San Mateo Union High School District
Course of Study

GEOMETRY

Approved by
BOARD OF TRUSTEES
May 12, 2016

I. Course Description

A. UC/CSU “a-g” Subject Area: C) Mathematics
B. Rationale for Course: The California state standards in mathematics have changed. We need new courses of study that reflect the changes in content, practice, and rigor. The overall goal will be to increase A-G completion rates. Geometry is the second course that meet college and career readiness standards in mathematics.
C. Grade Level: 9 - 12
D. Credits: 10 Math
E. Pre-Requisites: Successful completion of Algebra I
F. Brief Course Description: The fundamental purpose of this Geometry course is to introduce students to formal geometric proof and the study of plane figures, culminating in the study of right triangle trigonometry and circles. They begin to prove results about the geometry of the plane formally, by using previously defined terms and notions. Similarity is explored in greater detail, with an emphasis on discovering trigonometric relationships and solving problems with right triangles. The correspondence between the plane and the Cartesian coordinate system is explored when students connect algebraic concepts with geometric ones. Students explore probability concepts and use probability in real-world situations. The major mathematical ideas in this course include geometric transformations, proving geometric theorems, congruence and similarity, analytic geometry, right-triangle trigonometry, mathematical modeling and probability.

II. Course Purpose: Goals and Student Outcomes

Students demonstrate the mathematical practice standards by:

- Students construct accurate diagrams of geometry problems to help make sense of them. They organize their work so that others can follow their reasoning, e.g. in proofs.
- Students understand that the coordinate plane can be used to represent geometric shapes and transformations and therefore connect their understanding of number and algebra to geometry.
- Students construct proofs of geometric theorems. They write coherent logical arguments and understand that each step in a proof must follow from the last, justified with a previously accepted or proven result.

- Students apply their new mathematical understanding to real-world problems. They learn how transformational geometry and trigonometry can be used to model the physical world.
- Students make use of visual tools for representing geometry, such as simple patty paper or transparencies, or dynamic geometry software.
- Students develop and use precise definitions of geometric terms. They verify that a specific shape has certain properties justifying its categorization (e.g. a rhombus as opposed to a quadrilateral).
- Students construct triangles in quadrilaterals or other shapes and use congruence criteria of triangles to justify results about those shapes.
- Students explore rotations, reflections and translations, noticing that certain attributes of different shapes remain the same (e.g. parallelism, congruency, orientation) and develop properties of transformations by generalizing these observations.

Students demonstrate the content standards:

- Students will experiment with transformations in the plane
- Students will understand congruence in terms of rigid motions
- Students will prove geometric theorems
- Students will make geometric constructions
- Students will understand similarity in terms of similarity transformations
- Students will prove theorems involving similarity
- Students will define trigonometric ratios and solve problems involving right triangles
- Students will apply trigonometry to general triangles
- Students will understand and apply theorems about circles
- Students will find arc lengths and areas of sectors of circles
- Students will translate between the geometric description and the equation for a conic section
- Students will use coordinates to prove simple geometric theorems algebraically
- Students will explain volume formulas and use them to solve problems
- Students will visualize relationships between two-dimensional and three-dimensional objects
- Students will apply geometric concepts in modeling situations
- Students will understand independence and conditional probability and use them to interpret data
- Students will use the rules of probability to compute probabilities of compound events in a uniform probability model
- Students will use probability to evaluate outcomes of decisions

III. **Course Outline**

I. Introduction and Constructions: Constructions with compass, string, mirror, patty paper and/or geometry software. Copy line segments and

angles. Construct parallel and perpendicular lines. Construct bisectors, equilateral triangles, squares and hexagons.

II. Basic Definitions, Rigid Motions and Congruence: Develop definitions. Experiment with transformations on a plane. Understand congruence in terms of rigid motion. Specify a sequence of transformations that will carry a given figure onto another. Triangle congruence in terms of rigid motion.

III. Geometric Relationships and Properties: Prove geometric theorems, Prove theorem of lines, angles, triangles, parallograms

IV. Similarity: Understand similarity in term of dilations.

V. Coordinate Geometry: Use coordinates to prove simple geometric theorems algebraically, Slope for parallel and perpendicular lines

VI. Circles and Conics: Equation of a circle, completing the square for equation of a circle, conic section, focus and directrix of a parabola, area and circumference of a circle, chords, angles and arcs, tangents and secants.

VII. Trig Ratios: Sine, cosine and tangent rations, inverses, applications, special right triangles, Pythagorean triples, law of sines, law of cosines

VIII. Modeling: applications of geometric modeling

IX. Probability: Conditional probability, independence, two-way tables, counting, permutations, combinations,

IV. **Exampl Key Assignments**

I. MAP: Table Tilings: In this task, you must work out how many whole, half and quarter tiles tiles are needed to cover the tops of tables of different sizes.This lesson unit is intended to help you assess how well students are able to recognize and visualize transformations of 2D shapes, translate, reflect and rotate shapes, and combine these transformations. It also aims to encourage discussion on some common misconceptions about transformations.

II. NCTM: Taking a Spin: What regular polygons have 80-degree rotational symmetry? Students have to explain their answers.

III. MAP: Analyzing Congruence Proofs: This lesson unit is intended to help you assess how well students are able to: Work with concepts of congruency and similarity, including identifying corresponding sides and corresponding angles within and between triangles. Identify and understand the significance of a counter-example. Prove, and evaluate proofs in a geometric context. NCTM: Bank Shot, MAP: Triangular Frameworks

IV. MAP: Floodlights, MAP: Rolling Cups, MAP: Applying Angle Theorems, Insidemathematics: Spatial Visualization: Cut it Out, MAP: Pythagorian Triples, MAP: Proofs of Pythagorean Theorem, MAP: Finding Equations of Parallel and Perpendicular Lines: This lesson unit is intended to help you assess how well students are able to understand the relationship between the slopes of parallel and

perpendicular lines and, in particular, to help identify students who find it difficult to:Find, from their equations, lines that are parallel and perpendicular.Identify and use intercepts.It also aims to encourage discussion on some common misconceptions about equations of lines.

V. MAP: Square, NCTM: As the Crow Flies- The distance formula is often presented as a “rule” for students to memorize. This task is designed to help students develop an understanding of the meaning of the formula.

VI. MAP: Equations of Circles: This lesson unit is intended to help you assess how well students are able to use the Pythagorean theorem to derive the equation of a circle and translate between the geometric features of circles and their equations.

VII. Ferris Wheel: This lesson unit is intended to help you assess how well students are able to model a periodic situation, the height of a person on a Ferris wheel, using trigonometric functions and interpret the constants *a, b, c* in the formula $h = a + b \cos ct$ in terms of the physical situation, where *h* is the height of the person above the ground and *t* is the elapsed time.

VIII. MAP: Medical Testing: This lesson unit is intended to help you assess how well students are able to make sense of a real life situation and decide what math to apply to the problem, understand and calculate the conditional probability of an event A, given an event B, and interpret the answer in terms of a model, represent events as a subset of a sample space using tables, tree diagrams, and Venn diagrams and interpret the results and communicate their reasoning clearly.

IX. MAP: Modeling Conditional Probabilities 2: This lesson unit is intended to help you assess how well students understand conditional probability, and, in particular, to help you identify and assist students who have the following difficulties representing events as a subset of a sample space using tables and tree diagrams and understanding when conditional probabilities are equal for particular and general situations.

V. Instructional Methods and/or Strategies

Formative Assessments, Number Talks, group work, think pair share, geometry proof blocks, online geometry software, construction online tools, architecture software.

VI. Assessment Methods and/or Tools

Formative assessments will be used with constructed response questions. Each chapter will have a summative exam that includes no more than 50% new material, projects will be included in the grade and there will be two final exams, one at the end of three weeks, the other at the end of six weeks.

VII. Textbook(s) and Supplemental Instructional Materials

CPM Core Connections; http://map.mathshell.org; MARS/MAC tasks; NCTM Illuminations, Math Vision Project, Engage NY, Georgia Standards, and any other CCSS aligned materials