CURRICULUM GUIDE

Geometry Honors

CEDAR GROVE PUBLIC SCHOOLS

520 Pompton Avenue

Cedar Grove, New Jersey 07009

Approved by the Cedar Grove Board of Education

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Description

This course is a development of the concepts of Euclidian Geometry in two and three dimensions. Emphasis is placed on knowledge of the basic properties and relationships of points, lines, angles, triangles, polygons, and circles. Additional focus is placed on proof and reasoning, logic and application of real-life phenomena. Concepts regarding perimeter, area, volume of geometric figures, along with the introduction to coordinate geometry and elementary trigonometry are explored.

Prerequisites: *Algebra I* and Teacher Recommendation

UNIT 1 – Essentials of Geometry

Course Objective(s)	Student Objectives	NJ CCCS	Strands & Indicators	Suggested Timeframe (in blocks)
Establish a foundation for Geometry	• Understand the origin of Geometry from an historical perspective • Establish an understanding of Euclidean vs. Non-Euclidean Geometry **(Optional)*	4.2	A.1	1/2
Identify basic geometric figures in a the Euclidean plane and associated terminology	• Review basic geometric terminology including congruence, coplanar, etc. • Sketch all basic geometric figures with correct labels • Use appropriate notation for points, lines, planes, line segments, etc.	4.2	A.1	3
Classify angles and angle relationships	• Identify all components of an angle • Classify angles(acute, obtuse, straight, right), and determine all associated characteristics • Determine angle pair relationships and apply algebraic concepts	4.1 4.2	A,B,C A.1	3
Present concepts of proof and mathematical rigor	• Review the meaning of "congruence" • Recognize well-defined terms, postulates, axioms and constructions • Utilize the Segment and Angle Addition Postulates	4.1 4.2	A,B,C A.1	2

UNIT 2 – Reasoning and Proof

Course Objective(s)	Student Objectives	NJ CCCS	Strands & Indicators	Suggested Timeframe (in blocks)
Define inductive reasoning	• Understand the process of inductive reasoning with mathematical and real-life applications • Identify the contributions of mathematicians such as Gauss and Fibonacci **(Optional)* • Make mathematical conjectures; support true statements with examples and disprove using counterexamples	4.2 4.3	A.4 A	2
Analyze conditional statements with deductive reasoning	• Identify components of if→then statements and associated forms of statements: hypothesis, conclusion, converse, inverse, etc. • Understand the process of inductive reasoning with mathematical and real-life applications • Research the logic of Lewis Carroll and complete logic problems	4.2 4.3	A.4 A	5
Present concepts of formal proof and associated terminology	• Recall postulates, theorems, axioms • Utilize Algebraic and Geometry properties (Addition, Substitution, Transitive, etc.) in justifying steps • Establish two-column proofs with statements and reasons including Segment and Angle Theorems	4.2	A.4	5

UNIT 3 – Parallel and Perpendicular Lines

Course Objective(s)	Student Objectives	NJ CCCS	Strands & Indicators	Suggested Timeframe (in blocks)
Define parallel and perpendicular lines in the Euclidean plane	• Describe parallel, skew and perpendicular lines in a Euclidean plane • Identify angle pairs and the mathematical relationships between corresponding, alternate interior and exterior and consecutive angles pairs when parallel lines are cut by a transversal • Apply Algebraic concepts	4.1 4.2 4.3	A,B,C A.1,A.3 B.1	4
Apply concepts of proof to parallel and perpendicular lines	• Prove that lines are parallel when restricted information is given • Complete two-column proofs using theorems and postulates associated with parallel and perpendicular lines	4.1 4.2	A,B,C A.1,A.3,A.4	3
Describe parallel and perpendicular lines in the coordinate plane	• Recall all concepts associated with the coordinate plane • Review slope and equations of lines in slope-intercept form • Graph and write equations of lines in y = mx+b form • Identify the relationship between parallel and perpendicular lines	4.1 4.2 4.3	A,B,C C.1 B.1,B.2	5

UNIT 4 – Triangles

Course Objective(s)	Student Objectives	NJ CCCS	Strands & Indicators	Suggested Timeframe (in blocks)
Identify characteristics of triangles	• Review basic properties of triangles • Classify triangles by angles and sides: acute, scalene, right, etc. • Utilize the Triangle Sum Theorem and the Exterior Angle Theorem • Apply Algebra to Geometric concepts	4.1 4.2 4.3	A,B,C C B.1	3
Analyze isosceles and equilateral triangles	• Recognize criteria needed to classify triangles as isosceles or equilateral • Solve algebraic problems associated with isosceles and equilateral triangles	4.1 4.2 4.3	A,B,C A.1,A.3 B.1	3
Introduce criteria for proving triangles congruent	• Understand appropriate use of the four Triangle Congruence Theorems: SAS, SSS, ASA, AAS • Recall previous properties and postulates that may contribute to two-column proofs for congruent triangles • Use the Congruence Theorems to prove triangles congruent • Utilize CPCTC in proving corresponding triangle parts congruent	4.2	A.1,A.3,A.4	4

UNIT 5 – Relationships within Triangles

Course Objective(s)	Student Objectives	NJ CCCS	Strands & Indicators	Suggested Timeframe (in blocks)
Introduce the midsegment of a triangle in the Euclidean and coordinate plane	• Identify the midsegment and its properties • Solve algebraic problems utilizing the midsegment	4.1 4,2	A,B,C A.1,A.3,C.1	1
Describe the perpendicular and angle bisectors in a triangle	• Draw perpendicular bisectors and understand its characteristics • Use perpendicular bisectors to determine the circumcenter and real-life applications • Draw angle bisectors and understand its characteristics • Use perpendicular bisectors to determine the incenter and real-life applications	4.1 4.2	A,B,C A.1,A.3,A.4	3
Describe the median and altitude in a triangle	• Draw median and understand its characteristics • Use medians to determine the centroid and real-life applications • Draw altitudes and understand its characteristics • Use altitudes to determine the orthocenter and real-life applications	4.1 4.2 4.1 4.2	A,B,C A.1,A.3,A.4 A,B,C A.1,A.3,A.4	3

Introduce Inequality relationships in Triangles	• Identify the "longest" side and connect to the "largest" angle • Determine the range of possible values for a missing side of a triangle • Compare sides and angles of two triangles	4.1 4.2	A,B,C A.1,A.3,A.4	3

UNIT 6 – Similarity and Ratio

Course Objective(s)	Student Objectives	NJ CCCS	Strands & Indicators	Suggested Timeframe (in blocks)
Introduce ratio and proportion	• Review fractions, ratio and proportions using various units: lengths, weights, monetary units, area, etc. • Find the geometric mean between two numbers • Use proportions to solve geometric problems • Investigate the Golden Ratio and its applications to several different disciplines **(Optional)*	4.1	A,B,C	3 *5 with optional concept
Introduce the concept of similarity between triangles and polygons	• Describe corresponding sides and angles between two similar figures • Use proper notation for similarity • Incorporate algebraic manipulation into proportions • Explore Fractal Geometry **(Optional)*	4.1 4.2	A,B,C A.1,A.3,A.4, E.1	3 *5 with optional concept
Apply concepts of proof to Similar Triangles	• Utilize the AA, SSS and SAS Similarity Theorems in two-column proofs to formally prove that two triangles are similar • Connect concepts to real-life applications	4.1 4.2	A,B,C A.1,A.3,A.4, B.4,E.1	3

UNIT 7 – Right Triangles

Course Objective(s)	Student Objectives	NJ CCCS	Strands & Indicators	Suggested Timeframe (in blocks)
Present the Pythagorean Theorem	• Understand the development of and the historical significance of the Pythagorean Theorem • Demonstrate algebraic and geometric proof of the Pythagorean Theorem • Utilize a^2 + b^2 = c^2 to solve for the missing sides of a right triangle • Derive the Distance Formula using the Pythagorean Theorem • Review simplifying radicals	4.1 4.2	A,B,C A.1,A.3,A.4, C.1,E.1	4
Analyze Special Right Triangles	• Develop quick methods for finding the missing sides in 45 – 45 – 90 and 30 – 60 – 90 triangles • Recognize special triangles in multi-figure exercises • Solve standardized test problems associated with these triangles	4.1 4.2	A,B,C A.1,A.3,A.4, E.1	6
Introduce Right Triangle Trigonometry	• Review the three basic trigonometric functions: sin, cos, tan • Solve for missing variable using sin, cos, tan • Utilize basic trigonometric identities • Set up equations using trigonometric functions to apply to real-life situations	4.1 4.2	A,B,C A.1,A.3,A.4, E.1	5

UNIT 8 – Polygons and Quadrilaterals

Course Objective(s)	Student Objectives	NJ CCCS	Strands & Indicators	Suggested Timeframe (in blocks)
Identify characteristics of polygons and associated terminology	• Review basic properties of polygons • Classify polygons as equilateral, equiangular, regular, etc. • Understand the difference between convex and concave • Identify vertices, sides and diagonals	4.2	A.1,A.3	1
Introduce quadrilaterals	• Recall properties of quadrilaterals: i.e. four sides, angle measures add to 360 degrees • Distinguish between quadrilaterals	4.1 4.2	A,B,C A.1,A.3	3
Analyze various quadrilaterals	• Establish criteria for naming a specific quadrilateral • Review trapezoids and isosceles trapezoids and all associated characteristics • Identify parallelograms and all figures in its "family" • Review properties of a kite • Utilize formulas for area for each quadrilateral • Create conditional statements connecting two of more quadrilaterals and analyze the way a quadrilateral is classified	4.1 4.2	A,B,C A.1,A.3,A.4	5

UNIT 9 – Transformations

Course Objective(s)	Student Objectives	NJ CCCS	Strands & Indicators	Suggested Timeframe (in blocks)
Introduce translations and vectors	• Recall terminology and appropriate notation with transformations • Apply translations to drawing 3D geometric figures • Use vectors to translate points in the coordinate plane • Understand component form of vectors • Recognize use of vectors in physics applications **(Optional)*	4.1 4.2	A,B,C A.1,A.2,A.3, B.2,C.2	3
Analyze reflections and rotations	• Identify characteristics of reflections and rotations in the Euclidean plane • Develop ideas about symmetry in various geometric figures and real-life objects • Apply concepts of reflections and rotations to the coordinate plane • Recognize use of reflections and rotations in games such as mini-golf and billiards **(Optional)*	4.1 4.2	A,B,C A.1,A.3,B.2,	4 *6 with optional concept
Present concepts and applications of combinations of transformations	• Perform multiple transformations on figures in the Euclidean and coordinate planes • Explore tessellations and associated properties • Investigate the work of MC Escher **(Optional)*	4.1 4.2	A,B,C A.1,A.2,A.3, B.3	3 *5 with optional concept

UNIT 10 – Circles

Course Objective(s)	Student Objectives	NJ CCCS	Strands & Indicators	Suggested Timeframe (in blocks)
Identify basic characteristics of circles and associated terminology	• Review basic components of circles including radius, diameter, chords, etc. • Identify tangent and secant lines and all properties	4.2	A.1,A.3	1
Establish relationships between line segments in circles	• Review chords, central angles and inscribed angles • Develop formulas for finding lengths of segments in a circle	4.1 4.2	A,B,C A.1,A.3	3
Present methods of finding sector area and perimeter	• Recall formulas for area and circumference • Understand arc measure and arc length • Review ratio and proportion	4.1 4.2	A,B,C A.1,A.3	5
Introduce circles in the coordinate plane	• Sketch circles in the coordinate plane • Write the equation for a circle based on radius and center of the circle	4.1 4.2 4.3	A,B,C A.1,A.3 B.1	2
Find area and probability using multiple figures	• Determine relationships between figures that are inscribed in circles or circumscribed by circles • Use methods of subtraction to find shaded area • Apply concepts of probability in mathematics and real-life situations	4.1 4.2	A,B,C A.1,A.3	4

UNIT 11 –Area and Volume

Course Objective(s)	Student Objectives	NJ CCCS	Strands & Indicators	Suggested Timeframe (in blocks)
Introduce area of various polygons	• Review properties of regular and non-regular polygons • Recognize patterns in the total number of degrees in a polygon and degree of each angle in a regular polygon • Compute area of polygons	4.1 4.2	A,B,C A.1,A.3,B.2, E.1,E.2	3
Present Three-Dimensional Figures	• Classify 3D figures as prisms, cones and pyramids • Understand all terminology associated with 3D figures (lateral face, net, edge, etc.) • Analyze 3D figures in the real world • Discuss concepts in Topology *(*Optional)*	4.1 4.2	A,B,C A.1,A.3,B.2, E.1,E.2	3 *4 with optional concepts
Generate formulas for Surface Area and Volume	• Find surface area and volume of right prisms, cones and pyramids • Analyze the relationship between volume and surface area of various 3D figures • Investigate biological connections between surface area and volume in living organisms *(*Optional)* • Investigate Modular Origami *(*Optional)*	4.1 4.2	A,B,C A.1,A.3,B.2, E.1,E.2	5 *7 with optional concepts

RESOURCES

- **Textbook**: *Geometry*
  Larson, Boswell, Kanold, Stiff
  McDougal Littell, 2008

- **Supplementary Materials**

  - **Workbooks**

    Chapter Guides, Transparencies, and Openers
    Geometry Series
    Larson, Boswell, Kanold, Stiff
    McDougal Littell, 2008

    Chapter Guides, Transparencies, and Openers
    Geometry Series
    Bass, Hall, Johnson, Wood
    Prentice Hall, 1998

  - **Videos**

    Donald Duck in Mathemagic Land. Disney Mini Classics. 1959

    Fractals: An Animated Discussion. Films for the Humanities and Sciences. 1997

    Spies and Code Breaking. MPI Home Video. 1997

    The Fantastic World of MC Escher. International and MC Escher Foundation. 1994.

    All videos included in the McDougal Littell *Geometry* Series. 2008

  - **Websites**

    www.classzone.com This site is used as a resource in conjunction with the McDougal Series and includes an online version of the textbook, workbook problems, interactive tutorials and parental resources

www.algebrahelp.com Contains online tutorials and practice quizzes from Algebra I

www.cut-the-knot.com This site is a thorough resource for tutorials and interactive programs for all branches of math

www.goldenratio.net Sources for a number of topics connected to the Golden Ratio

www.tessellations.org Detailed examples of how

- **Technology (Software/Equipment)**
  Geometer's Sketchpad
  Winplot
  Various Online Tutorials/Animations
  Smartboard© Technology
  CD Roms, Power Point Presentations and Worksheet Generator Programs associated with the McDougal Littell *Geometry* Series
  CD Roms, Power Point Presentations and Worksheet Generator Programs associated with the Prentice Hall *Geometry* Series

- **Calculators**
  TI-83 with associated software and programs

- **Additional Teacher Resources**

Bass, et. al. Geometry. Prentice Hall, 1998.

Clark, Barry. Official Mensa Puzzle Book Series. Sterling Publishing Company. 2003.

DeCordova, Chris. The Tessellations Files. Tarquin Publications. 1999.

DeVilliers, Michael D. Rethinking Proof with Geometer's Sketchpad. Key Curriculum Press. 2003.

Edward, Mervine. Preparing for the HSPA: Mathematics Coach. Triumph Learning. 2002.

Franco, Betsy. Unfolding Mathematics with Unit Origami. Key Curriculum Press. 1999.

Larson, et. al. Geometry. McDougal Littell, 2001.

Livio, Mario. The Golden Ratio. Broadway Books. 2002.

Lumpkin, Beatrice. Geometry Activities from Many Cultures. Walch. 1997.

Pappas, Theoni. The Joy of Mathematics. Wide World. 1989.

Perl, Terri. Women and Numbers. Wide World. 2003.

Primiami, A. Rose and William Caroscio. New Jersey HSPA Comprehensive Review. Prentice Hall. 2006.

Smith, Sanderson. Agnesis to Zeno. Key Curriculum Press. 1996.

NCTM Newsletter and Articles via NCTM website

Mathematics Teacher Magazine. NCTM. 2003 – 2008.

DIMACS at Rutgers (annual mathematics teaching conference)

Activities

- Lecture
- Class discussions
- Student presentations
- Cooperative Learning structures
- Guided practice
- Technology infusion
- Learning Styles activities
- Brain-based activities
- Differentiated Instruction
- Homework review
- State and National Standardized Test Preparation:
    - HSPA
    - SAT
    - ACT

Assessment

- Tests
- Quizzes
- Homework
- In-Class assignments
- Presentations
- Class participation
- Midterm/final exams