Geometry– Mathematics– Evidence Statements

Overview of the Maryland Comprehensive Assessment Program (MCAP)

The MCAP includes a coherent set of summative mathematics assessments aligned to the Maryland College and Career Ready Standards for Mathematics (MCCRSM). Students are required to take an MCAP mathematics assessment at the end of grades 3 – 8 and at the end of Algebra I. Students may also take an MCAP mathematics assessment at the end of Geometry and Algebra II.

The MCAP mathematics assessment development process is based on Evidence-Centered Design. The ECD process begins by establishing the answer to "What skills and understandings should be assessed?". The MCCRSM describes the skills and understandings that the MCAP mathematics assessments assess. Assessments are then designed to gather evidence that allows inferences to be made. Assessments can be designed to allow inferences of various grain sizes. The MCAP mathematics assessments are summative assessments and are therefore designed to provide evidence that allows only general inferences about a student's mathematical skills and understandings. The MCAP Mathematics Claims Structure describes the grain size of the evidence that the MCAP mathematics assessments will yield. Assessment items are designed to elicit evidence of a student's level of proficiency for each claim.

MCAP MATHEMATICS CLAIMS STRUCTURE

Master Claim

The student is college and career ready or is on track to being college and career ready in mathematics.

Subclaims

Content - The student solves problems related to all content of the grade/course related to the Standards for Mathematical Practice.

Reasoning - The student expresses grade/course level appropriate mathematical reasoning.

Modeling - The student solves real-world problems with a degree of difficulty appropriate to the grade/course.

OVERVIEW OF MCAP MATHEMATICS ASSESSMENT TASK TYPES

Item Type	Description	Subclaim	Scoring Method	Number of Operational Items per Form
Type I	Type I items will assess conceptual understanding, procedural skills, reasoning, and the ability to use mathematics to solve real-world problems.	Content Reasoning Modeling	Machine scored	**31**
Type II	Type II items assess a student's ability to reason mathematically. Items may require students to provide arguments or justifications, critique the reasoning of others, and to use precision when explaining their thinking related to mathematics.	Reasoning	Human scored	**2**
Type III	Type III items assess a student's ability to apply their understanding of mathematics when solving real-world contextual problems.	Modeling	Human scored	**2**
			Total	**35**

Overview of the MCAP Mathematics Evidence Statements

MCAP Mathematics Evidence Statements help teachers, curriculum developers, and administrators understand how the MCCRSM will be assessed. Assessment items are designed to elicit the evidence described in the Evidence Statements.

The MCAP Mathematics Evidence Statements for the Content Sub-Claim are organized using the same structure as the Maryland College and Career Ready Standards for Mathematics. The Algebra I, Geometry and Algebra II Content Evidence Statements are organized by Conceptual Category, Domains, Clusters, and then Standards.

Evidence Statements

Evidence statements are provided for each standard to describe the type of evidence that a task addressing the standard should elicit. In some cases, Evidence statements are provided for each standard to describe the type of evidence that a task addressing the standard should elicit. In some cases, the standard clearly describes the type of evidence that an aligned task should elicit. The Evidence Statement for such standards will read “As stated in the standard”. In cases where the wording of a standard does not adequately describe the type of evidence that should be elicited, the Evidence Statement will attempt to better describe the type of evidence items should elicit. In cases where a standard is taught in both Algebra I and Algebra II, the Evidence Statement and/or Item Specification will seek to describe how the items might differ between the two courses.

Clarifications

Clarifications provide additional information to help the reader better understand how a standard might be assessed.

Modeling Standards ★

Modeling is best interpreted not as a collection of isolated topics but rather in relation to other standards. Making mathematical models is a Standard for Mathematical Practice, and specific modeling standards appear throughout the high school standards indicated by a star symbol («).

Calculator Codes

The last column of each table found in the Content Sub-Claim Evidence Statement tables identifies whether items that assess a given standard will allow the use of a calculator. The codes are identified in the Calculator Key below.

Calculator Key:

Y – Yes. A calculator will be available on the tool bar when this standard is assessed.

N – No. A calculator will NOT be available on the tool bar when this standard is assessed.

X – The calculator designation will be dependent on the task and will be determined as a Yes or No during content review.

Reasoning Sub-Claim

The MCAP Mathematics Evidence Statements for the Reasoning Sub-Claim have a different structure than the Content Evidence Statements. The codes for the Reasoning Evidence Statements begin with either A1, G or A2 that correspond to Algebra I, Geometry or Algebra II. The letter “R” appears after the course designation in the code to indicate that the statement is a Reasoning Evidence Statement. The Reasoning Evidence Statements may apply to both machine-scored and constructed response items, unless otherwise noted. Reasoning items may align to any of the content standards from a given course.

Modeling Sub-Claim

The MCAP Mathematics Evidence Statements for the Modeling Sub-Claim have a different structure than the Content Evidence Statements. The codes for the Modeling Evidence Statements begin with either A1, G or A2 that correspond to Algebra I, Geometry or Algebra II. The letter “M” appears after the course designation in the code to indicate that the statement is a Modeling Evidence Statement. The Modeling Evidence Statements may apply to both machine-scored and constructed response items, unless otherwise noted. Modeling items may align to any of the content standards from a given course.

Standards for Mathematical Practice

The Standards for Mathematical Practice describe the varieties of expertise that mathematics educators at all levels should seek to develop in their students.

These practice rest on important “processes and proficiencies” with longstanding importance in mathematics education.

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Content Subclaim

G.CO Congruence

G.CO.A Experiment with transformations in the plane.

G.CO.A.1 Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.

Evidence Statement:

- As stated in the standard.

Clarifications:

- Limit to definitions listed in the standard.

Calculator Code: X

G.CO.A.2 Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not.

Evidence Statement:

- Identify transformations that preserve distance and angle measure to those that do not (e.g., translation versus horizontal stretch).

Clarifications:

- N/A

Calculator Code: X

G.CO.A.3 Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.

Evidence Statement:

- As stated in the standard.

Clarifications:

- Use symmetries to describe properties of a figure.
- Determine properties of a shape based on its symmetries. (e.g., Since a parallelogram has 180° rotational symmetry, its opposite sides and angles will coincide when rotated 180°).

Calculator Code: X

G.CO.A.4 Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.

Not assessed. This is an instructional standard only.

G.CO.A.5 Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.

Evidence Statement:

- As stated in the standard.

Clarifications:

- Items may ask a student to carry out a set of rigid motions.
- Items may ask a student to identify a set of rigid motions needed to map a pre-image on to a particular image.

Calculator Code: X

G.CO.B Understand congruence in terms of rigid motions.

G.CO.B.6 Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.

Evidence Statement:

- As stated in the standard.

Clarifications:

- N/A

Calculator Code: X

G.CO.B.7 Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.

Evidence Statement:

- As stated in the standard.

Clarifications:

- N/A

Calculator Code: X

G.CO.B.8 Explain how the criteria for triangle congruence (ASA, SAS, SSS, AAS and HL) follow from the definition of congruence in terms of rigid motions.

Evidence Statement:

- As stated in the standard.

Clarifications

- Identify criteria for triangle congruence demonstrated in a problem while still making a connection to rigid motions.

Calculator Code: X

G.CO.C Prove geometric theorems.

G.CO.C.9 Prove and/or apply theorems about lines and angles. Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.

Evidence Statement:

- As stated in the standard.

Clarifications:

- Items may involve a proof.
- Proofs must explicitly provide a given statement and a prove statement.

Calculator Code: X

G.CO.C.10 Prove and/or apply theorems about triangles. Theorems include: measures of interior angles of a triangle sum to 180°; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.

Evidence Statement:

- As stated in the standard.

Clarifications:

- Items may involve a proof.
- Proofs must explicitly provide a given statement and a prove statement.

Calculator Code: X

G.CO.C.11 Prove and/or apply theorems about parallelograms. Theorems include: opposite sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals.

Evidence Statement:

- As stated in the standard.

Clarifications:

- Items may involve a proof.
- Proofs must explicitly provide a given statement and a prove statement.

Calculator Code: X

G.CO.D Make geometric constructions.

G.CO.D.12 Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.

Evidence Statement:

- As stated in the standard.

Clarifications:

- Items may require justification of steps and results of a given construction.
- Items may require identification a construction from an image.

Calculator Code: X

G.CO.D.13 Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.

Evidence Statement:

- As stated in the standard.

Clarifications:

- Items may require justification of steps and results of a given construction.

Calculator Code: X

G.SRT Similarity, Right Triangles and Trigonometry

G.SRT.A Understand similarity in terms of similarity transformations.

G.SRT.A.1 Verify experimentally the properties of dilations given by a center and a scale factor.

1a. A dilation takes a line not passing through the center of the dilation to a parallel line and leaves a line passing through the center unchanged.

Evidence Statement:

- As stated in the standard.

Clarifications:

- N/A

Calculator Code: X

1b. The dilation of a line segment is longer or shorter in the ratio given by the scale factor.

Evidence Statement:

- As stated in the standard.

Clarifications:

- N/A

Calculator Code: X

G.SRT.A.2 Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.

Evidence Statement:

- Given two figures, determine if they are similar and provide support for the determination.

Clarifications:

- N/A

Calculator Code: X

G.SRT.A.3 Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.

Evidence Statement:

- As stated in the standard.

Clarifications:

- N/A

Calculator Code: X

G.SRT.B Prove theorems involving similarity.

G.SRT.B.4 Prove and/or apply theorems about triangles. Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity.

Evidence Statement:

- As stated in the standard.

Clarifications:

- Items may involve a proof.
- Proofs must explicitly provide a given statement and a prove statement.

Calculator Code: X

G.SRT.B.5 Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.

Evidence Statement:

- Use given information to determine if two triangles are similar or congruent and then find either a missing side or a missing angle.

Clarifications:

- Items include those that address the area and perimeter of similar triangles.
- Items may involve a proof.
- Proofs must explicitly provide a given statement and a prove statement.

Calculator Code: X

G.SRT.C Define trigonometric ratios and solve problems involving right triangles.

G.SRT.C.6 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.

Evidence Statement:

- Use trigonometric ratios to find missing sides and angles of right triangles given other sides and angles.

Clarifications:

- N/A

Calculator Code: X

G.SRT.C.7 Explain and use the relationship between the sine and cosine of complementary angles.

Evidence Statement:

- Use the relationship between the sine and cosine of complementary angles to solve problems.

Clarifications:

- N/A

Calculator Code: X

G.SRT.C.8★ Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.

Evidence Statement:

- As stated in the standard.

Clarifications:

- Items may have a real world or mathematical context.
- For rational solutions, exact values are required.
- For irrational solutions, exact or decimal approximations may be required.
- Simplifying or rewriting radicals is not required; however, students will not be penalized if they simplify the radicals correctly.

Calculator Code: Y

G.C Circles

G.C.A Understand and apply theorems about circles.

G.C.A.1 Prove that all circles are similar.

Not assessed. This is an instructional standard only.

G.C.A.2 Identify and describe relationships among inscribed angles, radii, and chords. Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.

Evidence Statement:

- As stated in the standard.

Clarifications:

- Angle relationships include
  - Central angles.
  - Inscribed angles.
  - Circumscribed angles.
    - Two tangents.
  - Angles formed by
    - Radius and tangent.
    - Intersecting chords.
    - Tangent and chord.
- Items will not assess angles formed by
  - Two secant lines.
  - A tangent and a secant.
- Items may involve the degree measure of an arc.

Calculator Code: Y

G.C.A.3 Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.

Evidence Statement:

- Use the relationship between the angles of a quadrilateral inscribed in a circle to solve problems.
- Identify how to find the incenter or circumcenter of a triangle.

Clarifications:

- N/A

Calculator Code: X

G.C.B Find arc lengths and areas of sectors of circles.

G.C.B.5 Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector.

Evidence Statement:

- Find arc length and areas of sectors.

Clarifications:

- Items involve computing arc lengths or areas of sectors given the radius and the angle subtended or vice versa.
- Items that address this standard may use radians.

Calculator Code: Y

G.GPE Expressing Geometric Properties

G.GPE.A Translate between the geometric description and the equation for a conic section.

G.GPE.A.1 Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.

Evidence Statement:

- Given the center-radius form of the equation of a circle, identify the coordinates of the center of the circle and the radius.
- Items could ask a student to use the distance formula to find the radius of a circle.

Clarifications:

- N/A

Calculator Code: X

G.GPE.B Use coordinates to prove simple geometric theorems algebraically.

G.GPE.B.4 Use coordinates to prove simple geometric theorems algebraically.

Evidence Statement:

- As stated in the standard.

Clarifications:

- N/A

Calculator Code: X

G.GPE.B.5 Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems.

Evidence Statement:

- Use the relationships between the slopes for parallel and perpendicular lines to solve problems.

Clarifications:

- Items go beyond determining if two lines are parallel or perpendicular.

Calculator Code: X

G.GPE.B.6 Find the point on a directed line segment between two given points that partitions the segment in a given ratio.

Evidence Statement:

- As stated in the standard.

Clarifications:

- N/A

Calculator Code: X

G.GPE.B.7★ Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.

Evidence Statement:

- As stated in the standard.

Clarifications:

- N/A

Calculator Code: X

G.GMD Geometric Measurement and Dimension

G.GMD.A Explain volume formulas and use them to solve problems.

G.GMD.A.1 Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. Use dissection arguments, Cavalieri's principle, and informal limit arguments.

Evidence Statement:

- As stated in the standard.

Clarifications:

- N/A

Calculator Code: X

G.GMD.A.3★ Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.

Evidence Statement:

- As stated in the standard.

Clarifications:

- Items must have real-world context.
- Items go beyond finding the volume of a given figure.

Calculator Code: X

G.GMD.B Visualize relationships between two-dimensional and three-dimensional objects.

G.GMD.B.4 Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.

Note: G.GMD.B.4-1 focuses on **shapes of two-dimensional cross-sections of three-dimensional objects**

Evidence Statement:

- Identify the shape of a two-dimensional cross-sections of three-dimensional objects.

Clarifications:

- N/A

Calculator Code: X

Note: G.GMD.B.4-2 focuses on **three-dimensional objects generated by rotations of two-dimensional objects**

Evidence Statement:

- Identify the three-dimensional object generated by a rotation of a two-dimensional object.

Clarifications:

- Items should use language asking students to identify the three-dimensional object created by the rotation of a two-dimensional object.

Calculator Code: X

G.MG Modeling With Geometry

G.MG.A Apply geometric concepts to modeling situations.

G.MG.A.1★ Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).

Evidence Statement:

- As stated in the standard.

Clarifications:

- Items must have real-world context.
- Items require the use three dimensional shapes to gather information about a real world object with a similar shape.
- Items should allow students to determine the correct three dimensional model without being told directly.

Calculator Code: Y

G.MG.A.2★ Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).

Evidence Statement

- As stated in the standard.

Clarifications

- Items must have real-world context.
- Density problems require students to understand compound units (e.g. pounds per square inch; people per square mile).

Calculator Code: Y

G.MG.A.3★ Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).

Evidence Statement

- As stated in the standard.

Clarifications

- Items must have real-world context.

Calculator Code: Y

Reasoning Subclaim

All reasoning assessment items connect to both the Algebra I reasoning evidence statements and the content evidence statements.

Students must provide evidence of their ability to reason mathematically by responding to Type I and Type II items.

Type I

- Items are machine scored.
- Items are 1 point per item.
- Items may be aligned to any of the content standards.
- Calculators are allowed on all reasoning items.
- Four items from this grouping will appear on each assessment.

Type II

- Items are human scored constructed response.
- Items are 4 points per item.
- Items may be aligned to any of the content standards.
- Calculators are allowed on all reasoning items.
- Two items from this grouping will appear on each assessment.

The following pages provide the reasoning evidence statements and specific clarifications.

Reasoning Evidence Statements

G.R.1 **Evidence Statement:**

- Identify a counterexample to refute a conjecture/claim.

Clarifications:

- N/A

G.R.2 **Evidence Statement:**

- Identify a correct method and justification given two or more chains of reasoning.

Clarifications:

- N/A

G.R.3 **Evidence Statement:**

- Determine cases where a given proposition is true or false.

Clarifications:

- N/A

G.R.4 **Evidence Statement:**

- Identify an unstated assumption that makes a problem well-posed or makes a particular method viable.

Clarifications:

- N/A

G.R.5 **Evidence Statement:**

- Construct, autonomously, chains of reasoning that will justify or refute geometric propositions or conjectures.

Clarifications:

- N/A

G.R.6 **Evidence Statement:**

- Apply geometric reasoning in a coordinate setting, and/or use coordinates to draw geometric conclusions.

Clarifications:

- N/A

G.R.7 **Evidence Statement:**

- Present solutions to multi-step problems in the form of valid chains of reasoning or describe errors in solutions to multi-step problems and present corrected solutions.

Clarifications:

- N/A

G.R.8 **Evidence Statement:**

- Use a combination of algebraic and geometric reasoning to justify or refute propositions or conjectures about geometric figures.

Clarifications:

- N/A

Modeling Subclaim

All modeling assessment items connect to both the Algebra I modeling evidence statements and the content evidence statements.

Students must provide evidence of their ability to apply one or more steps of the modeling cycle by responding to Type I and Type III items.

Type I

- Items are machine scored.
- Items are 1 point per item.
- Items may be aligned to any of the content standards.
- Calculators are allowed on all reasoning items.
- Four items from this grouping will appear on each assessment.

Type II

- Items are human scored constructed response.
- Items are 4 points per item.
- Items may be aligned to any of the content standards.
- Calculators are allowed on all reasoning items.
- Two items from this grouping will appear on each assessment.

Modeling items can have context even if the aligned content evidence statement clarifies that “Items do not have context”.

The following pages provide the modeling evidence statements, specific clarifications.

Modeling Evidence Statements

G.M.1 **Evidence Statement:**

- Choose an appropriate mathematical model to solve a real-world problem.

Clarifications:

- Type I items only.

G.M.2 **Evidence Statement:**

- Construct a mathematical model to solve a real-world problem.

Clarifications:

- N/A

G.M.3 **Evidence Statement:**

- Validate a given model and/ or make improvements to a given model.

Clarifications:

- N/A

G.M.4 **Evidence Statement:**

- Interpret the solution to a real-world problem in terms of context.

Clarifications:

- N/A

G.M.5 **Evidence Statement:**

- Use and/or provide a reasonable estimate of a quantity needed to solve a problem.

Clarifications:

- Type I Items only
- Items require students to make reasonable estimates of things they do know, so that they can then build a chain of reasoning that gives them an estimate of something they do not know.

G.M.6 **Evidence Statement:**

- Solve multi-step contextual word problems with degree of difficulty appropriate to the course, requiring application of course-level knowledge and skills articulated in the standards.

Clarifications:

- Items do not cue students to the type of equation or specific solution method involved in the item.

G.M.6-1 **Evidence Statement:**

- Solve multi-step contextual word problems with degree of difficulty appropriate to the course, **involving perimeter, area, or volume that require the use 8th grade algebra skills.**

Clarifications:

- Items do not cue students to the type of equation or specific solution method involved in the item.
- Items should not require the use algebraic skills beyond those in the 8th grade standards.

G.M.6-2 **Evidence Statement:**

- Solve multi-step contextual word problems with degree of difficulty appropriate to the course, requiring application of course-level knowledge and **skills involving right triangles in an applied setting.**

Clarifications:

- N/A

G.M.7 **Evidence Statement:**

- Identify information or assumptions needed to solve a problem.

Clarifications:

- Type I items only.