Reading Public Schools

Instilling a joy of learning and inspiring the innovative leaders of tomorrow

Course Description

This is a year-long, non-AP course in Calculus. It is intended for students who have a strong knowledge of college preparatory mathematics through Pre-Calculus. The course covers the definition, computation, and application of derivatives and integrals. Polynomial, rational, trigonometric, logarithmic, and exponential will be studied.

Content Standards

1. Students demonstrate knowledge of both the formal definition and the graphical interpretation of limit of values of functions. This knowledge includes one-sided limits, infinite limits, and limits at infinity. Students know the definition of convergence and divergence of a function as the domain variable approaches either a number or infinity.

2. Students demonstrate knowledge of both the formal definition and the graphical interpretation of continuity of a function.

3. Students demonstrate an understanding and the application of the intermediate value theorem and the extreme value theorem.

4. Students demonstrate an understanding of the formal definition of the derivative of a function at a point and the notion of differentiability.

5. Students know the chain rule and its proof and applications to the calculation of the derivative of a variety of composite functions.

6. Students use differentiation to sketch, by hand, graphs of functions. They can identify maxima, minima, inflection points, and intervals in which the function is increasing and decreasing.

7. Students use differentiation to solve optimization (maximum–minimum problems) in a variety of pure and applied contexts.

8. Students use differentiation to solve related rate problems in a variety of pure and applied contexts.

9. Students use definite integrals in problems involving area, velocity, acceleration, volume of a solid, area of a surface of revolution, length of a curve, and work.

10. Students compute, by hand, the integrals of a wide variety of functions by using techniques of integration, such as substitution, integration by parts, and trigonometric substitution. They can also combine these techniques when appropriate.

Mathematical Practice Standards

- Making sense of problems and persevering in solving them
- Reasoning abstractly and quantitatively
- Constructing viable arguments and critiquing the reasoning of others
- Modeling with mathematics
- Using appropriate tools strategically
- Attending to precision
- Looking for and making use of structure
- Looking for and expressing regularity in repeated reasoning

Key Activities

MAY include:

Units	Essential Questions
A Library of Functions	• What are the properties of the following function families: linear, exponential, power, logarithmic, trigonometric, rational, composite and inverse? • How do you graph the following function families: linear, exponential, power, logarithmic, trigonometric, rational, composite and inverse? • How do you write the equation for functions in the following function families: linear, exponential, power, logarithmic, trigonometric, rational, composite and inverse? • How do you find the domain and range for functions in the following function families: linear, exponential, power, logarithmic, trigonometric, rational, composite and inverse?
The Derivative	• How do we measure speed based on distance traveled? • How do you find the slope of a curve? • How do you find the derivative at a point? • How do you find the derivative of a function? • What does the derivative tell you? • How do you find the second derivative?
Short-Cuts to Differentiation	• How do you find the derivative of a function using the power rule, product rule, quotient rule and chain rule? • What are the derivatives of exponential, natural log, and trigonometric functions? • How do you use tables to find function and derivative values?
Using the Derivative	• How do you find the critical and inflection points of a graph? • How do you use the derivative to find where a function is increasing and decreasing? • How do you use the second derivative to find where a function is concave up and concave down? • How do you graph a function based on information from its first and second derivative? • How do you use derivatives to solve optimization problems? • How do you use derivatives to solve related rates problems?
The Definite Integral	• How do you find distance traveled based on velocity? • How do you estimate the area under a curve? • How do you use Riemann sums to estimate distance traveled and the area under a curve?
Constructing Anti-derivatives	• How do you use the first and second fundamental theorems of Calculus to find antiderivatives of functions? • How do you integrate a function using direct integration? • How do you graph an antiderivative function from the graph of a derivative? • How do you solve a basic differential equation? • How to you solve initial value problems?
Integration	• How do you integrate a function using integration by substitution? • How do you integrate a function using integration by parts? • How do you determine which integration method to use?

⇒ Whole class instruction

⇒ Small group instruction

⇒ Formative assessments

⇒ Summative assessments

⇒ Performance tasks

⇒ Group projects

⇒ Explorations with technology

Real-world application problems

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Curriculum Guide Overview

Curriculum Guide	Curriculum guides are public documents aligned with the Massachusetts Department of Education Curriculum Frameworks. They focus on the set of standards that students will learn within certain disciplines at appropriate grade levels. Each area of the curriculum is divided into general strands (broad categories) under which the standards fall. When we discuss "standards-based education" we mean that students are measured against their proficiency and growth towards meeting these standards. Curriculum Guides are intended for teachers, parents, and the wider school community as an overview document of the course of study for the year.
Curriculum Map	Curriculum maps are internal documents utilized as planning tools for teachers. Curriculum maps keep a focus on the end-of-year standards and chart a course for the teaching and learning over the year. They are typically organized in a grade-level overview organized by month or marking period. Curriculum maps typically include; standards and expectations for the grade/content, essential skills/concepts, methods of assessment, and major content resources. Maps are never "done" as ongoing work of educators include revisions, additions, and revisits to the maps. They provide an overview for the year while also allowing educators to see a vertical picture of how the content develops as students progress through each grade.
Standards	The standards used as the foundation of our curriculum come directly from the Massachusetts Department of Education Curriculum Frameworks. State standards may be viewed here: http://www.doe.mass.edu/frameworks/
Priority Areas	Priority areas are defined by the state of Massachusetts as the most critical areas in each grade level on which instructional time should focus.
Mathematical Practice Standards	Mathematical Practice Standards are a set of skills/behaviors that are replicated in grades preK-12. These standards describe ways in which students engage with the mathematical content and the level of application grows increasingly complex as students progress vertically throughout their education.
Content Standards	The Content Standards describe what students should know and be able to do once within the area of mathematics.
Essential Questions	Essential questions are questions that are not answerable with an easy answer or a simple instruction. The purpose of essential questions is to provide opportunities for inquiry into the learning and act as an umbrella to anchor the unit/lesson.
Resources	Resources identified in Curriculum Guides are not intended to be exhaustive, nor are they intended to be prescriptive. The resources identified may function as a menu of curriculum resources from which educators identify the most appropriate tools to utilized in their classrooms. More specifics about identified resources are identified within the curriculum map documents.