

Geometry Test Outs

What to bring: Pencils, TI-84 Calculator, student ID

Format: Two tests - 50 Multiple Choice and (30) Free Response

You can access the online text book by clicking here [Geometry](#) - To activate the online book, you will need activation code: 3531576-20

Michigan Merit Curriculum

Course/Credit Requirements



GEOMETRY

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1 Credit

CONTENT EXPECTATIONS FOR GEOMETRY (CONT.)

Geometry Goal Statement

Geometry builds on a number of key geometric topics developed in the middle grades, namely relationships between angles, triangles, quadrilaterals, circles, and simple three-dimensional shapes. It is expected that students beginning Geometry are able to recognize, classify, and apply properties of simple geometric shapes, know and apply basic similarity and congruence theorems, understand simple constructions with a compass and straight edge, and find area and volume of basic shapes.

Students studying Geometry in high school, further develop analytic and spatial reasoning. They apply what they know about two-dimensional figures to three-dimensional figures in real-world contexts, building spatial visualization skills and deepening their understanding of shape and shape relationships. Geometry includes a study of right triangle trigonometry that is developed through similarity relationships. These topics allow for many rich real-world problems to help students expand geometric reasoning skills. It is critical that connections are made from algebraic reasoning to geometric situations. Connections between transformations of linear and quadratic functions to geometric transformations should be made. Earlier work in linear functions and coordinate graphing leads into coordinate Geometry.

The study of formal logic and proof helps students to understand the axiomatic system that underlies mathematics through the presentation and development of postulates, definitions, and theorems. It is essential that students develop deductive reasoning skills that can be applied to both mathematical and real-world problem contexts.

Throughout Geometry, students will experience geometric thinking and reasoning techniques as accessible and powerful tools that can be used to explore the concept of mathematical proofs, as well as to model and solve real-world problems.

Geometry Content Expectations Outline

STANDARD L1: REASONING ABOUT NUMBERS, SYSTEMS, AND QUANTITATIVE SITUATIONS

- L1.1 Number Systems and Number Sense
- L1.2 Representations and Relationships

STANDARD L2: CALCULATION, ALGORITHMS, AND ESTIMATION

- L2.1 Calculation Using Real and Complex Numbers

STANDARD L3: MEASUREMENT AND PRECISION

- L3.1 Measurement Units, Calculations, and Scales

STANDARD L4: MATHEMATICAL REASONING, LOGIC, AND PROOF

- L4.1 Mathematical Reasoning
- L4.2 Language and Laws of Logic
- L4.3 Proof

STANDARD G1: FIGURES AND THEIR PROPERTIES

- G1.1 Lines and Angles; Basic Euclidean and Coordinate Geometry
- G1.2 Triangles and Their Properties
- G1.3 Triangles and Trigonometry
- G1.4 Quadrilaterals and Their Properties
- G1.5 Other Polygons and Their Properties
- G1.6 Circles and Their Properties
- G1.8 Three-Dimensional Figures

STANDARD G2: RELATIONSHIPS BETWEEN FIGURES

- G2.1 Relationships Between Area and Volume Formulas
- G2.2 Relationships Between Two-dimensional and Three-dimensional Representations
- G2.3 Congruence and Similarity

STANDARD G3: TRANSFORMATIONS OF FIGURES IN THE PLANE

- G3.1 Distance-preserving Transformations: Isometries
- G3.2 Shape-preserving Transformations: Dilations and Isometries

CONTENT EXPECTATIONS FOR GEOMETRY

STANDARD L1: REASONING ABOUT NUMBERS, SYSTEMS, AND QUANTITATIVE SITUATIONS

L1.1 Number Systems and Number Sense

- L1.1.6 Explain the importance of the irrational numbers $\sqrt{2}$ and $\sqrt{3}$ in basic right triangle trigonometry, and the importance of π because of its role in circle relationships.

L1.2 Representations and Relationships

- L1.2.3 Use vectors to represent quantities that have magnitude and direction, interpret direction and magnitude of a vector numerically, and calculate the sum and difference of two vectors.

STANDARD L2: CALCULATION, ALGORITHMS, AND ESTIMATION

L2.3 Measurement Units, Calculations, and Scales

- L2.3.1 Convert units of measurement within and between systems; explain how arithmetic operations on measurements affect units, and carry units through calculations correctly.

STANDARD L3: MATHEMATICAL REASONING, LOGIC, AND PROOF

L3.1 Mathematical Reasoning

- L3.1.1 Distinguish between inductive and deductive reasoning, identifying and providing examples of each.
- L3.1.2 Differentiate between statistical arguments (statements verified empirically using examples or data) and logical arguments based on the rules of logic.

CONTENT EXPECTATIONS FOR GEOMETRY (CONT.)

- L3.1.3 Define and explain the roles of axioms (postulates), definitions, theorems, counterexamples, and proofs in the logical structure of mathematics. Identify and give examples of each.

L3.2 Language and Laws of Logic

- L3.2.1 Know and use the terms of basic logic.
- L3.2.2 Use the connectives “not,” “and,” “or,” and “if..., then,” in mathematical and everyday settings. Know the truth table of each connective and how to logically negate statements involving these connectives.
- L3.2.3 Use the quantifiers “there exists” and “all” in mathematical and everyday settings and know how to logically negate statements involving them.
- L3.2.4 Write the converse, inverse, and contrapositive of an “If..., then...” statement. Use the fact, in mathematical and everyday settings, that the contrapositive is logically equivalent to the original while the inverse and converse are not.

L3.3 Proof

- L3.3.1 Know the basic structure for the proof of an “If..., then...” statement (assuming the hypothesis and ending with the conclusion) and that proving the contrapositive is equivalent.
- L3.3.2 Construct proofs by contradiction. Use counterexamples, when appropriate, to disprove a statement.
- L3.3.3 Explain the difference between a necessary and a sufficient condition within the statement of a theorem. Determine the correct conclusions based on interpreting a theorem in which necessary or sufficient conditions in the theorem or hypothesis are satisfied.

CONTENT EXPECTATIONS FOR GEOMETRY (CONT.)

STANDARD G1: FIGURES AND THEIR PROPERTIES

G1.1 Lines and Angles; Basic Euclidean and Coordinate Geometry

- G1.1.1 Solve multistep problems and construct proofs involving vertical angles, linear pairs of angles, supplementary angles, complementary angles, and right angles.
- G1.1.2 Solve multistep problems and construct proofs involving corresponding angles, alternate interior angles, alternate exterior angles, and same-side (consecutive) interior angles.
- G1.1.3 Perform and justify constructions, including midpoint of a line segment and bisector of an angle, using straightedge and compass.
- G1.1.4 Given a line and a point, construct a line through the point that is parallel to the original line using straightedge and compass. Given a line and a point, construct a line through the point that is perpendicular to the original line. Justify the steps of the constructions.
- G1.1.5 Given a line segment in terms of its endpoints in the coordinate plane, determine its length and midpoint.
- G1.1.6 Recognize Euclidean geometry as an axiom system. Know the key axioms and understand the meaning of and distinguish between undefined terms, axioms, definitions, and theorems.

G1.2 Triangles and Their Properties

- G1.2.1 Prove that the angle sum of a triangle is 180° and that an exterior angle of a triangle is the sum of the two remote interior angles.
- G1.2.2 Construct and justify arguments and solve multistep problems involving angle measure, side length, perimeter, and area of all types of triangles.

CONTENT EXPECTATIONS FOR GEOMETRY (CONT.)

- G1.2.3 Know a proof of the Pythagorean Theorem, and use the Pythagorean Theorem and its converse to solve multi-step problems.
- G1.2.4 Prove and use the relationships among the side lengths and the angles of 30° - 60° - 90° triangles and 45° - 45° - 90° triangles.
- G1.2.5 Solve multistep problems and construct proofs about the properties of medians, altitudes and perpendicular bisectors to the sides of a triangle, and the angle bisectors of a triangle. Using a straightedge and compass, construct these lines.

G1.3 Triangles and Trigonometry

- G1.3.1 Define the sine, cosine, and tangent of acute angles in a right triangle as ratios of sides. Solve problems about angles, side lengths, or areas using trigonometric ratios in right triangles.
- G1.3.2 Know and use the Law of Sines and the Law of Cosines and use them to solve problems. Find the area of a triangle with sides a and b and included angle θ using the formula $\text{Area} = (1/2) ab \sin \theta$.
- G1.3.3 Determine the exact values of sine, cosine, and tangent for 0° , 30° , 45° , 60° , and their integer multiples and apply in various contexts.

G1.4 Quadrilaterals and Their Properties

- G1.4.1 Solve multistep problems and construct proofs involving angle measure, side length, diagonal length, perimeter, and area of squares, rectangles, parallelograms, kites, and trapezoids.
- G1.4.2 Solve multistep problems and construct proofs involving quadrilaterals using Euclidean methods or coordinate geometry.

CONTENT EXPECTATIONS FOR GEOMETRY (CONT.)

G1.4.3 Describe and justify hierarchical relationships among quadrilaterals.

G1.4.4 Prove theorems about the interior and exterior angle sums of a quadrilateral.

G1.5 Other Polygons and Their Properties

G1.5.1 Know and use subdivision or circumscription methods to find areas of polygons.

G1.5.2 Know, justify, and use formulas for the perimeter and area of a regular n -gon and formulas to find interior and exterior angles of a regular n -gon and their sums.

G1.6 Circles and Their Properties

G1.6.1 Solve multistep problems involving circumference and area of circles.

G1.6.2 Solve problems and justify arguments about chords and lines tangent to circles.

G1.6.3 Solve problems and justify arguments about central angles, inscribed angles, and triangles in circles.

G1.6.4 Know and use properties of arcs and sectors, and find lengths of arcs and areas of sectors.

G1.8 Three-dimensional Figures

G1.8.1 Solve multistep problems involving surface area and volume of pyramids, prisms, cones, cylinders, hemispheres, and spheres.

G1.8.2 Identify symmetries of pyramids, prisms, cones, cylinders, hemispheres, and spheres.

STANDARD G2: RELATIONSHIPS BETWEEN FIGURES

G2.1 Relationships Between Area and Volume Formulas

- G2.1.1 Know and demonstrate the relationships between the area formula of a triangle, the area formula of a parallelogram, and the area formula of a trapezoid.
- G2.1.2 Know and demonstrate the relationships between the area formulas of various quadrilaterals.
- G2.1.3 Know and use the relationship between the volumes of pyramids and prisms.

G2.2 Relationships Between Two-dimensional and Three-dimensional Representations

- G2.2.1 Identify or sketch a possible three-dimensional figure, given two-dimensional views. Create a two-dimensional representation of a three-dimensional figure.
- G2.2.2 Identify or sketch cross sections of three-dimensional figures. Identify or sketch solids formed by revolving two-dimensional figures around lines.

G2.3 Congruence and Similarity

- G2.3.1 Prove that triangles are congruent using the SSS, SAS, ASA, and AAS criteria and that right triangles are congruent using the hypotenuse-leg criterion.
- G2.3.2 Use theorems about congruent triangles to prove additional theorems and solve problems, with and without use of coordinates.
- G2.3.3 Prove that triangles are similar by using SSS, SAS, and AA conditions for similarity.

CONTENT EXPECTATIONS FOR GEOMETRY (CONT.)

- G2.3.4 Use theorems about similar triangles to solve problems with and without use of coordinates.
- G2.3.5 Know and apply the theorem stating that the effect of a scale factor of k relating one two-dimensional figure to another or one three-dimensional figure to another, on the length, area, and volume of the figures, is to multiply each by k , k^2 , and k^3 , respectively.

STANDARD G3: TRANSFORMATIONS OF FIGURES IN THE PLANE

G3.1 Distance-preserving Transformations Isometries

- G3.1.1 Define reflection, rotation, translation, and glide reflection and find the image of a figure under a given isometry.
- G3.1.2 Given two figures that are images of each other under an isometry, find the isometry and describe it completely.
- G3.1.3 Find the image of a figure under the composition of two or more isometries and determine whether the resulting figure is a reflection, rotation, translation, or glide reflection image of the original figure.

G3.2 Shape-preserving Transformations: Dilations and Isometries

- G3.2.1 Know the definition of dilation and find the image of a figure under a given dilation.
- G3.2.2 Given two figures that are images of each other under some dilation, identify the center and magnitude of the dilation.

Preparing Students for Successful Post-Secondary Engagement

As educators use these standards and expectations to develop rigorous and relevant units of instruction, it is critical to keep in mind that content knowledge alone will not provide adequate preparation for success in entry-level university courses or entry-level positions in today's workforce. Successful post-secondary engagement requires that students must be able to apply knowledge in new situations; to solve problems by generating new ideas; and to make connections between what they read and hear in class, and the world around them. Therefore educators must model for and develop in students, the cognitive skills and habits of mind that will result in mathematical proficiency and successful post-secondary engagement.

CONTENT EXPECTATIONS FOR GEOMETRY (CONT.)

