Reading Public Schools

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

Mathematics Curriculum Guide   **Honors Precalculus**

Course Description

The course begins by continuing the study of families of functions, including polynomial, trigonometric, rational, exponential and logarithmic functions. The focus is on graphing, analysis, and solving equations for each type of function. Conic sections and other relations are introduced. Functions are analyzed in the Cartesian, parametric, and polar coordinate systems as appropriate. The final topic is an introduction to limits and continuity that builds the foundation for derivative calculus. Problem-solving and analysis using numerical, algebraic, and graphical methods will be stressed. Students need graphing calculators because they are an integral component of this course.

Content Standards

Number and Quantity Content Standards

The Complex Number System

- Use complex numbers in polynomial identities and equations.

Algebra Content Standards

Seeing Structure in Expressions

- Interpret the structure of expressions.
- Write expressions in equivalent forms to solve problems.

Arithmetic with Polynomials & Rational Expressions

- Perform arithmetic operations on polynomials.
- Understand the relationship between zeros and factors of polynomials.
- Use polynomial identities to solve problems
- Rewrite rational expressions.

Creating Equations

- Create equations that describe numbers or relationships.

Reasoning with Equations and Inequalities

- Understand solving equations as a process of reasoning and explain the reasoning.
- Represent and solve equations and inequalities graphically.

Functions Content Standards

Interpreting Functions

- Interpret functions that arise in applications in terms of the context.

Functions Content Standards (continued)

- Analyze functions using different representations.

Building Functions

- Build a function that models a relationship between two quantities.
- Build new functions from existing functions.

Linear, Quadratic, and Exponential Models

- Construct and compare linear, quadratic, and exponential models and solve problems.

Trigonometric Functions

- Extend the domain of trigonometric functions using the unit circle.
- Model periodic phenomena with trigonometric functions.

Geometry Content Standards

Similarity, Right Triangles, and Trigonometry

- Apply trigonometry to general triangles.

Geometric Measurement and Dimension

- Visualize relationships between two-dimensional and three-dimensional objects.

Expressing Geometric Properties with Equations

- Translate between the geometric description and the equation for a conic section.

Modeling with Geometry

- Apply geometric concepts in modeling situations.

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

Units	Essential Questions
Functions and Graphs	• What is a function and what are multiple ways that we can represent them? • How can we use characteristics of functions to analyze a function? • How can we link graphical transformations of functions to their algebraic representations? • What is the inverse of a function? • How can we use functions to model real-life applications?
Polynomial Functions	• What are the unique properties of polynomial functions? • What makes an accurate sketch of a polynomial function? • How can polynomials be simplified and applied to solve problems? • How are the properties of real numbers related to polynomials?
Exponential and Logarithmic Functions	• Why do we need the logarithm function? • What real-world phenomena are modeled by exponential or logarithmic functions? • What are the algebraic and graphical connections between exponential and logarithmic functions? • What is the nature of the number e?
Rational Functions	• Are two quantities inversely proportional if an increase in one corresponds to a decrease in the other? • What kinds of asymptotes are possible for a rational function? • Are a rational expression and its simplified form equivalent?
Analytical Trigonometry	• What does evaluating a trig function at a given angle mean in real life? • How are the x and y coordinates of a point related to the angles and their trigonometric functions? • What do the key features (max, min, increasing, decreasing, etc.) tell us about trigonometric graphs, and what do they represent in real-world situations modeled by trigonometric functions? • How does changing the parameters of the equations affect the graphs of trigonometric functions?
Parametric and Polar Equations & Conic Sections	• What is the benefit of using parametric equations? Rectangular equations? • How are rectangular and parametric coordinates related? • How can parametric equations be used to graph conic sections? • How are rectangular and polar coordinates related? • How can polar equations be used to graph conic sections?

Classroom Structures and Key Learning Routines

• Whole class instruction
• Small group instruction
• Formative assessments
• Summative assessments
• Performance tasks
• Group projects
• Explorations with technology
• Real-world application problems
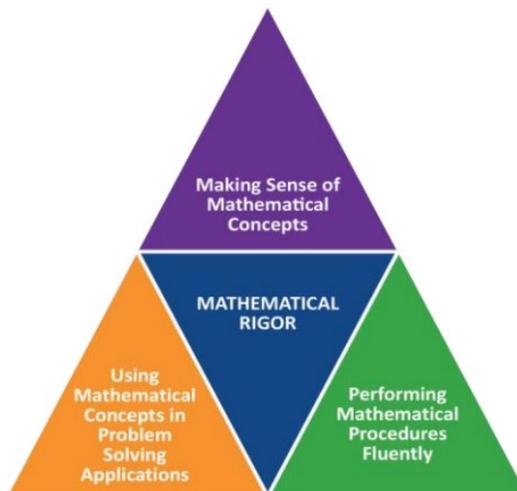
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Curriculum Guide	Curriculum guides are public documents aligned with the Massachusetts Department of Education Curriculum Frameworks. They focus on the set of standards that students will learn within certain disciplines at appropriate grade levels. 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.
Content 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/
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.
Units	Units are the learning themes for the course. They are generally cumulative in nature, meaning that new units are based upon knowledge from previous units.
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.
Activities	Activities identified in Curriculum Guides are not intended to be exhaustive, nor are they intended to be prescriptive. The activities identified may function as a menu of curriculum resources from which educators identify the most appropriate tools to utilize in their classrooms.