Precalculus | Georgia's K–12 Mathematics Standards Correlation to *Eureka Math*®

About *Eureka Math*

Created by Great Minds®, a mission-driven Public Benefit Corporation, *Eureka Math*® helps teachers deliver unparalleled math instruction that provides students with a deep understanding and fluency in math. Crafted by teachers and math scholars, the curriculum carefully sequences the mathematical progressions to maximize coherence from Prekindergarten through Precalculus—a principle tested and proven to be essential in students' mastery of math.

Teachers and students using *Eureka Math* find the trademark "Aha!" moments in *Eureka Math* to be a source of joy and inspiration, lesson after lesson, year after year.

Aligned

Great Minds offers detailed analyses that demonstrate how each grade of *Eureka Math* aligns with specific state standards. Access these free alignment studies at greatminds.org/state-studies.

Data

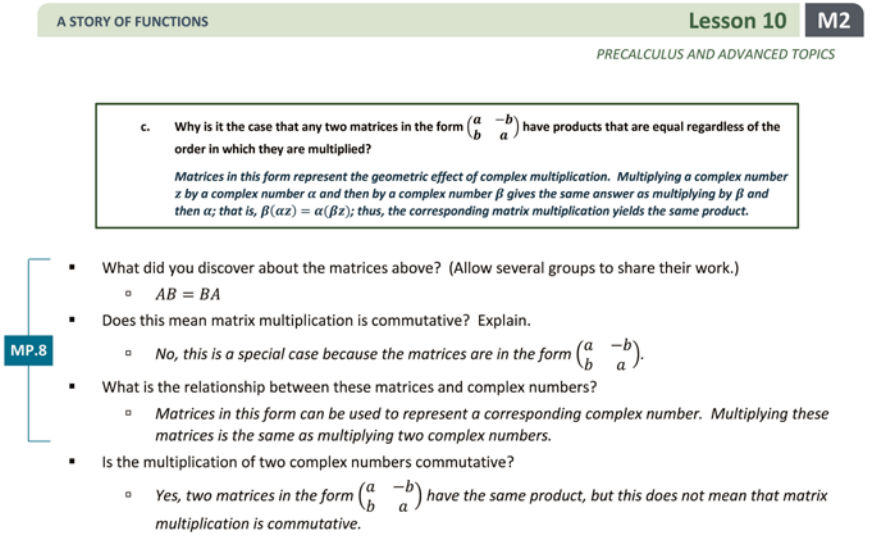
Schools and districts nationwide are experiencing student growth and impressive test scores after using *Eureka Math*. See their stories and data at greatminds.org/data.

Full Suite of Resources

Great Minds offers the *Eureka Math* curriculum as PDF downloads for free, noncommercial use. Access the free PDFs at greatminds.org/math/curriculum.

The teacher–writers who created the curriculum have also developed essential resources, available only from Great Minds, including the following:

- Printed material in English and Spanish
- Digital resources
- Professional development
- Classroom tools and manipulatives
- Teacher support materials
- Parent resources

Standards for Mathematical Practice	Aligned Components of *Eureka Math*
MP.1 Make sense of problems and persevere in solving them.	Lessons in every module engage students in mathematical practices. These are designated in the Module Overview and labeled in lessons. For example: 
MP.2 Reason abstractly and quantitatively.	
MP.3 Construct viable arguments and critique the reasoning of others.	
MP.4 Model with mathematics.	
MP.5 Use appropriate tools strategically.	
MP.6 Attend to precision.	
MP.7 Look for and make use of structure.	
MP.8 Look for and express regularity in repeated reasoning.	

Mathematical Modeling Framework	Aligned Components of *Eureka Math*
MF.1 Explore and describe real-life, mathematical situations or problems.	Lessons in every module engage students in mathematical modeling.
MF.2 Gather information, make assumptions, and define variables related to the problem.	
MF.3 Create a model and arrive at a solution to explain the problem presented.	
MF.4 Analyze and revise models, as necessary.	
MF.5 Evaluate the model and interpret solutions generated from other models. Draw and validate conclusions.	

Framework for Statistical Reasoning	Aligned Components of *Eureka Math*
SR.I **Formulate Statistical Investigative Questions** Ask questions that anticipate variability.	*Supplemental material is necessary to address the Framework for Statistical Reasoning.*
SR.II **Collect & Consider the Data** Ensure that data collection designs acknowledge variability.	
SR.III **Analyze the Data** Make sense of data and communicate what the data mean using pictures (graphs) and words. Give an accounting of variability, as appropriate.	
SR.IV **Interpret the Results** Answer statistical investigative questions based on the collected data.	

Functional & Graphical Reasoning—Functions and their Characteristics

PC.FGR.2 Analyze the behaviors of rational and piecewise functions to model contextual mathematical problems.

Georgia's K–12 Mathematics Standards	Aligned Components of *Eureka Math*
Analyze piecewise-defined functions using different representations.	*This cluster is addressed by the lessons aligned to the learning expectations.*
PC.FGR.2.1 Graph piecewise-defined functions, including step functions and absolute value functions.	Algebra I M3 Lesson 15: Piecewise Functions Algebra I M4 Lesson 24: Piecewise and Step Functions in Context
PC.FGR.2.2 Describe characteristics by interpreting the algebraic form and graph of a piecewise-defined function.	Algebra I M3 Lesson 15: Piecewise Functions Algebra I M4 Lesson 24: Piecewise and Step Functions in Context
PC.FGR.2.3 Represent the limit of a function using both the informal definition and the graphical interpretation in the context of piecewise-defined functions; interpret limits expressed in analytic notation.	*Supplemental material is necessary to address this standard.*
Analyze rational functions using different representations.	*This cluster is addressed by the lessons aligned to the learning expectations.*
PC.FGR.2.4 Divide polynomials using various methods.	Algebra II M1 Lesson 4: Comparing Methods—Long Division, Again? Algebra II M1 Lesson 18: Overcoming a Second Obstacle in Factoring—What If There Is a Remainder? Algebra II M1 Lesson 22: Equivalent Rational Expressions Algebra II M1 Lesson 24: Multiplying and Dividing Rational Expressions Algebra II M1 Lesson 25: Adding and Subtracting Rational Expressions

Georgia's K–12 Mathematics Standards	Aligned Components of *Eureka Math*
PC.FGR.2.5 Graph rational functions and identify key characteristics.	Precalculus and Advanced Topics M3 Lesson 12: End Behavior of Rational Functions Precalculus and Advanced Topics M3 Lesson 13: Horizontal and Vertical Asymptotes of Graphs of Rational Functions Precalculus and Advanced Topics M3 Lesson 14: Graphing Rational Functions Precalculus and Advanced Topics M3 Lesson 15: Transforming Rational Functions
PC.FGR.2.6 Represent the behavior of a rational function using limit notation for vertical and horizontal asymptotes and end behavior.	Precalculus and Advanced Topics M3 Lesson 12: End Behavior of Rational Functions Precalculus and Advanced Topics M3 Lesson 13: Horizontal and Vertical Asymptotes of Graphs of Rational Functions
PC.FGR.2.7 Represent the limit of a function using both the informal definition and the graphical interpretation in the context of rational functions; interpret limits expressed in analytic notation.	Precalculus and Advanced Topics M3 Lesson 12: End Behavior of Rational Functions Precalculus and Advanced Topics M3 Lesson 13: Horizontal and Vertical Asymptotes of Graphs of Rational Functions *Supplemental material is necessary to fully address this standard.*
PC.FGR.2.8 Solve simple rational equations in one variable, and give examples showing how extraneous solutions may arise.	Algebra II M1 Lesson 26: Solving Rational Equations Algebra II M1 Lesson 27: Word Problems Leading to Rational Equations
PC.FGR.2.9 Perform partial fraction decomposition of rational functions using non-repeated linear factors.	*Supplemental material is necessary to address this standard.*

Functional & Graphical Reasoning—Trigonometric Relationships and Functions

PC.FGR.3 Utilize trigonometric expressions to solve problems and model periodic phenomena with trigonometric functions.

Georgia's K–12 Mathematics Standards	Aligned Components of *Eureka Math*
Define and analyze trigonometric relationships.	*This cluster is fully addressed by the lessons aligned to the learning expectations.*
PC.FGR.3.1 Use the concept of a radian as the ratio of the arc length to the radius of a circle to establish the existence of 2π radians in one revolution.	Algebra II M2 Lesson 9: Awkward! Who Chose the Number 360, Anyway?
PC.FGR.3.2 Utilize right triangles on the unit circle to determine the values of the six trigonometric ratios for $\frac{\pi}{6}$, $\frac{\pi}{4}$, and $\frac{\pi}{3}$. Use reflections of the triangles as reference angles to establish known values in all four quadrants of the coordinate plane.	Algebra II M2 Lesson 9: Awkward! Who Chose the Number 360, Anyway? Algebra II M2 Lesson 10: Basic Trigonometric Identities from Graphs Precalculus and Advanced Topics M4 Lesson 1: Special Triangles and the Unit Circle
PC.FGR.3.3 Define the six trigonometric ratios in terms of x, y, and r using the unit circle centered at the origin of the coordinate plane. Interpret radian measures of angles as a rotation both counterclockwise and clockwise around the unit circle.	Algebra II M2 Lesson 1: Ferris Wheels—Tracking the Height of a Passenger Car Algebra II M2 Lesson 2: The Height and Co-Height Functions of a Ferris Wheel Algebra II M2 Lesson 3: The Motion of the Moon, Sun, and Stars—Motivating Mathematics Algebra II M2 Lesson 4: From Circle-ometry to Trigonometry Algebra II M2 Lesson 5: Extending the Domain of Sine and Cosine to All Real Numbers Algebra II M2 Lesson 6: Why Call It Tangent? Algebra II M2 Lesson 7: Secant and the Co-Functions

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PC.FGR.3.4 Derive the fundamental trigonometric identities.	Algebra II M2 Lesson 15: What Is a Trigonometric Identity? Algebra II M2 Lesson 16: Proving Trigonometric Identities
PC.FGR.3.5 Determine the value(s) of trigonometric functions for a set of given conditions.	Precalculus and Advanced Topics M4 Lesson 1: Special Triangles and the Unit Circle
Analyze trigonometric functions and their inverses.	*This cluster is fully addressed by the lessons aligned to the learning expectations.*
PC.FGR.3.6 Graph and write equations of trigonometric functions using period, phase shift, and amplitude in modeling contexts.	Algebra II M2 Lesson 11: Transforming the Graph of the Sine Function Algebra II M2 Lesson 12: Ferris Wheels—Using Trigonometric Functions to Model Cyclical Behavior Algebra II M2 Lesson 14: Graphing the Tangent Function Precalculus and Advanced Topics M4 Lesson 6: Waves, Sinusoids, and Identities Precalculus and Advanced Topics M4 Lesson 11: Revisiting the Graphs of the Trigonometric Functions
PC.FGR.3.7 Classify the six trigonometric functions as even or odd and describe the symmetry.	Precalculus and Advanced Topics M4 Lesson 2: Properties of Trigonometric Functions
PC.FGR.3.8 Restrict the domain of a trigonometric function to create an invertible function and graph the inverse function. Evaluate inverse trigonometric expressions.	Precalculus and Advanced Topics M4 Lesson 12: Inverse Trigonometric Functions

Algebraic & Geometric Reasoning—Trigonometric Identities and Equations

PC.AGR.4 Manipulate, prove, and apply trigonometric identities and equations to solve contextual mathematical problems.

Georgia's K–12 Mathematics Standards	Aligned Components of *Eureka Math*
Verify trigonometric identities and solve trigonometric equations.	*This cluster is fully addressed by the lessons aligned to the learning expectations.*
PC.AGR.4.1 Apply the fundamental trigonometric identities to simplify expressions and verify other identities.	Algebra II M2 Lesson 16: Proving Trigonometric Identities Algebra II M2 Lesson 17: Trigonometric Identity Proofs
PC.AGR.4.2 Use sum, difference, double-angle, and half-angle formulas for sine, cosine, and tangent to establish other identities and apply them to solve problems.	Algebra II M2 Lesson 17: Trigonometric Identity Proofs Precalculus and Advanced Topics M4 Lesson 3: Addition and Subtraction Formulas Precalculus and Advanced Topics M4 Lesson 4: Addition and Subtraction Formulas Precalculus and Advanced Topics M4 Lesson 6: Waves, Sinusoids, and Identities
PC.AGR.4.3 Solve trigonometric equations arising in modeling contexts.	Precalculus and Advanced Topics M4 Lesson 12: Inverse Trigonometric Functions
Apply trigonometry to general triangles.	*This cluster is fully addressed by the lessons aligned to the learning expectations.*
PC.AGR.4.4 Prove and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles.	Geometry M2 Lesson 32: Using Trigonometry to Find Side Lengths of an Acute Triangle Precalculus and Advanced Topics M4 Lesson 8: Law of Sines Precalculus and Advanced Topics M4 Lesson 9: Law of Cosines

Georgia's K–12 Mathematics Standards	Aligned Components of *Eureka Math*
PC.AGR.4.5 Determine the area of an oblique triangle.	Precalculus and Advanced Topics M4 Lesson 7: An Area Formula for Triangles

Geometric & Spatial Reasoning—Conic Sections and Polar Equations

PC.GSR.5 Analyze the behaviors of conic sections and polar equations to model contextual mathematical problems.

Georgia's K–12 Mathematics Standards	Aligned Components of *Eureka Math*
Analyze conic sections using different representations.	*This cluster is addressed by the lessons aligned to the learning expectations.*
PC.GSR.5.1 Identify and graph different conic sections given the equations in standard form.	Algebra II M1 Lesson 33: The Definition of a Parabola Algebra II M1 Lesson 34: Are All Parabolas Congruent? Algebra II M1 Lesson 35: Are All Parabolas Similar? Precalculus and Advanced Topics M3 Lesson 7: Curves from Geometry Precalculus and Advanced Topics M3 Lesson 8: Curves from Geometry
PC.GSR.5.2 Identify different conic sections in general form and complete the square to convert the equation of a conic section into standard form.	*Supplemental material is necessary to address this standard.*
Extend trigonometry to the polar plane.	*Supplemental material is necessary to address this cluster.*

Georgia's K–12 Mathematics Standards	Aligned Components of *Eureka Math*
PC.GSR.5.3 Define polar coordinates and relate polar coordinates to Cartesian coordinates.	*Supplemental material is necessary to address this standard.*
PC.GSR.5.4 Classify special polar equations and apply to contextual situations.	*Supplemental material is necessary to address this standard.*
PC.GSR.5.5 Graph equations in the polar coordinate plane with and without the use of technology.	*Supplemental material is necessary to address this standard.*

Algebraic & Graphical Reasoning—Vectors and Parametric Equations

PC.AGR.6 Represent and model vector quantities to solve problems in contextual situations.

Georgia's K–12 Mathematics Standards	Aligned Components of *Eureka Math*
Perform operations with vectors in context.	*This cluster is fully addressed by the lessons aligned to the learning expectations.*
PC.AGR.6.1 Represent vector quantities as directed line segments; represent magnitude and direction of vectors in component form using appropriate mathematical notation.	Precalculus and Advanced Topics M2 Lesson 17: Vectors in the Coordinate Plane Precalculus and Advanced Topics M2 Lesson 18: Vectors and Translation Maps Precalculus and Advanced Topics M2 Lesson 20: Vectors and Stone Bridges

Georgia's K–12 Mathematics Standards	Aligned Components of *Eureka Math*
PC.AGR.6.2 Add and subtract vectors and multiply vectors by a scalar to find the resultant vector.	Precalculus and Advanced Topics M2 Lesson 5: Coordinates of Points in Space Precalculus and Advanced Topics M2 Lesson 6: Linear Transformations as Matrices Precalculus and Advanced Topics M2 Lesson 17: Vectors in the Coordinate Plane Precalculus and Advanced Topics M2 Lesson 18: Vectors and Translation Maps Precalculus and Advanced Topics M2 Lesson 19: Directed Line Segments and Vectors Precalculus and Advanced Topics M2 Lesson 20: Vectors and Stone Bridges Precalculus and Advanced Topics M2 Lesson 23: Why Are Vectors Useful? Precalculus and Advanced Topics M2 Lesson 24: Why Are Vectors Useful?
PC.AGR.6.3 Add and subtract vectors on a coordinate plane using different methods.	Precalculus and Advanced Topics M2 Lesson 5: Coordinates of Points in Space Precalculus and Advanced Topics M2 Lesson 6: Linear Transformations as Matrices Precalculus and Advanced Topics M2 Lesson 17: Vectors in the Coordinate Plane Precalculus and Advanced Topics M2 Lesson 18: Vectors and Translation Maps Precalculus and Advanced Topics M2 Lesson 19: Directed Line Segments and Vectors Precalculus and Advanced Topics M2 Lesson 20: Vectors and Stone Bridges Precalculus and Advanced Topics M2 Lesson 23: Why Are Vectors Useful? Precalculus and Advanced Topics M2 Lesson 24: Why Are Vectors Useful?
PC.AGR.6.4 Solve contextual vector problems, such as those involving velocity, force, and other quantities.	Precalculus and Advanced Topics M2 Lesson 20: Vectors and Stone Bridges Precalculus and Advanced Topics M2 Lesson 23: Why Are Vectors Useful? Precalculus and Advanced Topics M2 Lesson 24: Why Are Vectors Useful?
Model situations with parametric equations.	*This cluster is addressed by the lessons aligned to the learning expectations.*

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PC.AGR.6.5 Sketch the graph of a curve represented parametrically, indicating the direction of motion.	Precalculus and Advanced Topics M2 Lesson 21: Vectors and the Equation of a Line Precalculus and Advanced Topics M2 Lesson 22: Linear Transformations of Lines
PC.AGR.6.6 Apply parametric equations to contextual problems.	*Supplemental material is necessary to address this standard.*

Patterning & Algebraic Reasoning—Sequences and Series

PC.PAR.7 Demonstrate how sequences and series apply to mathematical models in real-life situations.

Georgia's K–12 Mathematics Standards	Aligned Components of *Eureka Math*
Analyze sequences using multiple representations.	This cluster is addressed by the lessons aligned to the learning expectations.
PC.PAR.7.1 Demonstrate that sequences are functions whose domain is the set of natural numbers.	Algebra I M3 Lesson 2: Recursive Formulas for Sequences Algebra I M3 Lesson 3: Arithmetic and Geometric Sequences
PC.PAR.7.2 Represent sequences graphically, numerically, and symbolically.	Algebra I M3 Lesson 2: Recursive Formulas for Sequences Algebra I M3 Lesson 3: Arithmetic and Geometric Sequences Algebra I M3 Lesson 4: Why Do Banks Pay YOU to Provide Their Services? Algebra II M3 Lesson 25: Geometric Sequences and Exponential Growth and Decay Algebra II M3 Lesson 26: Percent Rate of Change Algebra II M3 Lesson 27: Modeling with Exponential Functions

Georgia's K–12 Mathematics Standards	Aligned Components of *Eureka Math*
PC.PAR.7.3 Determine the limit of a sequence if it exists.	*Supplemental material is necessary to address this standard.*
Analyze series using multiple representations.	*This cluster is addressed by the lessons aligned to the learning expectations.*
PC.PAR.7.4 Demonstrate that a series is the sum of the sequence and represent series graphically, numerically, and symbolically.	Algebra II M3 Lesson 29: The Mathematics Behind a Structured Savings Plan
PC.PAR.7.5 Describe the behavior of a series in terms of the limit of its partial sums.	*Supplemental material is necessary to address this standard.*
PC.PAR.7.6 Derive and use the sum formula of a finite geometric series to solve contextual problems to model real-life situations.	Algebra II M3 Topic E: Geometric Series and Finance
PC.PAR.7.7 Derive and use the sum formula of an infinite geometric series to solve contextual problems to model real-life situations.	*Supplemental material is necessary to address this standard.*