Dover-Sherborn High School
Mathematics Curriculum
Geometry Level 1/CP

A. DESCRIPTION

This is the traditional geometry course with emphasis on the student's understanding of the characteristics and properties of two- and three-dimensional geometry. Focus areas include problem solving using visualization, spatial reasoning, and geometric modeling, coordinate geometry, transformations, and the relationship between algebraic and geometric concepts.

B. OBJECTIVES

The student should be able to:
1. restate the definitions of the basic terms used in geometry;
2. demonstrate geometric constructions;
3. solve geometric problems commensurate with his/her ability by applying the appropriate formulae or techniques,
4. develop flowchart proofs for various geometric theorems (e.g., triangle congruence and similarity), and
5. appreciate the cumulative structure of geometry.

C. OUTLINE (Common Core State Standards for Mathematics in parentheses)

1. Inductive reasoning
   a. defining and applying the process of inductive reasoning to various types of problems
   b. picture patterns
   c. finding the *n*th term of number sequences
   d. triangular numbers and patterns in geometric shapes
2. Definitions of basic geometric terms and properties
   a. defined and undefined terms [G-CO.1]
   b. lines, line segments, half-lines, rays, angles, planes, half-planes, dihedral angles [G-CO.1]
   c. right, straight, acute, obtuse angles; complementary and supplementary angles
   d. perpendicular lines and planes [G-CO.1]
   e. parallel lines and planes, skew lines [G-CO.1]
   f. bisectors of angles and segments in two or three dimensions
   g. congruence of angles and line segments
   h. coordinate geometry and the calculation of midpoints
   i. angles formed by a transversal over two parallel lines
   j. coordinate geometry and the slope of a line
   k. slope of parallel and perpendicular lines

3. Proofs of basic theorems about lines, angles, and triangles [G-CO.9, G-CO.10]
   a. vertical angles theorem
   b. alternate interior angles theorem
   c. perpendicular bisector theorem
   d. isosceles triangle theorem
4. Triangles
   a. classification
   b. angle sum theorem and its proof [G-CO.10]
   c. congruence
      (1) recognizing and identifying congruent polygons [G-CO.6, G-CO.7]
      (2) postulates and theorems for proving congruence of triangles - SSS, SAS, ASA, AAS, CPCTC [G-CO.8, G-CO.9]
      (3) overlapping triangles
   d. altitudes and medians: definitions and constructions
   e. inequalities in one and two triangles
5. Polygons
   a. recognition of convex and concave polygons
   b. derive the formula for the relationship between the number of sides and the sums of the measures of the interior and exterior angles of convex polygons [G-CO.11, G-C.3a]
   c. quadrilaterals, parallelograms, rectangles, squares, rhombuses, trapezoids: definitions and properties
      (1) proof of theorems about parallelograms: opposite sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and the diagonals of a rectangle are congruent [G-CO.11]
6. Similar polygons
   a. ratio and proportion [G-SRT.2]
   b. definition of similarity [G-SRT.2]
   c. proofs involving similar triangles - SSS, SAS, AA [G-SRT.3, G-SRT.4]
   d. ratios in similar triangles [G-SRT.2]
   e. angle bisector theorem
   f. application of ratios to altitudes, angle bisectors and medians of similar triangles [G-MG.1, G-MG. 4]
   g. geometric mean in right triangles
   h. indirect measurement using similar triangles [G-SRT.5]
   i. finding missing parts of similar geometric figures [G-SRT.5]
7. Pythagorean Theorem
   a. review of radicals
   b. distance and midpoint formulae in the coordinate plane [G-GPE.7]
   c. derivation of Pythagorean Theorem
   d. special right triangles [G-SRT.7]
   e. trigonometry of the right triangle: sine, cosine, tangent [G-SRT.6]
   f. application of trigonometry to right triangle problems [G-SRT.8]

8. Circles
   a. definitions: diameter, radius, central angle, minor arc, major arc, chord, segment, sector, semicircle, tangent, secant, inscribed and circumscribed triangles, common tangents, concentric circles, apothem [G-CO.1]
   b. theorems and calculations involving the relationships between angles (central, inscribed, and circumscribed) and arcs [G-C.2]
   c. theorems and calculations involving tangents, chords, secants [G-C.2]
   d. theorems and calculations involving arcs, arc length, and arc measure [G-C.2, G-C.5]
   e. development of the value of pi and the relation to the circumference [G-GMD.1]
   f. applicable proofs involving circles
9. Areas of polygons and circles
   a. definitions and derivations considering the area of the circle as the limiting
      case of the area of a regular polygon [G-GMD.1]
   b. calculating areas of polygons
   c. calculating the area of sectors and segments of a circle [G-C.5]
   d. calculating shaded areas
10. Volumes and surface areas
   a. defining and recognizing three-dimensional solids (prism, cylinder, pyramid, cone, sphere)
   b. recognizing projections and cross sections of solids [G-GMD.4]
   c. presentation of an informal argument for the formulas for the volume of a cylinder, pyramid, cone and sphere [G-GMD.1, G-GMD.2]
   d. calculating volume of the prism, cylinder, pyramid, cone and sphere [G-GMD.3]
   e. calculating the surface areas of prisms, cylinders, pyramids, cones and spheres
11. Constructions [G-CO.12, G-CO.13]
   a. copying segments and angles
   b. perpendicular bisectors
   c. perpendiculars
   d. angle bisectors
   e. parallel lines
   f. equilateral triangles
   g. square
   h. regular hexagon inscribed in a circle
   i. various other constructions based on those previously given (e.g. points of concurrency in triangles)
12. Transformations and Symmetry
   a. defining and recognizing transformations (isometries, rotations, reflections, translations) [G-CO.2, G-CO.3, G-CO.4, G-CO.5]

b. defining and recognizing symmetries (reflectional, rotational, transformational) [G-CO.2, G-CO.3, G-CO.4, G-CO.5]
c. defining and recognizing dilations [G-SRT.1]

13. Other topics
    a. coordinate geometry
    b. review of algebra
    c. logic
    d. flowchart thinking

D. TEXT

Geometry, Bass, Charles, Hall, Johnson, and Kennedy
(Pearson Education, Inc., 2009)
ISBN 0-13-365952-6

E. SUPPLEMENTARY MATERIAL
1. Geometer's Sketchpad
2. Computer programs
3. Web sites
4. Mathematics Teacher

Course Title: Geometry – Level 1 Grade: 9

Unit: Inductive Reasoning

Month Presented: September Unit Length (in weeks): 1-2

Essential Question(s):
- What is inductive reasoning?
- How do we use inductive reasoning to solve various types of problems?

Learning Objectives:
- Defining and applying the process of inductive reasoning to various types of problems
- Picture patterns
- Finding the nth term
- Triangular numbers

Instructional Strategies & Activities:
- Note taking
- Cooperative learning/group work
- Competitive review games

Materials Utilized:
- Textbook
- Teacher generated worksheets
- SmartBoard

Assessment Strategies:
- Daily homework
- Class participation
- Tests and quizzes

Course Title: Geometry – Level 1 Grade: 9

Unit: Definitions and basic geometric terms and properties

Month Presented: September-October Unit Length (in weeks): 2-3

Essential Question(s):

- How do we write precise definitions for geometric terms?
- How do we calculate the midpoint of two points?
- What relationships exist between angles formed by a transversal over two parallel lines?
- How do we calculate the slope of a line?
- What relationships exist between the slopes of parallel and perpendicular lines?
- How do you prove that a known theorem is true?

Learning Objectives:

- Defined and undefined terms
- Lines, line segments, rays, angles, planes
- Right, straight, acute, obtuse angles
- Complementary and supplementary angles
- Perpendicular lines and planes
- Parallel lines and planes, skew lines
- Bisectors of angles and segments in two and three dimensions
- Congruence of angles and line segments
- Coordinate geometry and the calculation of midpoints
- Angles formed by a transversal over two parallel lines
- Coordinate geometry and the slope of a line
- Slope of parallel and perpendicular lines
- The vertical angles theorem
- The alternate interior angles theorem
- The perpendicular bisector theorem
- The isosceles triangle theorem

Instructional Strategies & Activities:

- Note taking
- Cooperative learning/group work
- Competitive review games

Materials Utilized:

- Textbook
- Teacher generated worksheets
- SmartBoard

Assessment Strategies:

- Daily homework
- Class participation
- Tests and quizzes

Course Title: Geometry – Level 1 Grade: 9

Unit: Triangles

Month Presented: November - December Unit
Length (in weeks): 2-3

Essential Question(s):

- How can we classify all of the different types of triangles?
- What is the angle sum of a triangle?
- How do we write triangle congruence proofs?
- How do we define and construct altitudes and medians?

Learning Objectives:

- Classification of triangles
- The angle sum theorem
- Triangle congruence
- Defining and constructing altitudes and medians
- Inequalities in one and two triangles

Instructional Strategies & Activities:

- Note taking
- Cooperative learning/group work
- Competitive review games

Materials Utilized:

- Textbook
- Teacher generated worksheets
- SmartBoard

Assessment Strategies:

- Daily homework
- Class participation
- Tests and quizzes

Course Title: Geometry – Level 1 Grade: 9

Unit: Polygons

Month Presented: December - January Unit
Length (in weeks): 2-3

Essential Question(s):

- What are convex and concave polygons?
- What is the interior and exterior angle sum of a polygon?
- How do we define various polygons?

Learning Objectives:

- Recognizing convex and concave polygons
- Sum of the measures of the interior and exterior angles of convex polygons
- Quadrilaterals, parallelograms, rectangles, squares, rhombuses, and trapezoids: definitions and properties
- Prove theorems related to parallelograms (opposite sides are congruent, opposite angles are congruent, the diagonals bisect each other) and rectangles (the diagonals are congruent)

Instructional Strategies & Activities:

- Note taking
- Cooperative learning/group work
- Competitive review games

Materials Utilized:

- Textbook
- Teacher generated worksheets
- SmartBoard

Assessment Strategies:

- Daily homework
- Class participation
- Tests and quizzes

Course Title: Geometry – Level 1 Grade: 9

Unit: Similar Polygons

Month Presented: May - June Unit
Length (in weeks): 2-3

Essential Question(s):
- What are similar polygons?
- How do we write proofs involving similar triangles?
- How do we measure distances indirectly using similar triangles?

Learning Objectives:
- Ratio and proportion
- Definition of similarity
- Proofs involving similar polygons
- Ratios in similar triangles
- Angle bisector theorem
- Application of ratios to altitudes, angle bisectors, and medians of similar triangles
- Geometric mean in right triangles
- Indirect measurement using similar triangles
- Finding missing parts of similar geometric figures

Instructional Strategies & Activities:
- Note taking
- Cooperative learning/group work
- Competitive review games

Materials Utilized:
- Textbook
- Teacher generated worksheets
- SmartBoard

Assessment Strategies:
- Daily homework
- Class participation
- Tests and quizzes

Course Title: Geometry – Level 1 Grade: 9

Unit: Pythagorean Theorem

Month Presented: May - June Unit
Length (in weeks): 2-3

Essential Question(s):

- What is the Pythagorean Theorem?
- What is the Distance Formula?
- What special relationships exist between the side lengths of 45-45-90 and 30-60-90 triangles?

Learning Objectives:

- Review of radicals
- Distance formula in the coordinate plane
- Derivation of Pythagorean Theorem
- Special right triangles
- Trigonometry of a right triangle: sine, cosine, tangent

Instructional Strategies & Activities:

- Note taking
- Cooperative learning/group work
- Competitive review games

Materials Utilized:

- Textbook
- Teacher generated worksheets
- SmartBoard

Assessment Strategies:

- Daily homework
- Class participation
- Tests and quizzes

Course Title: Geometry – Level 1 Grade: 9

Unit: Circles

Month Presented: January - February Unit
Length (in weeks): 2-3

Essential Question(s):

- How do we write precise definitions for geometric terms relating to circles?
- What did the value of pi develop and what is its relationship to the circumference of a circle?
- How do we write proofs involving circles?

Learning Objectives:

- Definitions: diameter, radius, central angle, minor arc, chord, segment, sector, semicircle, tangent, secant, inscribed and circumscribed triangles, common tangents, concentric circles, apothem
- Theorems and calculations involving the relationships between angles and arcs
- Theorems and calculations involving tangents, chords, and secants
- Theorems and calculations involving arcs, arc length, and arc measure
- Development of the value of pi and the relation to the circumference
- Applicable proofs involving circles

Instructional Strategies & Activities:

- Note taking
- Cooperative learning/group work
- Competitive review games

Materials Utilized:

- Textbook
- Teacher generated worksheets
- SmartBoard

Assessment Strategies:

- Daily homework
- Class participation
- Tests and quizzes

Course Title: Geometry – Level 1 Grade: 9

Unit: Areas of polygons & circles

Month Presented: March - April Unit
Length (in weeks): 2-3

Essential Question(s):

- How do we calculate the area of circles?
- How do we calculate the area of various polygons?
- How do we calculate the area of sectors and segments of a circle?

Learning Objectives:

- Definitions and derivations considering the area of the circle as the limiting case of the area of a regular polygon
- Calculating areas of polygons
- Calculating the area of sectors and segments of a circle
- Calculating shaded areas

Instructional Strategies & Activities:

- Note taking
- Cooperative learning/group work
- Competitive review games

Materials Utilized:

- Textbook
- Teacher generated worksheets
- SmartBoard

Assessment Strategies:

- Daily homework
- Class participation
- Tests and quizzes

Course Title: Geometry – Level 1 Grade: 9

Unit: Volume & Surface Area

Month Presented: April - May Unit
Length (in weeks): 2-3

Essential Question(s):

- What are prisms, cylinders, pyramids, cones, and spheres?
- How do we calculate the volume of prisms, cylinders, pyramids, cones, and spheres?
- How do we calculate the volume of prisms, cylinders, pyramids, cones, and spheres?

Learning Objectives:

- Defining and recognizing three-dimensional solids (prism, cylinder, pyramid, cone, sphere)
- Recognizing projections and cross sections of solids
- Calculating volume of prisms, cylinders, pyramids, cones and spheres
- Calculating surface area of prisms, cylinders, pyramids, cones and spheres

Instructional Strategies & Activities:

- Note taking
- Cooperative learning/group work
- Competitive review games

Materials Utilized:

- Textbook
- Teacher generated worksheets
- SmartBoard

Assessment Strategies:

- Daily homework
- Class participation
- Tests and quizzes

Course Title: Geometry – Level 1 Grade: 9

Unit: Constructions

Month Presented: October - November Unit
Length (in weeks): 2-3

Essential Question(s):
- What are geometric constructions?

Learning Objectives:
- Duplicating segments and angles
- Perpendicular bisectors
- Perpendiculars
- Angle bisectors
- Parallel lines
- Equilateral Triangles
- Squares
- Regular hexagon inscribed in a circle
- Various other constructions based on those previously given (e.g., rhombus, points of concurrency in triangles)

Instructional Strategies & Activities:
- Note taking
- Cooperative learning/group work
- Competitive review games

Materials Utilized:
- Textbook
- Teacher generated worksheets
- SmartBoard

Assessment Strategies:
- Daily homework
- Class participation
- Tests and quizzes

Course Title: Geometry – Level 1 Grade: 9

Unit: Transformations & Symmetry

Month Presented: March - April Unit
Length (in weeks): 2-3

Essential Question(s):

- What is a transformation? What different types of transformations exist?
- What is symmetry? What different types of symmetry exist?
- What is a tessellation? How can different types of tessellations be classified?

Learning Objectives:

- Defining and recognizing transformations (isometries, rotations, reflections, translations)
- Defining and recognizing symmetries (reflectional, rotational, transformational)
- Defining and recognizing tessellations (monohedral, regular, semi-regular)

Instructional Strategies & Activities:

- Note taking
- Cooperative learning/group work
- Competitive review games

Materials Utilized:

- Textbook
- Teacher generated worksheets
- SmartBoard

Assessment Strategies:

- Daily homework
- Class participation
- Tests and quizzes