a variety of situations including modeling contexts.*** ***C.MM.1: Apply mathematics to real-life situations; model real-life phenomena using mathematics.***		
Learning Objectives		***Evidence of Student Learning***
C.FGR.3.1	Interpret the derivative as an instantaneous rate of change that is a two-sided limit of an average rate of change.	
C.FGR.3.2	Demonstrate and apply the relationship between differentiability and continuity.	
C.FGR.3.3	Apply the concept of derivative geometrically, numerically, and analytically.	
C.FGR.3.4	Find the derivatives of sums, products, quotients, and composite functions.	Strategies and Methods • Blend chain rule with prior rules.
C.FGR.3.5	Find the derivatives of a variety of relations.	Strategies and Methods • Include algebraic, trigonometric, inverse, logarithmic, and exponential functions as well as implicitly defined curves.
C.FGR.3.6	Calculate higher order derivatives.	Fundamentals • Include the first derivative, second derivative, and general nth derivative.
C.MM.1.1	Explain contextual, mathematical problems using a mathematical model.	Fundamentals • Students should be provided with opportunities to learn mathematics in the context of real-life problems. • Contextual, mathematical problems are mathematical problems presented in context where the context makes sense, realistically and mathematically, and allows for students to make decisions about how to solve the problem (model with mathematics).
C.MM.1.2	Create mathematical models to explain phenomena that exist in the natural sciences, social sciences, liberal arts, fine and performing arts, and/or humanities contexts.	Fundamentals • Students should be able to use the content learned in this course to create a mathematical model to explain real-life phenomena.
C.MM.1.3	Using abstract and quantitative reasoning, make	

	decisions about information and data from a contextual situation.	
C.MM.1.4	Use various mathematical representations and structures with this information to represent and solve real-life problems.	

Mathematical Practices (C.MP.1- 8) should be evidenced at some point throughout each unit depending on the tasks that are explored. It is important to note that MPs 1, 3 and 6 should support the learning in every lesson.

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Unit 3: Applications of Derivatives (6 – 7 weeks)		
Big Ideas: Functional & Graphical Reasoning and Mathematical Modeling		
Standards Addressed in this Unit: ***C.FGR.4: Apply derivatives to situations in order to draw conclusions including curve analysis and modeling rates of change in applications.*** ***C.MM.1: Apply mathematics to real-life situations; model real-life phenomena using mathematics.***		
Learning Objectives		***Evidence of Student Learning***
C.FGR.4.1	Calculate the slope of a curve at a point.	Example • Include both zero and undefined slopes.
C.FGR.4.2	Write the equation of the tangent line to a curve at a point and use it to obtain a local linear approximation of a value near the point of tangency.	
C.FGR.4.3	Identify intervals where functions are increasing, decreasing, and constant by using the relationship between the function and the sign of its first derivative.	
C.FGR.4.4	Identify points of inflection and intervals of concavity of a function by using the second derivative of a function.	
C.FGR.4.5	Compare characteristics of f, f,' and f" graphically, numerically, analytically, and with technology.	Example • Relate the functions in ways such as: f(x) is concave upward on an interval when f'(x) increases which also means that f" (x) is positive.
C.FGR.4.6	Apply Mean Value Theorem.	Example • Examine function behavior in context graphically, in a table, and real-world applications.
C.FGR.4.7	Apply Extreme Value Theorem.	Relevance and Application • Examine function behavior to determine absolute maxima and minima including real-world applications.

C.FGR.4.8	Apply the derivative to real-world problems to find both local and absolute extrema, with and without technology.	Relevance and Application • Include optimization problems.
C.FGR.4.9	Model rates of change in applied situations.	Relevance and Application • Include related rate problems and one-dimensional particle motion with velocity and acceleration.
C.MM.1.1	Explain contextual, mathematical problems using a mathematical model.	Fundamentals • Students should be provided with opportunities to learn mathematics in the context of real-life problems. • Contextual, mathematical problems are mathematical problems presented in context where the context makes sense, realistically and mathematically, and allows for students to make decisions about how to solve the problem (model with mathematics).
C.MM.1.2	Create mathematical models to explain phenomena that exist in the natural sciences, social sciences, liberal arts, fine and performing arts, and/or humanities contexts.	Fundamentals • Students should be able to use the content learned in this course to create a mathematical model to explain real-life phenomena.
C.MM.1.3	Using abstract and quantitative reasoning, make decisions about information and data from a contextual situation.	
C.MM.1.4	Use various mathematical representations and structures with this information to represent and solve real-life problems.	

Mathematical Practices (C.MP.1- 8) should be evidenced at some point throughout each unit depending on the tasks that are explored. It is important to note that MPs 1, 3 and 6 should support the learning in every lesson.

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Semester 2		
Unit 4: Fundamental Theorem of Calculus in Action (6 – 7 weeks)		
Big Ideas: Geometric & Spatial Reasoning and Mathematical Modeling		
Standards Addressed in this Unit: ***C.GSR.5: Analyze the relationship between the derivative and the integral using the Fundamental Theorem of Calculus.*** ***C.MM.1: Apply mathematics to real-life situations; model real-life phenomena using mathematics.***		
Learning Objectives		***Evidence of Student Learning***
C.GSR.5.1	Use Riemann sums to approximate values of definite integrals.	Strategies and Methods • Include left rectangle, right rectangle, midpoint rectangle, and trapezoids as well as equal and unequal subdivisions.
C.GSR.5.2	Interpret a definite integral as a limit of Riemann sums.	
C.GSR.5.3	Find the exact value of a definite integral using geometric formulas on a coordinate plane.	Strategies and Methods • Include circles, triangles, rectangles, and trapezoids.
C.GSR.5.4	Demonstrate the use of properties of definite integrals.	Fundamentals $\int_a^b [f(x) \pm g(x)]dx = \int_a^b f(x)dx \pm \int_a^b g(x)dx$ $\int_a^b kf(x)dx = k\int_a^b f(x)dx$ $\int_a^a f(x)dx = 0$ $\int_a^b f(x)dx = -\int_b^a f(x)dx$ $\int_a^c f(x)dx = \int_a^b f(x)dx + \int_b^c f(x)dx$ If $f(x) \le g(x)$ on [a, b], then $\int_a^b f(x)dx \le \int_a^b g(x)dx$

C.GSR.5.5	Apply the Fundamental Theorem of Calculus as an interpretation of the accumulation in the rate of change of a function as equivalent to the change in the antiderivative over the interval.	
C.GSR.5.6	Apply Fundamental Theorem of Calculus to indefinite integrals to represent the family of antiderivatives.	
C.GSR.5.7	Apply integration by substitution to definite and indefinite integrals.	
C.MM.1.1	Explain contextual, mathematical problems using a mathematical model.	Fundamentals • Students should be provided with opportunities to learn mathematics in the context of real-life problems. • Contextual, mathematical problems are mathematical problems presented in context where the context makes sense, realistically and mathematically, and allows for students to make decisions about how to solve the problem (model with mathematics).
C.MM.1.2	Create mathematical models to explain phenomena that exist in the natural sciences, social sciences, liberal arts, fine and performing arts, and/or humanities contexts.	Fundamentals • Students should be able to use the content learned in this course to create a mathematical model to explain real-life phenomena.
C.MM.1.3	Using abstract and quantitative reasoning, make decisions about information and data from a contextual situation.	
C.MM.1.4	Use various mathematical representations and structures with this information to represent and solve real-life problems.	

Mathematical Practices (C.MP.1- 8) should be evidenced at some point throughout each unit depending on the tasks that are explored. It is important to note that MPs 1, 3 and 6 should support the learning in every lesson.

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Unit 5: Applications of Integrals (6 – 7 weeks)

Big Ideas: Patterning & Algebraic Reasoning and Mathematical Modeling

Standards Addressed in this Unit:

C.PAR.6: Apply the definite integral and indefinite integral to contextual situations.

C.MM.1: Apply mathematics to real-life situations; model real-life phenomena using mathematics.

Learning Objectives		***Evidence of Student Learning***
C.PAR.6.1	Find a particular curve in a family of antiderivatives using an initial condition.	
C.PAR.6.2	Solve separable differential equations and use them to model real-world problems.	Relevance and Application • Interpret slope fields as a visual representation of antiderivatives.
C.PAR.6.3	Apply definite integrals to find the area between two curves.	Strategies and Methods • Include the area between a curve and the x-axis or y-axis.
C.PAR.6.4	Apply definite integrals to find the average value of a function over a closed interval.	Relevance and Application • Include algebraic, numerical, and graphical contextual situations such as traffic flow, average cost, etc.
C.MM.1.1	Explain contextual, mathematical problems using a mathematical model.	Fundamentals • Students should be provided with opportunities to learn mathematics in the context of real-life problems. • Contextual, mathematical problems are mathematical problems presented in context where the context makes sense, realistically and mathematically, and allows for students to make decisions about how to solve the problem (model with mathematics).
C.MM.1.2	Create mathematical models to explain phenomena that exist in the natural sciences, social sciences, liberal arts, fine and performing arts, and/or humanities contexts.	Fundamentals • Students should be able to use the content learned in this course to create a mathematical model to explain real-life phenomena.
C.MM.1.3	Using abstract and quantitative reasoning, make decisions about information and data from a contextual situation.	
C.MM.1.4	Use various mathematical representations and structures with this information to represent and solve real-life problems.	

Mathematical Practices (C.MP.1- 8) should be evidenced at some point throughout each unit depending on the tasks that are explored. It is important to note that MPs 1, 3 and 6 should support the learning in every lesson.

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Unit 6: Culminating Capstone Unit (1 - 2 weeks) *(applying concepts in real-life contexts through a culminating interdisciplinary unit)*
ALL Standards Addressed in this Unit ***The capstone unit applies content that has already been learned in previous interdisciplinary PBLs and units throughout the school year. The capstone unit is an interdisciplinary unit that allows students to create a presentation, report, or demonstration that could include their models used to answer an overarching driving question. (e.g., Students can present their solution(s), findings, project, or answer to the driving question to a larger audience during the culminating capstone unit.)***

Mathematical Practices (C.MP.1- 8) should be evidenced at some point throughout each unit depending on the tasks that are explored. It is important to note that MPs 1, 3 and 6 should support the learning in every lesson.