

Masconomet Regional High School Curriculum Guide

COURSE TITLE: Geometry

COURSE NUMBER: 1124

DEPARTMENT: Mathematics

GRADE LEVEL(S) & PHASE: 9, CP

LENGTH OF COURSE: Full Year

Course Description:

This geometry course will provide the student with language and notation to use in communicating about geometric objects and relations. Students will be provided with experiences necessary to both ask and answer the questions inherent within the richness of its content. Students will be allowed and encouraged to use a variety of mathematical methods to probe its content. The course will serve as a training ground for problem solving, developing the ability to choose the best method to solve individual problems as they arise. Problems and interesting questions exist and are easily found in the world around us. When students learn to find and identify these questions, they will have gained the ability to take charge of their own learning process. Specifically, this course presents coordinates and transformations in both two and three dimensions, along with measurement, area and volume, important work for students. Concentrated work with proof writing is delayed until midyear and later, following a carefully sequenced development of the logical and conceptual precursors to proof. Skill in drawing, visualizing and using algorithms; understanding properties, mathematical relationships and proof; using geometric ideas in real situations; and representing geometric concepts with coordinates, networks or other diagrams are emphasized. A ruler, protractor, compass, and scientific calculator are essential equipment.

Objectives:

(Some are adapted from the Massachusetts Mathematics Curriculum Framework – November 2000)

At the end of the course, students should be able to:

- A. Recognize special types of polygons, apply properties of sides, diagonals and angles, determine interior angles for regular polygons, and detect symmetries of geometric figures.
 - B. Determine when figures are congruent or similar or when lines are parallel or perpendicular and write convincing arguments for these.
 - C. Use inductive and deductive reasoning, distinguish between postulates and theorems, and give the inverse, converse and contrapositive for a given conditional statement.
 - D. Apply properties of angles, parallel lines, arcs, radii, chords, tangents and secants to solve problems.
 - E. Apply congruence correspondences and properties of figures to find missing parts of triangles and provide logical justification.
 - F. Solve simple triangle problems using the triangle angle sum property and/or the Pythagorean Theorem.
 - G. Apply trigonometric ratios in right triangles to solve problems.
 - H. Use the properties of special triangles to solve problems.
 - I. Apply the triangle inequality and other inequalities associated with triangles to prove theorems and solve problems.
 - J. Demonstrate an understanding of the relationship among various representations of a line.
 - K. Determine a line's slope and x- and y- intercepts from its graph or from a linear equation that represents the line.
 - L. Find linear equations that represent lines either perpendicular or parallel to a given line and through a given point using either point slope or slope intercept form.
 - M. Using rectangular coordinates, calculate midpoints of segments, slopes of lines or segments, and distances between two points, and apply the results to the solution of problems.
 - N. Demonstrate an understanding of the relationship between geometric and algebraic representations of circles.
 - O. Draw the results and interpret transformations on figures in the coordinate plane. Apply transformations to the solutions of everyday problems.
 - P. Demonstrate the ability to visualize solid objects and recognize their projections and cross sections.
 - Q. Use vertex-edge graphs to model and solve problems.
 - R. Calculate perimeter, circumference, and area of common geometric figures.
 - S. Given the formula, apply formulas for lateral area, surface area, and volume of prisms, pyramids, spheres, cylinders and cones.
 - T. Relate changes in the measurement of one attribute of an object to changes in other attributes.
 - U. Describe the effects of approximate error in measurement and rounding on measurements and on computed values from measurements.
 - V. Use dimensional analysis for unit conversion and to confirm the expressions and equations make sense.
- These objectives address the Academic Expectations relating to effective communication, mathematical competency and problem solving skills.

Materials and Activities:

Text(s): Geometry: Explorations and Applications

By: Douglas B. Aichele, Patrick W. Hopfensperger, Miriam A. Leiva, Marguerite M. Mason, Stuart J. Murphy, Vicki J. Schell, Matthias C. Vheru
McDougal Littell, Inc.: Evanston, IL: 1998

Students are expected to have and use a scientific calculator in class and when doing assignments.

- Discovery activities to introduce the central concepts of each unit and to provide hands on experience concerning the usefulness of these concepts. The Geometer's Sketchpad and/or Cabri Junior will be used throughout the course.
- Lecture and class discussion to explain concepts and processes.
- Individual and group work to practice skills presented in class, to apply them to various problem-solving situations and to develop the ability to work cooperatively in such situations.
- Group and individual investigations related to understanding and applying the concepts in the central objectives.
- Projects, reports and computer work may be presented by students, either individually or as a group.

Scope and Sequence:

At the end of unit one, students will be able to:

- Reason inductively
- Make predictions about patterns in real-life situations
- Write and analyze conjectures
- Identify the hypothesis and conclusion of conditional statements
- Tell whether conditional statements are true or false
- Describe and sketch relationships between points, lines and planes in coordinate systems and as real-world objects
- Represent points, lines, planes, segments, rays, et al,
- Find segment lengths and distances between points in the coordinate plane and in real-life situations
- Name and measure angles
- Describe angles in various real-world situations
- Identify bisectors of angles and segments
- Find angle measures in real-world situations.

At the end of unit two, students will be able to:

- Identify and classify angles and pairs of angles
- Use protractors to measure angles and to draw angles with a specific degree measure
- Calculate the measures of multiple angles in a diagram
- Name, label and classify triangles
- Sketch triangles and find the measures of their angles
- Use types of triangles to describe real-world objects
- Identify and classify polygons
- Find the sum of the measures of the interior angles of a polygon
- Find the sum of the measures of the exterior angles of a polygon
- Find specific measures for a given polygon

At the end of unit three, students will be able to:

- Use deductive reasoning to reach conclusions
- Apply postulates, definitions and properties to given figures
- Justify statements about geometric figures
- Write the converse of conditional statement
- Know and apply the Pythagorean theorem to find the lengths of an unknown side of a right triangle
- Find the lengths of parts of figures and real-life objects
- Determine whether a triangle is acute, right or obtuse from the length of its sides
- Know and apply the triangle inequality theorems
- Simplify square roots

At the end of unit four, students will be able to:

- Find the distance between two points and the coordinates of the midpoint of a segment
- Determine distances in real-life situations
- Find the slope of a segment or a line and write equations of lines slope-intercept form

- Graph and compare equations of lines
- Find the slopes of parallel and perpendicular lines
- Use slope to determine whether lines are parallel, perpendicular or neither
- Identify properties of perpendicular bisectors
- Write equations for parallel and perpendicular lines
- Identify circles and parts of circles
- Write equations for circles
- Find coordinates in three dimensions
- Use the distance formula and midpoint formula in three dimensions
- Identify and describe relationships between geometric figures in three dimensions

At the end of unit five, students will be able to:

- Identify pairs of angles formed by transversals and lines
- Find the measures of angles formed by transversals and parallel lines
- Analyze real-world examples of parallel and intersecting lines
- Find congruent angles in real-world objects
- Use angle relationships to determine if lines are parallel

At the end of unit six, students will be able to:

- Identify corresponding parts of polygons
- Match congruent polygons to real-world objects
- Use the definition of congruent polygons to find the measures of unknown angles/sides
- Use SSS, SAS, ASA, AAS, and HL to show two triangles are congruent
- Use corresponding parts of congruent triangles (CPCTC)
- Apply the isosceles triangle theorem and its converse
- Find measures in isosceles triangles and write proofs using isosceles triangles
- Identify and draw medians, altitudes, angle bisectors, perpendicular bisectors and midsegments of triangles
- Explore the properties of medians, altitudes, angle bisectors, perpendicular bisectors and midsegments

At the end of unit seven, students will be able to:

- Simplify ratios and unit rates
- Use cross multiplication to solve simple proportions and word problems involving proportions
- Use ratios and proportions to find measures of similar figures
- Identify similar figures
- Use scale models to find the dimensions of the object being modeled and vice versa
- Use special rules to identify similar triangles
- Write appropriate proportions using the sides of similar figures
- Compare measures of similar figures

At the end of unit eight, students will be able to:

- Identify types of quadrilaterals
- Know and apply the properties of parallelograms, rectangles, rhombuses, squares, trapezoids, isosceles trapezoids and kites
- Find the measure of unknown sides and angles in quadrilaterals
- Identify quadrilaterals using their properties
- Recognize the relationships between the diagonals of special quadrilaterals

At the end of unit nine, students will be able to:

- Find the perimeter of polygons
- Find the areas of triangles and quadrilaterals
- Use the formulas for finding areas of triangles and quadrilaterals in real-world applications
- Find the areas and perimeters (circumference) of regular polygons and circles
- Use area formulas of regular polygons and circles to find areas of real-world objects
- Find the length of arcs and the area of sectors
- Find perimeters and areas of similar polygons
- Use lengths and areas to find probabilities
- Know and apply the relationships among the sides of special right triangles (45 – 45 – 90 and 30 – 60 – 90)

- Find area and perimeter on a coordinate plane

At the end of unit ten, students will be able to:

- Name prisms and cylinders and identify parts of them
- Sketch three dimensional figures
- Draw and analyze nets for three dimensional figures
- Find the volumes, lateral areas and surface areas of prisms and cylinders
- Find the volumes, lateral areas and surface areas of cones and pyramids
- Find the volume and surface area of spheres
- Find surface areas and volumes for similar prisms, cylinders and cones

At the end of unit eleven, students will be able to:

- Draw the reflection of a polygon over a given line (horizontal, vertical or the line $y = x$)
- Draw a line of reflection for a figure and its image
- Find the coordinates of a polygon reflected over a horizontal line, a vertical line or the line $y = x$
- Describe how coordinates change after reflections
- Find the coordinates of the image of a figure after translation
- Describe a translation based on the original figure and its image
- Rotate a figure around a center of rotation
- Find the coordinates of the vertices of a polygon that has been rotated about origin
- Make reductions and enlargements of figures
- Compare the lengths of corresponding parts of a pre-image and image after dilation
- Find the scale factor for a given dilation

If time permits,

At the end of unit twelve, students will be able to:

- Identify types of arcs and angles in circles
- Find the measures of arcs and angles
- Find arc and angle measures when segments intersect circles
- Solve real world problems involving arcs and chords of circles

At the end of unit thirteen, students will be able to:

- Recognize relationships among the triangles formed by the altitude to the hypotenuse of a right triangle
- Find the geometric mean of two numbers
- Find the tangent of an acute angle
- Use tangents to find lengths and angle measures in right triangles
- Find the sine and cosine of an acute angle
- Find the measure of an acute angle whose sine and cosine is given
- Find the length of the sides of right triangles
- Solve real-world problems using sines and cosines

Assessment:

- Daily assignments to be evaluated in light of completeness, care of presentation and the student's ability to explain the results. Late or incomplete assignments can earn at most half credit. Generally, no credit will be given for any assignment not completed within one day of the time it was due.
- Individual and group classwork/investigations to be evaluated in light of their completeness, care of presentation, student participation in the process and the student's ability to discuss the results/conclusions.
- Frequent quizzes to assess the student's progress in achieving course objectives on a short-term basis.
- Chapter tests to assess the student's ability to synthesize several classes and achieve course objectives on a long-term basis.
- Semester exam in January.
- Architecture project as culminating experience for course. Students work on this throughout second semester as their final exam.
- Assessments designed to determine how the student has met the Academic Expectations relating to effective communication, mathematical competency and problem solving skills.