Georgia Mathematics

Calculus

Mathematical Practices

0 Display perseverance and patience in problem-solving. Demonstrate skills and strategies needed to succeed in mathematics, including critical thinking, reasoning, and effective collaboration and expression. Seek help and apply feedback. Set and monitor goals. C.MP

- 0.1 Make sense of problems and persevere in solving them. C.MP.1
- 0.2 Reason abstractly and quantitatively. C.MP.2
- 0.3 Construct viable arguments and critique the reasoning of others. C.MP.3
- 0.4 Model with mathematics. C.MP.4
- 0.5 Use appropriate tools strategically. C.MP.5
- 0.6 Attend to precision. C.MP.6
- 0.7 Look for and make use of structure. C.MP.7
- 0.8 Look for and express regularity in repeated reasoning. C.MP.8

Mathematical Modeling

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

- 1.1 Explain contextual, mathematical problems using a mathematical model. C.MM.1.1
- 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. C.MM.1.2
- 1.3 Using abstract and quantitative reasoning, make decisions about information and data from a contextual situation. C.MM.1.3
- 1.4 Use various mathematical representations and structures with this information to represent and solve real-life problems. C.MM.1.4

Functional & Graphical Reasoning

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

- 2.1 Estimate limits from graphs and tables of values. C.FGR.2.1
- 2.2 Find limits of sums, differences, products, and quotients using substitution. C.FGR.2.2
- 2.3 Represent asymptotic behavior using limits. C.FGR.2.3
- 2.4 Find limits of rational functions using algebraic techniques. C.FGR.2.4

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2.5 Demonstrate continuity at a point using the definition and limit notation. C.FGR.2.5

2.6 Apply the Intermediate Value Theorem to a function over a closed interval. C.FGR.2.6

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.FGR.3

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.3.1

3.2 Demonstrate and apply the relationship between differentiability and continuity. C.FGR.3.2

3.3 Apply the concept of derivative geometrically, numerically, and analytically. C.FGR.3.3

3.4 Find the derivatives of sums, products, quotients, and composite functions. C.FGR.3.4

3.5 Find the derivatives of a variety of relations. C.FGR.3.5

3.6 Calculate higher order derivatives. C.FGR.3.6

4 Apply derivatives to situations in order to draw conclusions including curve analysis and modeling rates of change in applications. C.FGR.4

4.1 Calculate the slope of a curve at a point. C.FGR.4.1

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.4.2

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.4.3

4.4 Identify points of inflection and intervals of concavity of a function by using the second derivative of a function. C.FGR.4.4

4.5 Compare characteristics of f, f', and f" graphically, numerically, analytically, and with technology. C.FGR.4.5

4.6 Apply Mean Value Theorem. C.FGR.4.6

4.7 Apply Extreme Value Theorem. C.FGR.4.7

4.8 Apply the derivative to real-world problems to find both local and absolute extrema, with and without technology. C.FGR.4.8

4.9 Model rates of change in applied situations. C.FGR.4.9

Geometric & Spatial Reasoning

5 Analyze the relationship between the derivative and the integral using the Fundamental Theorem of Calculus. C.GSR.5

5.1 Use Riemann sums to approximate values of definite integrals. C.GSR.5.1

.2 Interpret a definite integral as a limit of Riemann sums. C.GSR.5.2

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5.3 Find the exact value of a definite integral using geometric formulas on a coordinate plane. C.GSR.5.3

5.4 Demonstrate the use of properties of definite integrals. C.GSR.5.4

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.5.5

5.6 Apply Fundamental Theorem of Calculus to indefinite integrals to represent the family of antiderivatives. C.GSR.5.6

5.7 Apply integration by substitution to definite and indefinite integrals. C.GSR.5.7

Patterning & Algebraic Reasoning

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

6.1 Find a particular curve in a family of antiderivatives using an initial condition. C.PAR.6.1

6.2 Solve separable differential equations and use them to model real-world problems. C.PAR.6.2

6.3 Apply definite integrals to find the area between two curves. C.PAR.6.3

6.4 Apply definite integrals to find the average value of a function over a closed interval. C.PAR.6.4