MT. DIABLO UNIFIED SCHOOL DISTRICT
COURSE OF STUDY

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COURSE TITLE:	**Geometry**
COURSE NUMBER:	**1320**
DEPARTMENT:	**Mathematics**
LENGTH OF COURSE:	**One Year**
CREDITS PER SEMESTER:	**5**
GRADE LEVEL(S)	**9-12**
REQUIRED OR ELECTIVE:	**This course fulfills one year of the high school mathematics requirement and UC/CSU "c" requirement. Eighth grade students do not receive high school credit for this course.**
PREREQUISITES:	**Successful completion of Algebra I. Concurrent support recommended for students who received a D in Algebra I.**
BOARD OF EDUCATION ADOPTION:	~~**June 22, 2010**~~

~~**COURSE DESCRIPTION:**~~

~~This course provides the student with the knowledge, concepts and skills identified in the California State Mathematics Standards for Geometry. The ability to communicate mathematical reasoning and understanding will be incorporated into all math topics. In addition, students will develop their ability to construct formal, logical arguments and proofs in geometric settings and problems. This course is the second course in the three year mathematics requirement for four-year college admission.~~

COURSE OVERVIEW

This Geometry course is designed to develop critical thinking and problem solving skills through the study of the basic elements of geometry and geometric concepts. In this course, students learn to use geometric reasoning as a method for problem solving. The course begins with an introduction to the basic tools of geometry: the structure of a mathematical system, connecting definitions, postulates, logical reasoning, and theorems. From there students move on to proofs, parallel and perpendicular lines, congruence and relationships in triangles and quadrilaterals, proportions and similarity, right triangles and trigonometry, transformations and symmetry, measurements of circles, surface area and volume, and probability and measurement.

In addition to the California Common Core State Standards for Mathematics, students will experience and gain fluency with the 8 Standards for Mathematical Practice:

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

Overall, the quality of a learning environment depends on the extent to which it provides opportunities for students along the following five dimensions:

1. The richness of disciplinary concepts and practices ("the content") available for learning;
2. Student sense-making and "productive struggle";
3. Meaningful and equitable access to concepts and practices for all students;
4. Means for constructing positive disciplinary identities through presenting, discussion and refining ideas; and
5. The responsiveness of the environment to student thinking.

~~**COURSE OUTLINE**~~

1. ~~MAJOR GOALS~~

~~1.1 To develop the ability to reason logically and think spatially 1.2 To develop skills for communicating mathematically 1.3 To build geometric models, formulate and solve problems 1.4 To improve the skills necessary to be successful in multiple career~~

~~2. PERFORMANCE OBJECTIVES~~

~~(numbers in parentheses refers to an appropriate California State Standard) 2.1 Geometry 2.1.1 Demonstrate understanding by identifying and giving examples of undefined terms, axioms, theorems, and inductive and deductive reasoning. (1.0) 2.1.2 Write geometric proofs, including proofs by contradiction. (2.0) 2.1.3 Construct and judge the validity of a logical argument and give counterexamples to disprove a statement. (3.0)~~

~~2.1.4 Prove basic theorems involving congruence and similarity. (4.0) 2.1.5 Prove that triangles are congruent or similar, and be able to use the concept of corresponding parts of congruent triangles. (5.0) 2.1.6 Demonstrate knowledge of the triangle inequality theorem. (6.0) 2.1.7 Prove and use theorems involving the properties of parallel lines cut by a transversal, the properties of quadrilaterals, and the properties of circles (7.0) 2.1.8 Know, derive, and solve problems involving the perimeter, circumference, area, volume, lateral area, and surface area of common geometric figures. (8.0) 2.1.9 Compute the volumes and surface areas of prisms, pyramids, cylinders, cones, and spheres; and commit to memory the formulas for prisms, pyramids, and cylinders. (9.0) 2.1.10 Compute the areas of polygons, including rectangles, scalene triangles, equilateral triangles, rhombi, parallelograms, and trapezoids. (10.0) 2.1.11 Determine how changes in dimensions affect the perimeter, area, and volume of common geometric figures and solids. (11.0) 2.1.12 Find and use the measures of sided and of interior and exterior angles of triangles and polygons to classify figures and solve problems. (12.0) 2.1.13 Prove relationships between angles in polygons by using properties of complementary, supplementary, vertical, and exterior angles. (13.0) 2.1.14 Prove the Pythagorean Theorem. (14.0) 2.1.15 Use the Pythagorean Theorem to determine distance and find missing lengths of sides of right triangles. (15.0) 2.1.16 Perform basic constructions with straightedge and compass, such as angle bisectors, perpendicular bisectors, and the line parallel to a given line through a point off the line. (16.0) 2.1.17 Prove theorems by using coordinate geometry, including the midpoint of a line segment, the distance formula, and various forms of equations of lines and circles. (17.0) 2.1.18 Demonstrate knowledge of the definitions of the basic trigonometric functions defined by the angles of a right triangle. Understand and use elementary relationships between trigonometric functions and right triangles. For example, $\tan(x) = \sin(x)/\cos(x)$, $(\sin(x))^2 + (\cos(x))^2 = 1$. (18.0) 2.1.19 Use trigonometric functions to solve for an unknown length of a side of a right triangle,~~

~~given an angle and a length of a side. (19.0) 2.1.20 Demonstrate knowledge of and ability to use angle and side relationships in problems with special right triangles, such as 30º, 60º, and 90º triangles and 45º, 45º, 90º triangles. (20.0) 2.1.21 Prove and solve problems regarding relationships among chords, secants, tangents, inscribed angles, and inscribed and circumscribed polygons of circles. (21.0) 2.1.22 Understand the effect of rigid motions on figures in the coordinate plane and space, including rotations, translations, and reflections. (22.0)~~

~~**3. CONTENT COMPONENTS**~~

~~(numbers in parentheses refer to appropriate performance objectives) 3.1 Geometry 3.1.1 Axioms, theorems, inductive and deductive reasoning (2.1.1, 2.1.4) 3.1.2 Geometric proofs (2.1.2) 3.1.3 Logical arguments and counterexamples (2.1.3) 3.1.4 Properties of geometric figures including career applications (2.1.8- 2.1.11, 2.1.21) 3.1.5 Angles of geometric figures (2.1.5-2.1.13, 2.1.20) 3.1.6 Pythagorean theorem including career applications (2.1.14-2.1.15) 3.1.7 Geometric constructions (2.1.16) 3.1.8 Coordinate geometry (2.1.17) 3.1.9 Trigonometric functions (2.1.18-2.1.19) 3.1.10 Transformations (2.1.22)~~

COURSE CONTENT:

Unit 1: Basics of Geometry

This unit reviews understanding points/lines/planes, measuring and constructing line segments, measuring and constructing angles, pairs of angles, using formulas in geometry, calculating midpoints and distances in the coordinate plane, and transformations in the coordinate plane. Students will use these skills to use the correct terminology for basic geometric figures, apply basic formulas in and out of the coordinate plane, determine how much material is needed to make a rectangular or triangular object, find distances between cities, and/or apply this information in physics with light bouncing off of objects.

At the end of the unit, a scavenger hunt project can be used to reinforce geometry basic concepts.

Unit 2: Reasoning and Proofs

This unit covers conditional statements, inductive and deductive reasoning, postulates, and proving statements about segments, angles and geometric relationships. Two-column proofs and flowchart proofs will be taught. Students will apply postulates, deductive reasoning, and laws of logic to write paragraph proofs. Students will evaluate logical arguments using the Law of Detachment and the Law of Syllogism. They will use algebraic properties to justify each step in solving algebraic equations.

At the end of the unit, students will use deductive and inductive reasoning to match cards depicting various transformations and the rules that map one onto another. They will also write rules to help solve more complex puzzles. The performance task at the close of the unit extends learning to find the midpoint in a 3-dimensional space.

Unit 3: Parallel and Perpendicular Lines

This unit covers pairs of lines and angles, parallel lines with transversals and all of the angles they form, and proofs about and equations for parallel and perpendicular lines. New vocabulary is introduced in this unit which students will be expected to learn. Also, reinforcement of proofs using a different set of theorems and postulates will be given. Students will learn to use slope and equations of lines to investigate geometric relationships, make conjectures and determine their validity, use geometric concepts and properties to solve problems, use numeric and geometric patterns to make generalizations about geometric properties, and use logical statements to prove statements are true.

At the end of the unit, there is a discussion of how lines come into play in the design of Navajo rugs. Students will explain their reasoning orally and in a paragraph.

Unit 4: Transformations
This unit offers instruction on all of the basic forms of transformation and combinations. This includes translations, reflections, rotations, and dilations. Congruence and similarity are also introduced and applied in problem solving. Students will use transformations and dilations to prove statements of congruence or similarity as they pertain to triangles and other polygons. Students explore methods to show triangle congruence and triangle similarity. Students prove various theorems involving similarity or congruence of triangles.

At the end of the unit, students will make a venn diagram to identify common properties amongst different quadrilaterals and will produce a visual representation of properties of quadrilaterals.

Unit 5: Congruent Triangles
Many geometric concepts about congruence triangles and polygons are presented in this unit. These include proofs by SAS, SSS, ASA, AAS for starters. Applications involving coordinates are also presented as well as concepts regarding equilateral and isosceles triangles. Students will use their knowledge of corresponding parts of congruent polygons to study and apply postulates and theorems related to triangle congruence.

At the end of the unit, students should be able to complete two-column proofs relating to triangle congruence, CPCTC and isosceles triangles.

Unit 6: Relationships with Triangles
More construction exercises involving line and angle bisectors, medians, altitudes, and midsegments are contained in this unit. Students will focus on presenting and proving relationships within a triangle that students will use to prove relationships within other figures.

A performance task about bicycle renting stations is offered at the close of the unit.

Unit 7: Quadrilateral and Other Polygons
Topics including angles of polygons and properties of parallelograms are in this unit. A full review of quadrilaterals with all of their properties is also contained in this unit. Students will apply triangle relationships, algebraic techniques, and methods of proof to the study of quadrilaterals.

An investigation about scissor lifts is provided at the close of the unit. Students will further their understanding by looking at the diagonals and determining which shapes have which properties with respect to the diagonals and information. Students will compile this information into one chart.

Unit 8: Similarity
Use of ratios and proportions is practiced during this unit about similar polygons, particularly triangles. The same arguments used earlier with congruence (ie. AA, SSS, and SAS) will be applied with similar triangles. Students will learn properties of ratios and proportions that are needed to study similarity. Students will learn ways to prove triangles similar using the definition of similar polygons and will find proportional relationships formed by parallel segments, and by angle bisectors within triangles.

Practice is given creating scaled drawings or models of real life objects at the end of the unit.

Unit 9: Right Triangles and Trigonometry
This unit presents explorations and lessons all regarding right triangles and their properties. The Pythagorean theorem, special right triangles, sine, cosine, tangent, and the law of sines/cosines

are all included in this unit. Students will use the Pythagorean Theorem to find missing side lengths and apply properties of 30-60-90 degree and 45-45-90 degree triangles. Students will use the ratios to find unknown lengths and angle measures in diagrams and real world situations involving angles of elevation, angles of depression, and vectors.

At the end of the unit, students can solve different scenarios involving right triangles. They will match the description to the picture and solve the missing piece of information using trigonometry. Students will then work collaboratively to analyze what each did incorrectly that led to the error.

Unit 10: Circles
This unit covers lines intersecting circles, arcs, chords, inscribed angles and polygons, angle and segment relationships in circles and circles in the coordinate plane. Students will build on their knowledge of circles by studying properties of tangents, secants, chords, and arcs. They will prove properties of tangents, establish properties of chords and their relationships to arcs. Students will also study angles formed by chords, tangents, and secants, their relationships to intercepted arcs, and the relationships among segments of intersection chords, tangents and secants.

At the end of the unit, students will be tasked to calculate the volume of a circular grain tower that sits next to a barn. Students will have to use what they learned in this and previous unit to complete the task.

Unit 11: Circumference, Area, and Volume
This unit does a more in-depth study of circles and 3-dimensional shapes which are derived from or include circles: cones, spheres, and circular pyramids. Circumference, arc length, and sectors are taught. Areas of various polygons and then volumes of prisms, cylinders, pyramids, cones and spheres are covered. Students will use Euler's Formula for faces, vertices, and edges of a polyhedron, and examine cross sections of three-dimensional figures. They will develop and apply formulas, first for surface area, and then for volume. Students will also look at the ratios of length, surface area, and volumes of similar solids, and how each ratio relates to the similarity ratio of the solid,

Volumes and surface areas of components of a water park are set up into a problem at the close of the unit.

Chapter 12: Probability
This unit contains an introduction to samples, independent vs dependent events, disjoint and overlapping events, permutations, combinations, and binomial distributions. Students will learn about the notation and language of probabilities, and the meaning of independent events. Students will use two-way tables, Venn Diagrams, and tree diagrams to help understand and solve problems.

At the end of the unit, students will use two-way tables to calculate and interpret conditional probabilities. Students will use tree diagrams to understand the sample space of experiments and compute probabilities. Students will use Venn Diagrams to represent events involving "and", "or", and "not". Students will determine the number of ways to arrange the items in a group, and the number of ways to select several objects from a larger group where the order does not matter.

~~4.~~ TIME ESTIMATES
~~4.1~~ Instructional sequences vary in length from a few days to several weeks
~~5. INSTRUCTIONAL MATERIALS~~

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~~5.1 District adopted textbooks 5.2 Supplementary and teacher-created materials that may include a career focus 5.3 Technology materials~~

COURSE MATERIALS

Authors	Copyright	Publisher	Title	Website
Larson, R. & Boswell	2019	National Geographic Learning	Big Ideas Math: Geometry	www.bigideaslearning.com

Teacher support resources can also be found in the Educational Services Website and supplemental online curriculum (for ex. Apex).

~~6.~~ EVALUATION OF STUDENT PROGRESS:
~~Students communicate mathematically and demonstrate content knowledge in a variety of ways that lead to mathematical competence in their chosen careers. 6.1 Teacher observation 6.2 Written assignments and projects 6.3 Quizzes and tests 6.4 Rubrics~~

Assessment Methods:
- Summative assessment
- Formative Assessment

Formative:
- Mathematical Discourse
- Reflection questions
- Teacher observations/evidence
- Student discussions
- Quiz
- Exit ticket

Summative:
- Performance task
- Unit Assessment

Committee Members:
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