EUREKA MATH™

GREAT MINDS

ABOUT *EUREKA MATH*

Created by the nonprofit Great Minds, *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

Eureka Math is the only curriculum found by EdReports.org to align fully with the Common Core State Standards for Mathematics for all grades, Kindergarten through Grade 8. Great Minds offers detailed analyses which 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

As a nonprofit, 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

INTEGRATED IV

Eureka Math does not currently offer an integrated curriculum; however, the Integrated IV[1] Delaware Common Core State Standards: Mathematics are fully covered by the *Eureka Math* curriculum. Standards from this pathway will require the use of *Eureka Math* content from multiple high school courses. A detailed analysis of alignment is provided in the table below.

[1]Fourth Course in the Integrated Pathway

Conceptual Category	Domain	Standards for Mathematical Content	Aligned Components of *Eureka Math*
Number and Quantity	**The Complex Number System**	**Cluster: Perform arithmetic operations with complex numbers.**	
		N-CN.A.3 (+) Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers.	Precalculus and Advanced Topics M1 Lessons 7–8: Complex Number Division Precalculus and Advanced Topics M1 Lesson 9: The Geometric Effect of Some Complex Arithmetic Precalculus and Advanced Topics M1 Lesson 17: The Geometric Effect of Multiplying by a Reciprocal
		Cluster: Represent complex numbers and their operations on the complex plane.	
		N-CN.B.4 (+) Represent complex numbers on the complex plane in rectangular and polar form (including real and imaginary numbers), and explain why the rectangular and polar forms of a given complex number represent the same number.	Precalculus and Advanced Topics M1: Complex Numbers and Transformations

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		N-CN.B.5 (+) Represent addition, subtraction, multiplication, and conjugation of complex numbers geometrically on the complex plane; use properties of this representation for computation.	Precalculus and Advanced Topics M1 Lesson 6: Complex Numbers as Vectors Precalculus and Advanced Topics M1 Topic B: Complex Number Operations as Transformations Precalculus and Advanced Topics M1 Lessons 18–19: Exploiting the Connection to Trigonometry Precalculus and Advanced Topics M1 Lesson 20: Exploiting the Connection to Cartesian Coordinates Precalculus and Advanced Topics M2 Lesson 4: Linear Transformations Review
		N-CN.B.6 (+) Calculate the distance between numbers in the complex plane as the modulus of the difference, and the midpoint of a segment as the average of the numbers at its endpoints.	Precalculus and Advanced Topics M1 Lessons 11–12: Distance and Complex Numbers
	Vector and Matrix Quantities	**Cluster: Represent and model with vector quantities.**	
		N-VM.A.1 (+) Recognize vector quantities as having both magnitude and direction. Represent vector quantities by directed line segments, and use appropriate symbols for vectors and their magnitudes (e.g., $\boldsymbol{v}$, $\lvert\boldsymbol{v}\rvert$, $\lvert\lvert\boldsymbol{v}\rvert\rvert$, v).	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

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		N-VM.A.2 (+) Find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point.	Precalculus and Advanced Topics M2 Lesson 19: Directed Line Segments and Vectors Precalculus and Advanced Topics M2 Lesson 20: Vectors and Stone Bridges
		N-VM.A.3 (+) Solve problems involving velocity and other quantities that can be represented by vectors.	Precalculus and Advanced Topics M2 Lesson 20: Vectors and Stone Bridges Precalculus and Advanced Topics M2 Lesson 23: Why Are Vectors Useful?
		Cluster: Perform operations on vectors.	
		N-VM.B.4 (+) Add and subtract vectors.	
		a. Add vectors end-to-end, component-wise, and by the parallelogram rule. Understand that the magnitude of a sum of two vectors is typically not the sum of the magnitudes.	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 20: Vectors and Stone Bridges
		b. Given two vectors in magnitude and direction form, determine the magnitude and direction of their sum.	Precalculus and Advanced Topics M2 Lesson 20: Vectors and Stone Bridges Precalculus and Advanced Topics M2 Lesson 23: Why Are Vectors Useful?

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		c. Understand vector subtraction $\boldsymbol{v} - \boldsymbol{w}$ as $\boldsymbol{v} + (-\boldsymbol{w})$, where $-\boldsymbol{w}$ is the additive inverse of $\boldsymbol{w}$, with the same magnitude as $\boldsymbol{w}$ and pointing in the opposite direction. Represent vector subtraction graphically by connecting the tips in the appropriate order, and perform vector subtraction component-wise.	Precalculus and Advanced Topics M2 Lesson 17: Vectors in the Coordinate Plane Precalculus and Advanced Topics M2 Lesson 18: Vectors and Translation Maps
		N-VM.B.5 (+) Multiply a vector by a scalar.	
		a. Represent scalar multiplication graphically by scaling vectors and possibly reversing their direction; perform scalar multiplication component-wise, e.g., as $c(v_x, v_y) = (cv_x, cv_y)$.	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

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		b. Compute the magnitude of a scalar multiple $\boldsymbol{cv}$ using $\|\|\boldsymbol{cv}\|\| = \|c\|v$. Compute the direction of $\boldsymbol{cv}$ knowing that when $\|c\|v \neq 0$, the direction of $\boldsymbol{cv}$ is either along $\boldsymbol{v}$ (for $c > 0$) or against $\boldsymbol{v}$ (for $c < 0$).	Precalculus and Advanced Topics M2 Lesson 17: Vectors in the Coordinate Plane Precalculus and Advanced Topics M2 Lesson 18: Vectors and Translation Maps
		Cluster: Perform operations on matrices and use matrices in applications.	
		N-VM.C.6 (+) Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network.	Precalculus and Advanced Topics M2 Topic A: Networks and Matrices
		N-VM.C.7 (+) Multiply matrices by scalars to produce new matrices, e.g., as when all of the payoffs in a game are doubled.	Precalculus and Advanced Topics M2 Topic A: Networks and Matrices Precalculus and Advanced Topics M2 Lesson 4: Linear Transformations Review 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 Topic E: First-Person Video Games—Projection Matrices

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		N-VM.C.8 (+) Add, subtract, and multiply matrices of appropriate dimensions.	Precalculus and Advanced Topics M1 Lesson 22: Modeling Video Game Motion with Matrices Precalculus and Advanced Topics M1 Lesson 24: Matrix Notation Encompasses New Transformations! Precalculus and Advanced Topics M1 Lesson 25: Matrix Multiplication and Addition Precalculus and Advanced Topics M2: Vectors and Matrices
		N-VM.C.9 (+) Understand that, unlike multiplication of numbers, matrix multiplication for square matrices is not a commutative operation, but still satisfies the associative and distributive properties.	Precalculus and Advanced Topics M2 Lesson 10: Matrix Multiplication Is Not Commutative Precalculus and Advanced Topics M2 Lesson 12: Matrix Multiplication Is Distributive and Associative
		N-VM.C.10 (+) Understand that the zero and identity matrices play a role in matrix addition and multiplication similar to the role of 0 and 1 in the real numbers. The determinant of a square matrix is nonzero if and only if the matrix has a multiplicative inverse.	Precalculus and Advanced Topics M1 Topic C: The Power of the Right Notation Precalculus and Advanced Topics M2 Lesson 6: Linear Transformations as Matrices Precalculus and Advanced Topics M2 Lesson 13: Using Matrix Operations for Encryption Precalculus and Advanced Topics M2 Topic C: Systems of Linear Equations

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		N-VM.C.11 (+) Multiply a vector (regarded as a matrix with one column) by a matrix of suitable dimensions to produce another vector. Work with matrices as transformations of vectors.	Precalculus and Advanced Topics M1 Lesson 21: The Hunt for Better Notation Precalculus and Advanced Topics M1 Lessons 22–23: Modeling Video Game Motion with Matrices Precalculus and Advanced Topics M2 Lesson 4: Linear Transformations Review Precalculus and Advanced Topics M2 Lesson 7: Linear Transformations Applied to Cubes Precalculus and Advanced Topics M2 Lesson 11: Matrix Addition Is Commutative Precalculus and Advanced Topics M2 Topic D: Vectors in Plane and Space Precalculus and Advanced Topics M2 Topic E: First-Person Video Games—Projection Matrices
		N-VM.C.12 (+) Work with 2 × 2 matrices as transformations of the plane, and interpret the absolute value of the determinant in terms of area.	Precalculus and Advanced Topics M1 Topic C: The Power of the Right Notation Precalculus and Advanced Topics M2 Lesson 8: Composition of Linear Transformations

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Algebra	**Reasoning with Equations and Inequalities**	**Cluster: Solve systems of equations.**	
		A-REI.C.8 (+) Represent a system of linear equations as a single matrix equation in a vector variable.	Precalculus and Advanced Topics M2 Topic C: Systems of Linear Equations
		A-REI.C.9 (+) Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension 3 × 3 or greater).	Precalculus and Advanced Topics M2 Topic C: Systems of Linear Equations

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Functions	**Interpreting Functions**	**Cluster: Analyze functions using different representations.**	
		F-IF.C.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.	
		d. (+) Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.	Precalculus and Advanced Topics M3 Topic B: Rational Functions and Composition of Functions
	Building Functions	**Cluster: Build a function that models a relationship between two quantities.**	
		F-BF.A.1 Write a function that describes a relationship between two quantities.	
		c. (+) Compose functions.	Precalculus and Advanced Topics M3 Lesson 16: Function Composition Precalculus and Advanced Topics M3 Lesson 17: Solving Problems by Function Composition

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		Cluster: Build new functions from existing functions.	
		F-BF.B.4 Find inverse functions.	
		b. (+) Verify by composition that one function is the inverse of another.	Precalculus and Advanced Topics M3 Topic C: Inverse Functions
		c. (+) Read values of an inverse function from a graph or a table, given that the function has an inverse.	Precalculus and Advanced Topics M3 Topic C: Inverse Functions
		d. (+) Produce an invertible function from a non-invertible function by restricting the domain.	Precalculus and Advanced Topics M3 Lesson 19: Restricting the Domain
		F-BF.B.5 (+) Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.	Precalculus and Advanced Topics M3 Topic C: Inverse Functions

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	Trigonometric Functions	**Cluster: Extend the domain of trigonometric functions using the unit circle.**	
		F-TF.A.3 (+) Use special triangles to determine geometrically the values of sine, cosine, tangent for $\pi/3$, $\pi/4$ and $\pi/6$, and use the unit circle to express the values of sine, cosine, and tangent for $\pi - x$, $\pi + x$, and $2\pi - x$ in terms of their values for x, where x is any real number.	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 10: Basic Trigonometric Identities from Graphs Precalculus and Advanced Topics M4 Lesson 1: Special Triangles and the Unit Circle
		F-TF.A.4 (+) Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions.	Precalculus and Advanced Topics M4 Lesson 2: Properties of Trigonometric Functions
		Cluster: Model periodic phenomena with trigonometric functions.	
		F-TF.B.6 (+) Understand that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed.	Precalculus and Advanced Topics M4 Lesson 12: Inverse Trigonometric Functions

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		F-TF.B.7 (+) Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context.	Precalculus and Advanced Topics M4 Topic C: Inverse Trigonometric Functions
		Cluster: Prove and apply trigonometric identities.	
		F-TF.C.9 (+) Prove the addition and subtraction formulas for sine, cosine, and tangent and use them to solve problems.	Algebra II M2 Lesson 17: Trigonometric Identity Proofs Precalculus and Advanced Topics M4 Topic A: Trigonometric Functions
Geometry	**Expressing Geometric Properties with Equations**	**Cluster: Translate between the geometric description and the equation for a conic section.**	
		G-GPE.A.3 (+) Derive the equations of ellipses and hyperbolas given the foci, using the fact that the sum or difference of distances from the foci is constant.	Precalculus and Advanced Topics M3 Lesson 6: Curves in the Complex Plane Precalculus and Advanced Topics M3 Lessons 7–8: Curves from Geometry

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	Geometric Measurement and Dimension	**Cluster: Explain volume formulas and use them to solve problems.**	
		G-GMD.A.2 (+) Give an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures.	Geometry M3 Lesson 10: The Volume of Prisms and Cylinders and Cavalieri's Principle Geometry M3 Lesson 11: The Volume Formula of a Pyramid and Cone Geometry M3 Lesson 12: The Volume Formula of a Sphere Geometry M3 Lesson 13: How Do 3D Printers Work? Precalculus and Advanced Topics M3 Lesson 9: Volume and Cavalieri's Principle
Statistics and Probability	**Using Probability to Make Decisions**	**Cluster: Calculate expected values and use them to solve problems.**	
		S-MD.A.1 (+) Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space; graph the corresponding probability distribution using the same graphical displays as for data distributions.	Precalculus and Advanced Topics M5 Lesson 5: Discrete Random Variables Precalculus and Advanced Topics M5 Lesson 6: Probability Distribution of a Discrete Random Variable Precalculus and Advanced Topics M5 Lessons 13–14: Games of Chance and Expected Value Precalculus and Advanced Topics M5 Lesson 15: Using Expected Values to Compare Strategies
		S-MD.A.2 (+) Calculate the expected value of a random variable; interpret it as the mean of the probability distribution.	Precalculus and Advanced Topics M5 Lesson 7: Expected Value of a Discrete Random Variable Precalculus and Advanced Topics M5 Lesson 8: Interpreting Expected Value Precalculus and Advanced Topics M5 Lessons 13–14: Games of Chance and Expected Value Precalculus and Advanced Topics M5 Lesson 15: Using Expected Values to Compare Strategies

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		S-MD.A.3 (+) Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value.	Precalculus and Advanced Topics M5 Lessons 9–10: Determining Discrete Probability Distributions Precalculus and Advanced Topics M5 Lessons 13–14: Games of Chance and Expected Value Precalculus and Advanced Topics M5 Lesson 15: Using Expected Values to Compare Strategies
		S-MD.A.4 (+) Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value.	Precalculus and Advanced Topics M5 Lessons 11–12: Estimating Probability Distributions Empirically Precalculus and Advanced Topics M5 Lessons 13–14: Games of Chance and Expected Value Precalculus and Advanced Topics M5 Lesson 15: Using Expected Values to Compare Strategies
		Cluster: Use probability to evaluate outcomes of decisions.	
		S-MD.B.5 (+) Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values.	
		a. Find the expected payoff for a game of chance.	Precalculus and Advanced Topics M5 Lessons 13–14: Games of Chance and Expected Value
		b. Evaluate and compare strategies on the basis of expected values.	Precalculus and Advanced Topics M5 Lesson 14: Games of Chance and Expected Value Precalculus and Advanced Topics M5 Lesson 15: Using Expected Values to Compare Strategies