Massachusetts Curriculum Frameworks | MATHEMATICS | MG

WHAT TO LOOK FOR

A quick guide for evaluating classroom content and practice

In **Model Geometry**, instructional time should focus on six critical areas:

1. Developing a foundation for the development of formal proof and using it to prove theorems using a variety of formats.
2. Applying dilations and proportional reasoning to build a formal understanding of similarity.
3. Developing explanations of circumference, area, and volume formulas
4. Applying the Pythagorean Theorem and continuing their study of quadratics with parabolas
5. Proving theorems about circles and studying the relationships among parts of a circle
6. Extending their work with probability and using it to make informed decisions

In a **Model Geometry** math class, you should observe students engaged with at least one mathematics content and practice standard*:

Mathematical Practices

- 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

Content Standards

Number and Quantity (N-Q)

• Reasoning quantitatively and using units to solve problems (*approximate error, significant figures*) «

Geometry (G-CO, G-SRT, G-C, G-GPE, G-GMD, G-MG)

- Experimenting with and drawing transformations (*reflection, rotation, translation*) in terms of angles, circles, perpendicular liens, parallel lines, and line segments, and with rectangles, parallelograms, trapezoids, and regular polygons
- Using geometric descriptions of rigid motions to transform figures and to explore triangle congruence
- Proving geometric theorems, and when appropriate the converse of theorems, for lines, angles, triangles, parallelograms, and polygons *(interior/exterior angles, vertical and corresponding angles, equidistant, bisect)*
- Making formal geometric constructions with a variety of tools and methods
- Understanding similarity in terms of similarity in transformations *(dilation, scale factor)*
- Proving similarity theorems and using congruence and similarity criteria for triangles to solve problems and prove relationships in geometric figures
- Defining trigonometric ratios *(sine, cosine, tangent)* and solving problems involving right triangles *(Pythagorean Theorem)* «
- Applying trigonometry to general triangles *(Law of Sines and Cosines)* (+)
- Understanding and applying theorems about circles *(similarity, radii, chords, inscribed and circumscribed angles)*

Geometry (cont.)

- Finding arc lengths and area of sectors of circles *(proportionality)*
- Translating between geometric description and the equation for a conic section *(derive, parabola, focus, directrix)*
- Using coordinates to prove simple geometric theorems algebraically and using the distance formula to compute perimeters of polygons and areas of triangles and rectangles «
- Explaining volume formulas and using them to solve problems *(dissection arguments, Cavalieri's principle)* «
- Visualizing relationships between 2-dimensional and 3-dimensional objects
- Applying geometric concepts and methods in modeling situations (density, dimensional analysis, unit conversions) «

Statistics and Probability (S-ID)

• Understanding independence and conditional probability and using them to interpret data from simulations or experiments *(events, subsets, sample space, outcomes, unions, intersections, complements, two-way frequency tables)* «

- Recognizing and explaining the concepts of conditional probability and independence in everyday language and everyday situations «
- Finding the conditional probability of an event as a fraction of another event's outcomes and interpreting the answer in terms of the model «
- Using the rules of probability to compute probabilities of compound events *(Addition Rule, Multiplication Rule, uniform probability model, permutations, combinations)* (+)«

*NOTES

(**«**) designates a modeling standard
(+) Designates standards that go beyond course level

Mathematics What to Look For The example below features three Indicators from the Standards of Effective Practice. These Indicators are just a sampling from the full set of Standards and were chosen because they create a sequence: the educator plans a lesson that sets clear and high **expectations**, the educator then delivers high quality **instruction**, and finally the educator uses a variety of **assessments** to see if students understand the material or if re-teaching is necessary. This example highlights teacher and student behaviors aligned to the three Indicators that you can expect to see in a rigorous Model Geometry math classroom.

Expectations (Standard II, Indicator E)

Plans and implements lessons that set clear and high expectations and also make knowledge accessible for all students.

What is the teacher doing?

- Communicating a lesson's objectives and their connections to unit essential questions and goals.
- Creating culturally responsive lessons that engage and sustain student attention
- Focusing attention on mathematical language (e.g., linguistic complexity, conventions, and vocabulary)
- Establishing classroom routines that support students to defend their thinking

What are the students doing?

- Applying mathematical strategies and concepts when engaging with meaningful real-world problems
- Using mathematical language precisely to convey meaning and understanding of concepts
- Justifying a solution method using a logical progression of arguments and critiquing the reasoning of others
- Using sophisticated mathematical models (e.g. computer models)

Instruction (Standard II, Indicator A)

Uses instructional practices that reflect high expectations regarding content and quality of effort and work; engage all students; and are personalized to accommodate diverse learning styles, needs, interests, and levels of readiness.

What is the teacher doing?

- Creating a culture of being careful and precise when communicating mathematical ideas
- Highlighting culturally appropriate and effective negotiation skills they observe in students
- Modeling incorporating others into discussions

What are the students doing?

- Actively incorporating others into discussions about mathematical ideas
- Negotiating with others in response to new ideas, preferences or contributions
- Evaluating the relative strengths and weaknesses of solution methods orally and in writing

Assessment (Standard I, Indicator B)

Uses a variety of informal and formal methods of assessments to measure student learning, growth, and understanding to develop differentiated and enhanced learning experiences and improve future instruction.

What is the teacher doing?

- Providing actionable feedback to students about their problem solving processes
- Using multiple formative approaches to assess students (e.g., mid-unit assessment, group work)
- Conducting frequent checks for student understanding and adjusting instruction accordingly

What are the students doing?

- Engaging in challenging learning tasks regardless of learning needs (e.g., linguistic background, disability, academic gifts)
- Using drawings, diagrams, and equations to explain mathematical concepts and relationships
- Using exemplars to inform their work