

Welcome to the High School-Level Geometry
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**The Year of Implementation and Alignment with the
Common Core Objectives**

***Learning Focus / Student-Centered - Teaching
Techniques;***

- **Direct Lessons and Instructions**
- **"See the big picture" and think...**
- **Treat each student as a "thinker" and ask "What do you think?"**
- **Connections with Algebra and Physical Science**
- **Group and In-Class Work and Practices**
- **One-on-One Guidance**
- **Peer-teaching**
- **Assessments as to reinforce learning and Review of teaching effectiveness and Adjust.**

Textbook: *Geometry*, McDougal Littell (2007), Larson, Boswell, Kanold, Stiff

Course Description: The High School Level Geometry is a collection of Mathematical skills in the areas of logical reasoning and mathematical proofs, specifically dominated in geometrical properties, shapes, and understanding geometrical postulates and axioms.

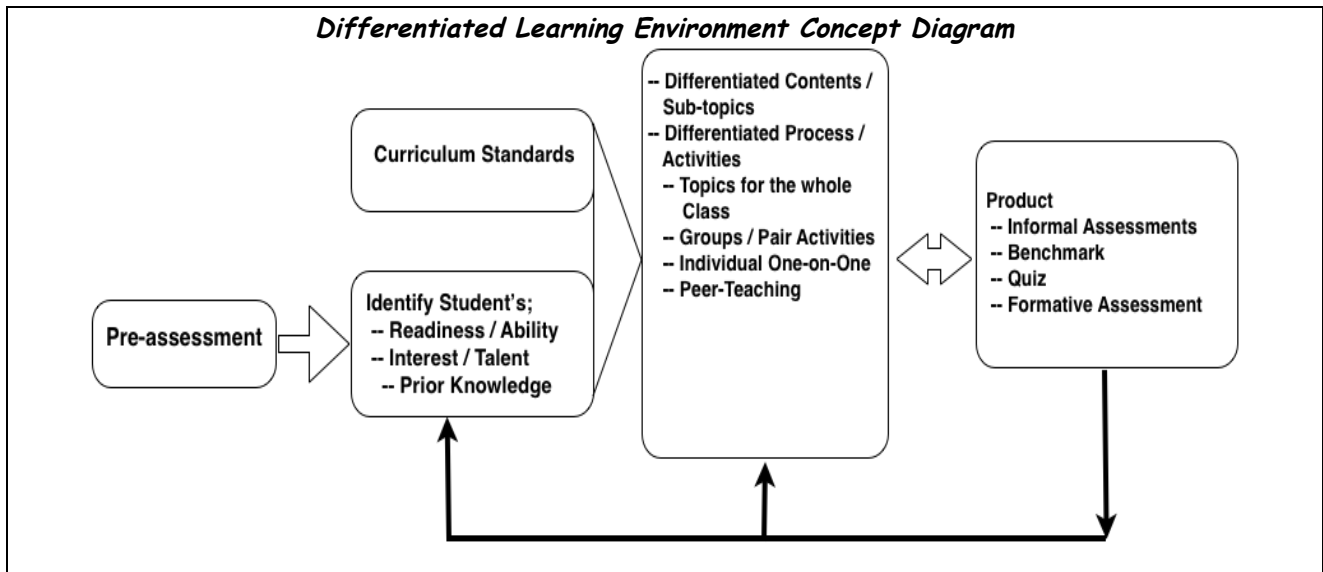
Materials covering in the one-year geometry class will include; Basic definitions of points, lines and planes, Strategies in Logical Reasoning and Proofs, Parallel and Perpendicular lines and their properties, Triangles (Congruencies, Similarities, Bisectors), Right Triangle and Introduction to Trigonometry, Polygons and Quadrilaterals (classifications, properties, interior and exterior angles, related theorems and calculating area), Circles and its properties, Inscribe Angles and Associated Theorems, Transformations, Solid Shapes (Surface and Volumes). In each unit, we will re-visit Algebra I and will make connections to Algebra I applications and review previous learned skill sets.

Goals: Geometry Curriculum - Students will learn to apply logical mathematical reasoning in two-column proof structure, and be able to apply the properties and theorems in solving Geometrical problems.

Utilizing the textbook and other resources, we will work to teach all of the Common Core Standards for High School Level Geometry. Common Core Standards are listed in the last section of this document.

Differentiated Learning Environment:

Mr. Motamed and Mr. Boegel assisted by Mrs. Yip will be co-teaching the Geometry class within the Differentiated Learning framework. You will be mostly working independently and meet one-on-one with Ms. Yip or I for individual instructions. We modulate the depth of each section according to the individual abilities. We use various forms of assessments to adjust and refine instructions.



Grading Scale 2012-2013:

- Tests..... 35%
- Quizzes..... 30%
- Group Tests / Math Facts Assessment 5%
- Homework / In-Class Work..... 15%
- Project 10%
- Participation / Conduct and Citizenship 3%
- Folders and Notebook 2%

Late Policy:

Assignments are due the next day, unless specified otherwise.

For each late day, we will deduct 10% off the graded percent of an assignment. Late assignments after 5 school days (1 week) will receive **ZERO** point for that assignment. No work will be accepted more than two weeks (5 school days) after the required due date. Missing assignments can seriously affect the final grade.

Attendance / Absence / Make-up Work Policy:

- If you miss a class, you are responsible for getting the notes, class work, and homework from your classmates or from the website. (will be available shortly)
- If you are absent for a test, you must make arrangements with us to reschedule the test as soon as you return to the school. Rescheduling is your own responsibility.
- All class information will be available online. (shortly)
- Being tardy is extremely disturbing to the class. You will lose part of your daily participation points for each tardy.
- Your attendance for the full length of all class periods is vital.

Daily Homework:

- Homework will be given daily (except Friday) and checked on the next day, unless otherwise specified.
- Homework serves as a review and practice of the day's lesson. On average you should expect to spend 30 to 45 minutes on homework.
- Homework must have the correct heading:
Your full name, Homework Number, Date, Period

Participation / Note Taking / Note Keeping / Organization / Conduct / Citizenship:

- Each student will automatically receive 3 points for this category daily. Every time you are late to class, misbehave, fail to follow directions, or are not on task, one point will be deducted from your daily participation grade.

Quizzes / Tests / Group Tests

- Quizzes / tests will be given almost once a week.
- No calculators are allowed on the tests or quizzes unless specified by us.
- Some tests will be completed in groups and others will be individually.
- Group tests generally will be prior to the chapter or unit test.
- Chapter tests will be given at the end of each chapter.
- We will provide guidance and practice worksheets prior to the chapter / unit test.

Classroom Rules:

- School policies on behavior fully apply in this class.

Geometry: 2013 - 2014 Yearly Focus Overview

1st Quarter

- ❖ PEARL Connection and Reflection
- ❖ Review – Math Facts / Pre-assessment
- ❖ Essentials of Geometry
 - Points, Lines, Planes, Midpoint and Distance
 - Connection to Algebra
- ❖ Logical Reasoning and Proof
- ❖ PEARL Review and Reflection
- ❖ Parallel and Perpendicular Lines
 - Equation of a line
 - Connection to Algebra: ‘if and Only if’ condition for Parallel and Perpendicular lines

2nd Quarter

- ❖ Excel Project
- ❖ PEARL Write Up
- ❖ Congruent Triangles
- ❖ Relationships within Triangles
 - Sum of Interior and Exterior angles
 - Congruent Triangles Theorems
- ❖ Similarity
 - Similar Triangles Theorems
- ❖ Right Triangles and Trigonometry
 - Sine, Cosine, Tangent, Cotangent
 - Pythagorean Theorem
 - Connection to Algebra
- ❖ PEARL Reflection
- ❖ Right Triangles and Trigonometry
 - Sine, Cosine, Tangent, Cotangent
 - Pythagorean Theorem

3rd Quarter

- ❖ PEARL Connection and Reflection
- ❖ Excel Project: Use Excel, graph and analyze, Linear Programming / Optimization
- ❖ Quadrilaterals
 - Classifications and Properties
 - Theorems
- ❖ Circles and its Properties
 - Measures of Arc and Chords and their Properties
 - Inscribed Angles and Theorems
 - Connection to Algebra II, Equation of a Circle
- ❖ Properties of Transformations
- ❖ PEARL Write Up

4th Quarter

- ❖ PEARL Connection and Growth Project
- ❖ Connection to Algebra II; Matrix and Transformation Matrix
- ❖ Measuring Length (Perimeter) and Area
 - Polygons
 - Circles and Arcs
- ❖ Surface Area and Volume of Solids
 - Prisms and Cylinders
 - Pyramids and Cones

Geometry Introduction¹



The fundamental purpose of the Model Geometry course is to formalize and extend students' geometric experiences from the middle grades. This course is comprised of standards selected from the high school **conceptual categories**, which were written to encompass the scope of content and skills to be addressed throughout grades 9–12 rather than through any single course. Therefore, the complete standard is presented in the model course, with clarifying footnotes as needed to limit the scope of the standard and indicate what is appropriate for study in this particular course.

In this high school Model Geometry course, students explore more complex geometric situations and deepen their explanations of geometric relationships, presenting and hearing formal mathematical arguments. Important differences exist between this course and the historical approach taken in geometry classes. For example, transformations are emphasized in this course. Close attention should be paid to the introductory content for the Geometry conceptual category found on page 92.

For the high school Model Geometry course, instructional time should focus on six critical areas: (1) establish criteria for congruence of triangles based on rigid motions; (2) establish criteria for similarity of triangles based on dilations and proportional reasoning; (3) informally develop explanations of circumference, area, and volume formulas; (4) apply the Pythagorean Theorem to the coordinate plan; (5) prove basic geometric theorems; and (6) extend work with probability.

- (1) Students have prior experience with drawing triangles based on given measurements and performing rigid motions including translations, reflections, and rotations. They have used these to develop notions about what it means for two objects to be congruent. In this course, students establish triangle congruence criteria, based on analyses of rigid motions and formal constructions. They use triangle congruence as a familiar foundation for the development of formal proof. Students prove theorems—using a variety of formats including deductive and inductive reasoning and proof by contradiction—and solve problems about triangles, quadrilaterals, and other polygons. They apply reasoning to complete geometric constructions and explain why they work.
- (2) Students apply their earlier experience with dilations and proportional reasoning to build a formal understanding of similarity. They identify criteria for similarity of triangles, use similarity to solve problems, and apply similarity in right triangles to understand right triangle trigonometry, with particular attention to special right triangles and the Pythagorean Theorem. Students derive the Laws of Sines and Cosines in order to find missing measures of general (not necessarily right) triangles, building on their work with

¹ Massachusetts Department of Elementary and Secondary Education, *Massachusetts Curriculum Framework for Mathematics*, 2011, p. 116–117.

Geometry Introduction

quadratic equations done in Model Algebra I. They are able to distinguish whether three given measures (angles or sides) define 0, 1, 2, or infinitely many triangles.

- (3) Students' experience with three-dimensional objects is extended to include informal explanations of circumference, area, and volume formulas. Additionally, students apply their knowledge of two-dimensional shapes to consider the shapes of cross-sections and the result of rotating a two-dimensional object about a line.
- (4) Building on their work with the Pythagorean Theorem in eighth grade to find distances, students use the rectangular coordinate system to verify geometric relationships, including properties of special triangles and quadrilaterals, and slopes of parallel and perpendicular lines, which relates back to work done in the Model Algebra I course. Students continue their study of quadratics by connecting the geometric and algebraic definitions of the parabola.
- (5) Students prove basic theorems about circles, with particular attention to perpendicularity and inscribed angles, in order to see symmetry in circles and as an application of triangle congruence criteria. They study relationships among segments on chords, secants, and tangents as an application of similarity. In the Cartesian coordinate system, students use the distance formula to write the equation of a circle when given the radius and the coordinates of its center. Given an equation of a circle, they draw the graph in the coordinate plane, and apply techniques for solving quadratic equations—which relates back to work done in the Model Algebra I course—to determine intersections between lines and circles or parabolas and between two circles.
- (6) Building on probability concepts that began in the middle grades, students use the language of set theory to expand their ability to compute and interpret theoretical and experimental probabilities for compound events, attending to mutually exclusive events, independent events, and conditional probability. Students should make use of geometric probability models wherever possible. They use probability to make informed decisions.

The Standards for Mathematical Practice complement the content standards so that students increasingly engage with the subject matter as they grow in mathematical maturity and expertise throughout the elementary, middle, and high school years.

Geometry Overview

Geometry

Congruence

- Experiment with transformations in the plane.
- Understand congruence in terms of rigid motions.
- Prove geometric theorems.
- Make geometric constructions.

Similarity, Right Triangles, and Trigonometry

- Understand similarity in terms of similarity transformations.
- Prove theorems involving similarity.
- Define trigonometric ratios and solve problems involving right triangles.
- Apply trigonometry to general triangles.

Circles

- Understand and apply theorems about circles.
- Find arc lengths and area of sectors of circles.

Expressing Geometric Properties with Equations

- Translate between the geometric description and the equation for a conic section.
- Use coordinates to prove simple geometric theorems algebraically.

Geometric Measurement and Dimension

- Explain volume formulas and use them to solve problems.
- Visualize relationships between two-dimensional and three-dimensional objects.

Modeling with Geometry

- Apply geometric concepts in modeling situations.

Statistics and Probability

Conditional Probability and the Rules of Probability

- Understand independence and conditional probability and use them to interpret data.
- Use the rules of probability to compute probabilities of compound events in a uniform probability model.

Using Probability to Make Decisions

- Use probability to evaluate outcomes of decisions.
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★ Indicates a modeling standard linking mathematics to everyday life, work, and decision-making
 (+) Indicates additional mathematics to prepare students for advanced courses.

Mathematical Practices

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.

Geometry

Congruence G-CO

Experiment with transformations in the plane.

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.
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 (e.g., translation versus horizontal stretch).
3. Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.
4. Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.
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.

Understand congruence in terms of rigid motions. [Build on rigid motions as a familiar starting point for development of concept of geometric proof.]

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

Prove geometric theorems. [Focus on validity of underlying reasoning while using variety of ways of writing proofs.]

9. Prove 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.*
10. Prove 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.*
11. Prove 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.*

Make geometric constructions. [Formalize and explain processes.]

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.*
13. Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.

Similarity, Right Triangles, and Trigonometry G-SRT

Understand similarity in terms of similarity transformations.

1. Verify experimentally the properties of dilations given by a center and a scale factor:
 - a. 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.
 - b. The dilation of a line segment is longer or shorter in the ratio given by the scale factor.
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.
3. Use the properties of similarity transformations to establish the Angle-Angle (AA) criterion for two triangles to be similar.

Prove theorems involving similarity.

4. Prove 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.*
5. Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.

Define trigonometric ratios and solve problems involving right triangles.

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.
7. Explain and use the relationship between the sine and cosine of complementary angles.
8. Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.

★

8.1 Derive and use the trigonometric ratios for special right triangles (30°, 60°, 90° and 45°, 45°, 90°). CA

Apply trigonometry to general triangles.

9. (+) Derive the formula $A = \frac{1}{2} ab \sin(C)$ for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side.
10. (+) Prove the Laws of Sines and Cosines and use them to solve problems.
11. (+) Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces).

Circles G-C

Understand and apply theorems about circles.

1. Prove that all circles are similar.
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.*
3. Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.
4. (+) Construct a tangent line from a point outside a given circle to the circle.

Find arc lengths and areas of sectors of circles. [Radian introduced only as unit of measure.]

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. **Convert between degrees and radians. CA**

Expressing Geometric Properties with Equations G-GPE

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

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.
2. Derive the equation of a parabola given a focus and directrix.

Use coordinates to prove simple geometric theorems algebraically. [Include distance formula; relate to Pythagorean Theorem.]

4. Use coordinates to prove simple geometric theorems algebraically. *For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point (1, **Error! Objects cannot be created from editing field codes.**) lies on the circle centered at the origin and containing the point (0, 2).*
5. Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point).
6. Find the point on a directed line segment between two given points that partitions the segment in a given ratio.
7. Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula. ★

Geometric Measurement and Dimension G-GMD

Explain volume formulas and use them to solve problems.

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

Visualize relationships between two-dimensional and three-dimensional objects.

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.
5. **Know that the effect of a scale factor k greater than zero on length, area, and volume is to multiply each by k , k^2 , and k^3 , respectively; determine length, area and volume measures using scale factors.** CA
6. **Verify experimentally that in a triangle, angles opposite longer sides are larger, sides opposite larger angles are longer, and the sum of any two side lengths is greater than the remaining side length; apply these relationships to solve real-world and mathematical problems.** CA

Modeling with Geometry G-MG

Apply geometric concepts in modeling situations.

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

Statistics and Probability

Conditional Probability and the Rules of Probability S-CP

Understand independence and conditional probability and use them to interpret data. [Link to data from simulations or experiments.]

1. Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events (“or,” “and,” “not”). ★
2. Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent. ★
3. Understand the conditional probability of A given B as $P(A \text{ and } B)/P(B)$, and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A , and the conditional probability of B given A is the same as the probability of B . ★
4. Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. *For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.* ★
5. Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. ★

Use the rules of probability to compute probabilities of compound events in a uniform probability model.

6. Find the conditional probability of A given B as the fraction of B 's outcomes that also belong to A , and interpret the answer in terms of the model. ★
7. Apply the Addition Rule, $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$, and interpret the answer in terms of the model. ★
8. (+) Apply the general Multiplication Rule in a uniform probability model, $P(A \text{ and } B) = P(A)P(B|A) = P(B)P(A|B)$, and interpret the answer in terms of the model. ★
9. (+) Use permutations and combinations to compute probabilities of compound events and solve problems. ★

Using Probability to Make Decisions S-MD

Use probability to evaluate outcomes of decisions. [Introductory; apply counting rules.]

6. (+) Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator). ★
7. (+) Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game). ★