# Geometry | Indiana Academic Standards for Mathematics 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

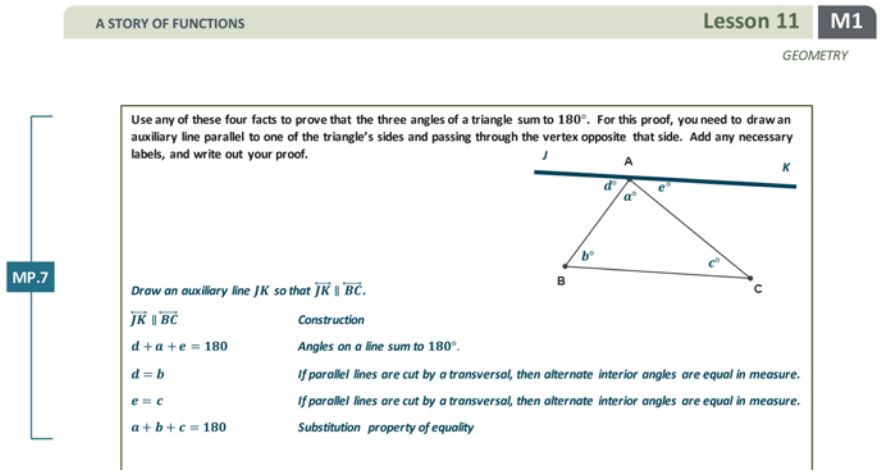
Schools and districts nationwide are experiencing student growth and impressive test scores after using *Eureka Math*. See their stories and data at greatminds.org/data.

### 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

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

## Geometry Foundations

**Students apply the logic of geometric proofs, including in core concepts related to angles and lines.**

| Indiana Academic Standards for Mathematics | Aligned Components of *Eureka Math* |
|---|---|
| **G.GF.1**<br>Describe the structure of and relationships within an axiomatic system (undefined terms, definitions, axioms and postulates, methods of reasoning, and theorems) and explain differences among supporting evidence, counterexamples, and actual proofs. (E) | Geometry M1 Topic G: Axiomatic Systems |
| **G.GF.2**<br>State, use, and examine the validity of the converse, inverse, and contrapositive of conditional ("if—then") and bi-conditional ("if and only if") statements. | *Supplemental material is necessary to address this standard.* |
| **G.GF.3**<br>Develop geometric proofs, including those involving coordinate geometry, using two-column, paragraph, and flow chart formats. | Geometry M1 Lesson 9: Unknown Angle Proofs—Writing Proofs<br>Geometry M1 Lesson 10: Unknown Angle Proofs—Proofs with Constructions<br>Geometry M1 Lesson 11: Unknown Angle Proofs—Proofs of Known Facts<br>Geometry M1 Topic D: Congruence<br>Geometry M1 Topic E: Proving Properties of Geometric Figures<br>Geometry M2 Lesson 4: Comparing the Ratio Method with the Parallel Method<br>Geometry M2 Lesson 5: Scale Factors<br>Geometry M2 Lesson 6: Dilations as Transformations of the Plane<br>Geometry M2 Lesson 7: How Do Dilations Map Segments? |

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|---|---|
| **G.GF.3** ***continued*** | Geometry M2 Lesson 8: How Do Dilations Map Lines, Rays, and Circles?<br>Geometry M2 Lesson 9: How Do Dilations Map Angles?<br>Geometry M2 Lesson 15: The Angle-Angle (AA) Criterion for Two Triangles to Be Similar<br>Geometry M2 Lesson 17: The Side-Angle-Side (SAS) and Side-Side-Side (SSS) Criteria for Two Triangles to Be Similar<br>Geometry M2 Lesson 18: Similarity and the Angle Bisector Theorem<br>Geometry M2 Lesson 19: Families of Parallel Lines and the Circumference of the Earth<br>Geometry M2 Lesson 24: Prove the Pythagorean Theorem Using Similarity<br>Geometry M4 Lesson 5: Criterion for Perpendicularity<br>Geometry M4 Lesson 13: Analytic Proofs of Theorems Previously Proved by Synthetic Means<br>Geometry M5 Lesson 1: Thales' Theorem<br>Geometry M5 Lesson 2: Circles, Chords, Diameters, and Their Relationships<br>Geometry M5 Lesson 5: Inscribed Angle Theorem and Its Applications<br>Geometry M5 Lesson 6: Unknown Angle Problems with Inscribed Angles in Circles<br>Geometry M5 Lesson 8: Arcs and Chords<br>Geometry M5 Lesson 11: Properties of Tangents<br>Geometry M5 Lesson 12: Tangent Segments<br>Geometry M5 Lesson 13: The Inscribed Angle Alternate—A Tangent Angle<br>Geometry M5 Lesson 15: Secant Angle Theorem, Exterior Case<br>Geometry M5 Topic E: Cyclic Quadrilaterals and Ptolemy's Theorem<br>*Supplemental material is necessary to address developing geometric proofs by using a flow chart format.* |

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|---|---|
| **G.GF.4**<br>Prove, construct, and apply theorems about parallel and perpendicular lines, parallel lines and transversals, vertical angles, and perpendicular bisectors. (E) | Geometry M1 Lesson 7: Solve for Unknown Angles—Transversals<br>Geometry M1 Lesson 9: Unknown Angle Proofs—Writing Proofs<br>Geometry M1 Lesson 10: Unknown Angle Proofs—Proofs with Constructions<br>Geometry M1 Lesson 11: Unknown Angle Proofs—Proofs of Known Facts<br>Geometry M1 Lesson 17: Characterize Points on a Perpendicular Bisector<br>Geometry M1 Lesson 18: Looking More Carefully at Parallel Lines<br>Geometry M4 Topic B: Perpendicular and Parallel Lines in the Cartesian Plane |
| **G.GF.5**<br>Determine if a pair of lines are parallel, perpendicular, or neither by comparing the slopes in coordinate graphs and equations. (E) | Geometry M4 Topic B: Perpendicular and Parallel Lines in the Cartesian Plane |
| **G.GF.6**<br>Use tools to explain and justify the process to construct congruent segments and angles, angle bisectors, perpendicular bisectors, altitudes, medians, parallel and perpendicular lines, and parallel lines and transversals. | Geometry M1 Topic A: Basic Constructions<br>Geometry M1 Lesson 18: Looking More Carefully at Parallel Lines<br>*Supplemental material is necessary to address constructing perpendicular lines.* |
| **G.GF.7**<br>Develop the distance formula using the Pythagorean Theorem. Find the lengths and midpoints of line segments in the two-dimensional coordinate system. (E) | G8 M2 Lesson 16: Applications of the Pythagorean Theorem<br>G8 M7 Lesson 17: Distance on the Coordinate Plane<br>Geometry M4 Lesson 1: Searching a Region in the Plane<br>Geometry M4 Lesson 12: Dividing Segments Proportionately |

## Triangles

**Students solve real-world and mathematical problems involving triangles, including proofs of theorems and definitions of trigonometric ratios.**

| Indiana Academic Standards for Mathematics | Aligned Components of *Eureka Math* |
|---|---|
| **G.T.1**<br>Prove and apply theorems about triangles, including: (E) | *This standard is addressed by the lessons aligned to its subsections.* |
| **G.T.1.a**<br>Interior angles of a triangle sum to $180^\circ$ | Geometry M1 Lesson 11: Unknown Angle Proofs—Proofs of Known Facts |
| **G.T.1.b**<br>The Isosceles Triangle Theorem and its converse | Geometry M1 Lesson 23: Base Angles of Isosceles Triangles |
| **G.T.1.c**<br>The Pythagorean Theorem | Geometry M2 Lesson 24: Prove the Pythagorean Theorem Using Similarity |
| **G.T.1.d**<br>The segment joining midpoints of two sides of a triangle is parallel to the third side and half the length | Geometry M2 Lesson 4: Comparing the Ratio Method with the Parallel Method |
| **G.T.1.e**<br>A line parallel to one side of a triangle divides the other two proportionally, and its converse | Geometry M2 Lesson 4: Comparing the Ratio Method with the Parallel Method |
| **G.T.1.f**<br>The Angle Bisector Theorem | Geometry M2 Lesson 18: Similarity and the Angle Bisector Theorem |

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|---|---|
| **G.T.1.g**<br>Triangle inequality | *Supplemental material is necessary to address this standard.* |
| **G.T.1.h**<br>Inequality in one triangle | *Supplemental material is necessary to address this standard.* |
| **G.T.1.i**<br>Hinge Theorem and its converse | *Supplemental material is necessary to address this standard.* |
| **G.T.2**<br>Prove and apply criteria for triangle congruence (ASA, SAS, AAS, SSS, and HL) from the definition of congruence in terms of rigid motions. (E) | Geometry M1 Lesson 22: Congruence Criteria for Triangles—SAS<br>Geometry M1 Lesson 24: Congruence Criteria for Triangles—ASA and SSS<br>Geometry M1 Lesson 25: Congruence Criteria for Triangles—AAS and HL |
| **G.T.3**<br>Use the definition of similarity in terms of similarity transformations to determine if two given triangles are similar. Explore and develop the meaning of similarity for triangles. | Geometry M2 Lesson 12: What Are Similarity Transformations, and Why Do We Need Them?<br>Geometry M2 Lesson 13: Properties of Similarity Transformations<br>Geometry M2 Lesson 14: Similarity<br>Geometry M2 Lesson 15: The Angle-Angle (AA) Criterion for Two Triangles to Be Similar<br>Geometry M2 Lesson 16: Between-Figure and Within-Figure Ratios<br>Geometry M2 Lesson 17: The Side-Angle-Side (SAS) and Side-Side-Side (SSS) Criteria for Two Triangles to Be Similar |

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|---|---|
| **G.T.4**<br>Use congruent and similar triangles to solve real-world and mathematical problems involving sides, perimeters, and areas of triangles. (E) | Geometry M1 Lesson 20: Applications of Congruence in Terms of Rigid Motions<br>Geometry M2 Lesson 19: Families of Parallel Lines and the Circumference of the Earth<br>Geometry M2 Lesson 20: How Far Away Is the Moon?<br>Geometry M2 Lesson 24: Prove the Pythagorean Theorem Using Similarity<br>Geometry M3 Lesson 3: The Scaling Principle for Area |
| **G.T.5**<br>Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles. | Geometry M2 Lesson 25: Incredibly Useful Ratios<br>Geometry M2 Lesson 26: The Definition of Sine, Cosine, and Tangent |
| **G.T.6**<br>Use trigonometric ratios (sine, cosine, tangent, and their inverses) and the Pythagorean Theorem to solve real-world and mathematical problems involving right triangles. (E) | Geometry M2 Lesson 27: Sine and Cosine of Complementary Angles and Special Angles<br>Geometry M2 Lesson 28: Solving Problems Using Sine and Cosine<br>Geometry M2 Lesson 29: Applying Tangents<br>Geometry M2 Lesson 30: Trigonometry and the Pythagorean Theorem<br>Geometry M2 Lesson 31: Using Trigonometry to Determine Area<br>Geometry M2 Lesson 32: Using Trigonometry to Find Side Lengths of an Acute Triangle |
| **G.T.7**<br>Use the relationship between the sides of special right triangles ($30° - 60°$ and $45° - 45°$) to solve real-world and other mathematical problems. (E) | Geometry M2 Lesson 24: Prove the Pythagorean Theorem Using Similarity |

## Quadrilaterals & Other Polygons

**Students solve real-world and mathematical problems involving regular and irregular polygons, including proofs of theorems.**

| Indiana Academic Standards for Mathematics | Aligned Components of *Eureka Math* |
|---|---|
| **G.QP.1**<br>Prove and apply theorems about parallelograms, including those involving angles, diagonals, and sides. (E) | Geometry M1 Lesson 28: Properties of Parallelograms<br>Geometry M1 Lesson 34: Review of the Assumptions |
| **G.QP.2**<br>Prove that given quadrilaterals are parallelograms, rhombuses, rectangles, squares, kites, or trapezoids. Include coordinate proofs of quadrilaterals in the coordinate plane. | *Supplemental material is necessary to address this standard.* |
| **G.QP.3**<br>Develop and use formulas to find measures of interior and exterior angles of polygons. | *Supplemental material is necessary to address this standard.* |
| **G.QP.4**<br>Compute perimeters and areas of regular and irregular polygons to solve real-world and other mathematical problems. (E) | Geometry M4 Lesson 1: Searching a Region in the Plane<br>Geometry M4 Topic C: Perimeters and Areas of Polygonal Regions in the Cartesian Plane |

## Circles

**Students solve real-world and mathematical problems involving circles.**

| Indiana Academic Standards for Mathematics | Aligned Components of *Eureka Math* |
|---|---|
| **G.CI.1**<br>Define, identify, and use relationships among the following: radius, diameter, arc, measure of an arc, chord, secant, tangent, congruent circles, and concentric circles. | Geometry M5 Lesson 2: Circles, Chords, Diameters, and Their Relationships<br>Geometry M5 Lesson 7: The Angle Measure of an Arc<br>Geometry M5 Lesson 8: Arcs and Chords<br>Geometry M5 Topic C: Secants and Tangents |
| **G.CI.2**<br>Explore and use relationships among inscribed angles, radii, and chords, including the following: | *This standard is fully addressed by the lessons aligned to its subsections.* |
| **G.CI.2.a**<br>The relationship that exists between central, inscribed, and circumscribed angles; | Geometry M5 Topic A: Central and Inscribed Angles<br>Geometry M5 Topic C: Secants and Tangents |
| **G.CI.2.b**<br>Inscribed angles on a diameter are right angles; and | Geometry M5 Lesson 1: Thales' Theorem |
| **G.CI.2.c**<br>The radius of a circle is perpendicular to a tangent where the radius intersects the circle. | Geometry M5 Lesson 11: Properties of Tangents |

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| **G.CI.3**<br>Solve real-world and other mathematical problems that involve finding measures of circumference, areas of circles and sectors, and arc lengths and related angles (central, inscribed, and intersections of secants and tangents). (E) | Geometry M5 Topic B: Arcs and Sectors |

## Transformations & Three-Dimensional Solids

**Students solve real-world and mathematical problems involving transformations of figures and three-dimensional solids.**

| Indiana Academic Standards for Mathematics | Aligned Components of *Eureka Math* |
|---|---|
| **G.TS.1**<br>Use geometric descriptions of rigid motions to transform figures and to predict and describe the results of translations, reflections and rotations on a given figure. Describe a motion or series of motions that will show two shapes are congruent. (E) | Geometry M1 Topic C: Transformations/Rigid Motions |

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| **G.TS.2**<br>Verify experimentally the properties of dilations given by a center and a scale factor. Understand the dilation of a line segment is longer or shorter in the ratio given by the scale factor. | Geometry M2 Topic B: Dilations |
| **G.TS.3**<br>Explore properties of congruent and similar solids, including prisms, regular pyramids, cylinders, cones, and spheres, and use them to solve problems. | Geometry M3 Lesson 9: Scaling Principle for Volumes |
| **G.TS.4**<br>Solve real-world and other mathematical problems involving volume and surface area of prisms, cylinders, cones, spheres, and pyramids, including problems that involve composite solids and algebraic expressions. (E) | G7 M6 Lesson 23: Surface Area<br>G7 M6 Lesson 24: Surface Area<br>G7 M6 Lesson 25: Volume of Right Prisms<br>G8 M5 Lesson 10: Volumes of Familiar Solids—Cones and Cylinders<br>G8 M5 Lesson 11: Volume of a Sphere<br>Geometry M3 Lesson 11: The Volume Formula of a Pyramid and Cone<br>Geometry M3 Lesson 12: The Volume Formula of a Sphere<br>*Supplemental material is necessary to address solving problems involving surface area of cones, cylinders, and spheres.* |
| **G.TS.5**<br>Apply geometric methods to create and solve design problems. (E) | Geometry M2 Lesson 2: Making Scale Drawings Using the Ratio Method<br>Geometry M3 Topic B: Volume |