GEOMETRY
GRADES 9-12

THE EWING PUBLIC SCHOOLS
2099 Pennington Road
Ewing, NJ 08618

Board Approval Date: December 16, 2019 Michael Nitti
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In accordance with The Ewing Public Schools' Policy 2230, Course Guides, this curriculum has been reviewed and found to be in compliance with all policies and all affirmative action criteria.

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COURSE DESCRIPTION AND RATIONALE

While 'geometry' originally comes from Greek meaning 'measuring the Earth', the mathematics of geometry has developed into one of the most practical and useful areas of mathematics over the last 2300 years.

Simply put, geometry is the study of the size, shape and position of two-dimensional shapes and three-dimensional figures. However, geometry is used daily by almost everyone. In geometry, one explores spatial sense and geometric reasoning. Geometry is found everywhere: in art, architecture, engineering, robotics, land surveys, astronomy, sculptures, space, nature, sports, machines, cars and much more. Geometry is linked to many other topics in math, specifically measurement and is used daily by architects, engineers, architects, physicists and land surveyors just to name a few.

When taking geometry, spatial reasoning and problem-solving skills will be developed. While the focus of this course will start on shapes, the course will moving to solids, studying their properties and relationships. As students move through this course, their abstract thinking will be developed, geometry will become much more about analysis and reasoning.

As this course develops, there is a focus on analyzing properties of two and three dimensional shapes, reasoning about geometric relationships and using the coordinate system. Studying geometry provides many foundational skills and helps to build the thinking skills of logic, deductive reasoning, analytical reasoning and problem solving to name just a few.

The Ewing Public Schools' Math Vision

The Ewing Public Schools will deliver an instructional program in mathematics where students are actively engaged in the discovery of math concepts and are applying these concepts in ways that they find meaningful and relevant.

Ewing students will be mathematical thinkers who can reason, communicate and solve problems.

Ultimately, Ewing students will master and will be able to utilize these math concepts and skills throughout their lives.

21st Century Skills - During this course, students will work on developing, to an age appropriate level, the following 21st century skills:

Career Readiness Pathways:

- CRP2. Apply appropriate academic and technical skills.
- CRP4. Communicate clearly and effectively and with reason.
- CRP6. Demonstrate creativity and innovation.
- CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
- CRP12. Work productively in teams while using cultural global competence.

Learning and Innovation Skills

Creativity and Innovation

Think Creatively

- Elaborate, refine, analyze and evaluate their own ideas in order to improve and maximize creative efforts

Work Creatively with Others

- View failure as an opportunity to learn; understand that creativity and innovation is a long-term, cyclical process of small successes and frequent mistakes

CRITICAL THINKING AND PROBLEM SOLVING

Reason Effectively

- Use various types of reasoning (inductive, deductive, etc.) as appropriate to the situation

Use Systems Thinking

- Analyze how parts of a whole interact with each other to produce overall outcomes in complex systems

Make Judgments and Decisions

- Effectively analyze and evaluate evidence, arguments, claims and beliefs
- Synthesize and make connections between information and arguments
- Interpret information and draw conclusions based on the best analysis

Solve Problems

- Identify and ask significant questions that clarify various points of view and lead to better solutions

COMMUNICATION AND COLLABORATION

Communicate Clearly

- Articulate thoughts and ideas effectively using oral, written and nonverbal communication skills in a variety of forms and contexts
- Listen effectively to decipher meaning, including knowledge, values, attitudes and intentions
- Use communication for a range of purposes (e.g. to inform, instruct, motivate and persuade)
- Utilize multiple media and technologies, and know how to judge their effectiveness a priori as well as assess their impact
- Communicate effectively in diverse environments (including multi-lingual)

Collaborate with Others

- Assume shared responsibility for collaborative work, and value the individual contributions made by each team member

Information, Media, and Technology Skills

Informational Literacy

Access and Evaluate Information

- Evaluate information critically and competently

Use and Manage Information

- Use information accurately and creatively for the issue or problem at hand

Life and Career Skills

Social and Cross-Cultural Skills

Interact Effectively with Others

- Know when it is appropriate to listen and when to speak

Work Effectively in Diverse Teams

- Respond open-mindedly to different ideas and values

Be Responsible to Others

- Act responsibly with the interests of the larger community in mind

Technology Integration

8.1 Educational Technology
All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and create and communicate knowledge.

ELA Integration:

SL.9-10.1. Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with peers on *grades 9–10 topics, texts, and issues,* building on others' ideas and expressing their own clearly and persuasively.

A. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.
B. Collaborate with peers to set rules for discussions (e.g. informal consensus, taking votes on key issues, presentation of alternate views); develop clear goals and assessment criteria (e.g. student developed rubric) and assign individual roles as needed.
C. Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions.
D. Respond thoughtfully to various perspectives, summarize points of agreement and disagreement, and justify own views. Make new connections in light of the evidence and reasoning presented.

SL.9-10.3. Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, identifying any false reasoning or distorted evidence.

SL.9-10.4. Present information, findings, and supporting evidence clearly, concisely, and logically. The content, organization, development, and style are appropriate to task, purpose, and audience

UNIT 1: THE LANGUAGE OF GEOMETRY (6 DAYS)

Why Is This Unit Important?

This introductory unit will serve to develop the basic terminology and tools used throughout the course in geometry. The big idea embedded through this unit is:

- Patterns lead to inductive reasoning and conjectures

Enduring Understandings: Students will understand:

- How to find and describe patterns
- How to use observed patterns and inductive reasoning to make real-life conjectures
- How to draw models of points, lines, planes, colinear and coplanar points, intersecting lines and planes
- How to find the distance and midpoint between two points
- How to identify and use congruent segments
- How to use terminology to solve problems involving angles and angle pairs

Essential Questions:

- What is a conjecture? What is a counterexample? How are the two related?
- How are colinear and coplanar points similar? How do they differ?
- What is the distance between points 'A' and 'B' on the map?
- What does congruent mean in geometry?
- What does adjacent mean in terms of everyday life? In geometry?
- What does complementary mean in terms of everyday life? In geometry?
- What does supplementary mean in terms of everyday life? In geometry?

Acquired Knowledge: After studying the material of this unit, the student should be able to:

- Identify ordered pairs
- Differentiate between points, line segments, lines, and planes
- Identify the parts of an angle
- Differentiate between acute, obtuse and right angles
- Define congruent
- Define adjacent
- Differentiate between complementary and supplementary

Acquired Skills: After studying the material of this unit, the student should be able to:

- Find and describe patterns
- Make real-life conjectures and attempt to refute them with counter-examples
- Graph ordered pairs
- Draw line segments, lines and planes
- Identify colinear points
- Identify coplanar points
- Find the distance of a line segment
- Find the midpoint of a line segment
- Identify and use congruent segments
- Solve problems involving angles and angle pairs

Differentiation:

Enrichment:

- Add segments and rays using segment addition and angle addition postulates.

Supplement:

- Exploring Intersections activity
- Kinds of Angles activity
- Geometry Scavenger Hunt
- Segment Bisectors activity
- Drawing in Perspective Project

Assessments:

Formative Assessments:

- Assessment Checklist for Identifying Congruency
- Assessment Checklist for Solving for Distance and Midpoint
- Teacher's observation of students at work; anecdotal records
- Individual conferences and group discussions
- Students' recording sheets

Summative Assessments:

- Teacher's observation of students at work
- Individual conferences
- Chapter Assessments

Benchmarks

- Language of Geometry Assessment

Alternative Assessments:

- Modified tasks and assessment rubrics
- Performance-based assessment tasks

List of Applicable New Jersey Student Learning Standards Covered in This Unit:

- NJSLS. G-CO-1, 9 and 12
- NJSLS.G-GPE-6
- NJSLS.MP.1-8

Suggested Learning Experiences and Instructional Activities:

Anticipatory Sets:

- Identify and repeat patterns to lengthen objects
- Making a Conjecture activity
- Exploring Undefined Terms
- Identifying Angles Around Us

In-Class Activities:

- Folding Bisectors
- Angles and Intersecting Lines

Technology:

- Geometric Constructions using Geometer Sketchpad

Websites:

- Geometric construction: http://www.absorblearning.com/mathematics/demo/units/KCA006.html#Equidistance
- Animated Geometric Constructions: http://www.mathsisfun.com/geometry/constructions.html
- Interactive Constructions: http://www.mathsnet.net/campus/construction/index.html
- Geometry Website for Teachers: http://www.mathsnet.net/geometry/index.html
- Virtual Manipulatives: http://nlvm.usu.edu/en/nav/category_g_4_t_3.html

UNIT 2: REASONING AND INTRODUCTION TO PROOF (6 DAYS)

Why Is This Unit Important?

Part of The Ewing Public Schools Math Vision is to facilitate the development of mathematical thinkers. This unit will provide students with an arsenal of tools, strategies, and processes to focus their reasoning in order to move from observed data to solving problems. The big idea embedded through this unit is:

- Conclusions should be based on sound reasoning

Enduring Understandings: Students will understand:

- How to write a conditional statement in an "if-then" form
- How to write the inverse, converse, and contrapositive of a conditional statement
- How to write a biconditional statement
- How to form a conclusion by applying the laws of logic
- How to use the algebraic properties of equality in geometric proofs
- How to justify statements about congruent segments
- How to use angle congruence properties
- How to prove properties of special pairs of angles

Essential Questions:

- What does the term 'condition' imply?
- What does inverse mean in terms of everyday life? In geometry?
- What does converse mean in terms of everyday life? In geometry?
- In this unit we have learned laws, properties, theorems, and postulates. How do they differ? What are some of there commonalities?

Acquired Knowledge: After studying the material of this unit, the student should be able to:

- Identify the hypothesis and conclusion of an "if-then" statement
- Differentiate between an inverse, converse, and contrapositive statement.
- Use symbolic notation to represent logical statements.
- Know the Law of Detachment
- Know the Law of Syllogism
- Know the following properties:
    - Addition Property
    - Subtraction Property
    - Multiplication Property
    - Division Property
    - Reflexive Property
    - Symmetric Property
    - Transitive Property
    - Substitution Property
- Know the following theorems:

- Segment Congruence
- Angle Congruence
- Congruent Complements
- Congruent Supplements
- Vertical Angles Theorem

Acquired Skills:

- Understand how to rewrite, illustrate, and link postulates
- Use symbolic notation to represent logical statements.
- Apply the laws of logic
- Differentiate between the following algebraic properties of equality: Addition Property, Subtraction Property, Multiplication Property, Division Property, Reflexive Property, Symmetric Property, Transitive Property, and Substitution Property
- Apply the reflexive, symmetric, and transitive properties of segment congruence
- Apply the reflexive, symmetric, and transitive properties of angle congruence
- Apply the Congruent Complements Theorem
- Apply the Congruent Supplements and its reverse the Linear Pair Postulate

Differentiation:

Enrichment:

- Use the Midpoint Theorem and the Angle Bisector theorem
- Plan and write a proof in two-column form

Supplement:

- Student designed logic puzzles

Assessments:

Formative Assessments:

- Assessment Checklist for Angle Congruency
- Assessment Checklist for Bi-Conditional Statements
- Teacher's observation of students at work; anecdotal records
- Individual conferences and group discussions
- Students' recording sheets

Summative Assessments:

- Teacher's observation of students at work
- Individual conferences
- Chapter Assessments

Benchmarks

- Reasoning and Introduction to Proof Assessment

Alternative Assessments:

- Modified tasks and assessment rubrics
- Performance-based assessment tasks

List of Applicable New Jersey Student Learning Standards Covered in This Unit:

NJSLS. G-CO-9
NJSLS.MP.1-8

Suggested Learning Experiences and Instructional Activities:

Anticipatory Sets:

- Dante II robotics application
- Lewis Carroll Logic Puzzle

In-Class Activities:

- Logic Puzzles
- Investigating Complimentary Angles activity
- Addition of vectors (e.g., treasure hunt)
- Web based Vector activity
- Complete a Force Table lab to show the sum of forces in equilibrium.

Technology:

- Investigating Supplementary Angles with Geometer Sketchpad

Websites:

- Reasoning and Proof Flashcards: http://quizlet.com/367349/chapter-2-geometry-reasoning-and-proof-flash-cards/

UNIT 3: PERPENDICULAR AND PARALLEL (5 DAYS)

Why Is This Unit Important?

In order to analyze shapes, we must begin with the line segments and angles formed by them. This unit will enable students to develop understanding about the relationships developed when line segments transverse each other. These relationships will be crucial as we move to analyzing shapes and figures. The big idea embedded through this unit is:

- Lines and their properties and intersections provide the foundations for geometry

Enduring Understandings: Students will understand:

- Relationships between pairs of angles formed by two lines and a transversal.
- The properties of parallel lines and how they can be used to determine angle measures.
- The angle conditions that produce parallel lines
- How to prove two lines are parallel based on given angle relationships
- How to calculate the slope of a line and identify parallel and perpendicular lines

Essential Questions:

- What does parallel mean in terms of everyday life? In geometry?

Acquired Knowledge: After studying the material of this unit, the student should be able to:

- Differentiate between parallel lines and skew lines.
- Know the following postulates:
    - Parallel Postulate
    - Perpendicular Postulate
- Differentiate between the following angles:
    - Corresponding
    - Alternate Interior
    - Alternate Exterior
    - Consecutive Interior
- Know the Corresponding Angles Postulate
- Know the following theorems:
    - Alternate Interior Angles
    - Consecutive Interior Angles
    - Alternate Exterior Angles
    - Perpendicular Transversal
- Know the Corresponding Angles Converse Postulate
- Know the following theorems:
    - Alternate Interior Angle Converse
    - Consecutive Interior Angles Converse

    - Alternate Exterior Angles Converse
- Find the slope of a line

Acquired Skills:

- Convert a paragraph proof into a flow proof
- Prove the following theorems:
    - Alternate Interior Angles
    - Consecutive Interior Angles
    - Alternate Exterior Angles
    - Perpendicular Transversal
- Prove the following theorems:
    - Alternate Interior Angle Converse
    - Consecutive Interior Angles Converse
    - Alternate Exterior Angles Converse
- Determine if two lines are parallel
- Determine of two lines are perpendicular
- Find the slope of a perpendicular line
- Write the equation of a perpendicular line

Differentiation:

Enrichment:

- Apply the theorems of angles formed by transversal lines to triangles and polygons

Supplement:

- Lines in Space activity
- Intersecting Lines activity
- Parallel Lines and Angles activity
- Constructing a Perpendicular to a Line activity
- What's the Angle game

Assessments:

Formative Assessments:

- Assessment Checklist for Parallel
- Assessment Checklist for Perpendicular
- Teacher's observation of students at work; anecdotal records
- Individual conferences and group discussions
- Students' recording sheets

Summative Assessments:

- Teacher's observation of students at work
- Individual conferences
- Chapter Assessments

Benchmarks

- Perpendicular and Parallel Assessment

Alternative Assessments:

- Modified tasks and assessment rubrics
- Performance-based assessment tasks

List of Applicable New Jersey Student Learning Standards Covered in This Unit:

- NJSLS G-CO-9, 12
- NJSLS.G-GPE-5
- NJSLS.MP.1-8

Suggested Learning Experiences and Instructional Activities:

Anticipatory Sets:

- Identify objects composed of parallel lines in the classroom. Do these objects need to be structured this way? Why or why not?
- Identify objects composed of perpendicular lines in the classroom. Do these objects need to be structured this way? Why or why not?

In-Class Activities:

- Constructing a Perpendicular Line activity
- Forming a Flow Proof activity
- Parallel Lines and Angles activity
- Copying an Angle activity
- Constructing Parallel Lines activity
- Investigating Slopes of Perpendicular Lines activity

Technology:

- Parallel Lines and Slope with Geometer Sketchpad

Websites:

- Videos on Parallel and Perpendicular Lines: http://www.youtube.com/watch?v=Rew54K6mYUo
- Tutorial on Transversals: http://algebralab.org/lessons/lesson.aspx?file=Geometry_AnglesParallelLinesTransversals.xml
- Transversals Flashcards: http://quizlet.com/3313552/geometry-chpt-3-transversals-flash-cards/

UNIT 4: TRIANGLES (25 DAYS)

Why Is This Unit Important?

Since triangles are among the simplest of two-dimensional shapes, they provide a canvas to pull together the relationships between line intersection angles and constructed shapes. While some of the processes and strategies learned in this unit will only be applicable to triangles (in many cases special triangles), the foundation of these processes will provide the building blocks to analyze and assess more complex shapes and even three-dimensional structures. The big ideas embedded in this unit are:

- We can use right triangles to help us measure large objects or distances indirectly.
- Angles of elevation and depression are needed to help solve indirect measurement problems.

Enduring Understandings: Students will understand:

- Triangle classification
- How to apply angle sum and exterior angle theorems
- Congruent triangle identification
- Testing for triangle congruence using SAS, SSS, ASA, AAS and HL
- Properties of isosceles and equilateral triangles
- Medians, altitudes, angle bisectors and perpendicular bisectors in a triangle
- Congruence test for right triangles
- Application of properties of inequalities to the measure of segments and angles
- Application of triangle inequality theorem
- Uses of SSS and SAS inequality theorems
- Geometric mean
- Relationships between parts of a right triangle and the altitude to the hypotenuse
- The Pythagorean theorem and its converse
- Properties of a 45-45-90 and 30-60-90 triangles
- Trigonometric relationships from right triangles
- Values of trigonometric ratios or measures of angles

Essential Questions:

- What defines a 'triangle'?
- How can you pout these strategies to use on intersections where triangles do not exist?
- What is the purpose of right triangles in our world?

Acquired Knowledge: After studying the material of this unit, the student will know:

- Triangle classifications
- Properties of Isosceles and Equilateral triangles
- Pythagorean theorem
- Distance formula
- Triangle congruency
- Angle bisectors
- Perpendicular bisectors
- Reflection and lines of symmetry
- Trigonometric relations:
    - Sine
    - Cosine
    - Tangent
- Law of sines
- Law of cosines

Acquired Skills: Students will be able to:

- Classify triangles by their sides and angles
- Find angle measures of triangles
- Use properties of Isosceles and Equilateral triangles
- Use the Pythagorean theorem and distance formula
- Use side lengths to classify triangles
- Identify medians in a triangle
- Use triangle measurements to decide which side is longest and which angle is largest
- Identify congruent triangles and congruent parts
- Show triangles are congruent
- Use angle bisector and perpendicular bisectors
- Identify and use reflection and lines of symmetry
- Find the side lengths of special right triangles
- Use trigonometry to solve a right triangle
- Identify and use relationships between sides and angles of a triangle
- Solve triangles using the law of sines and law of cosines

Differentiation:

Enrichment:

- Prove two triangles are congruent by first proving two other triangles are congruent

Supplement:

- Areas and Right Triangles activity
- Side Lengths of Triangles activity
- Intersecting Medians activity
- Picture It game
- Congruent triangles activity
- Investigating Congruence activity
- Investigating Bisectors activity
- Investigating Reflections activity
- Mirror Reflections game
- Special Right Triangles activity
- Right Triangle Ratio activity
- Right Triangle Bingo game

Assessments:

Formative Assessments:

- Assessment Checklist for Right Triangles
- Assessment Checklist for Congruence
- Assessment Checklist for Reflection
- Teacher's observation of students at work; anecdotal records
- Individual conferences and group discussions
- Students' recording sheets

Summative Assessments:

- Teacher's observation of students at work
- Individual conferences
- Chapter Assessments

Benchmarks

- Triangles Assessment

Alternative Assessments:

- Modified tasks and assessment rubrics
- Performance-based assessment tasks

List of Applicable New Jersey Student Learning Standards Covered in This Unit:

- NJSLS. G-CO 2, 4, 5, 7, 8, 10 & 12
- NJSLS.G-SRT 1-11
- NJSLS.G-GPE 7
- NJSLS.MP.1-8

Suggested Learning Experiences and Instructional Activities:

Anticipatory Sets:

- Placing Figures in a Coordinate Plane
- Perpendicular Through a Point in a Line construction
- Perpendicular Bisectors of a Triangle construction

In-Class Activities:

- Investigating Areas of Triangles activity
- Investigating Congruent Triangles activity
- Copying a Triangle Construction
- Investigating Triangles and Congruence activity
- Investigating Perpendicular Bisectors activity
- Investigating Special Right Triangles activity

Technology:

- Using Geometer Sketchpad:

Websites:

- Triangle Explorer: http://www.shodor.org/interactivate/activities/TriangleExplorer/
- Triangle Flashcards: http://quizlet.com/1410203/geometry-ch-4-flash-cards/
- Properties of Kites: http://www.keymath.com/x3329.xml
- Interactive Pythagorean Theorem: http://standards.nctm.org/document/eexamples/chap6/6.5/index.htm#applet
- Virtual Manipulatives: http://nlvm.usu.edu/en/nav/category_g_4_t_3.html

UNIT 5: TWO-DIMENSIONAL GEOMETRY (20 DAYS)

Why Is This Unit Important?

In this unit the foundations laid in the study of lines, their transversals, and triangles are expanded to encompass any two-dimensional shape. Likewise the analysis and processes learned in this unit will be expanded to analyze three-dimensional figures. Indeed one critical process in studying three-dimensional figures is to break them into two-dimensional nets to employ all the strategies and processes mastered throughout this unit. The big ideas embedded in this unit are:

- Polygons and their angles are useful for solving problems in architecture, construction, plumbing, engineering, landscaping, etc.
- Two-dimensional objects help us to analyze various parts of three-dimensional objects in the real world.

Enduring Understandings: Students will understand:

- The conditions that ensure that a quadrilateral is a parallelogram
- Properties of a rectangle, rhombus, square and trapezoid
- Classify of quadrilaterals
- Properties of similar figures
- How to calculate perimeter of plane figures
- How to calculate areas of plane figures

Essential Questions:

- What does 'polygon' mean? Are their commonalities and trends found in the names of differing polygons? What ways would you suggest for naming them?
- Are there trends observed between the number of sides in a polygon and the number of angles within the polygon?
- Are there trends observed between the size of the sides in a polygon and the size of the angles within the polygon?
- Are there trends observed between the number of sides in a polygon and the size of the angles within the polygon? How about the reverse?
- How do architects and landscapers use symmetry?
- Why do we study two-dimensional objects when we study in a three-dimensional world?

Acquired Knowledge: After studying the material of this unit, the student will know:

- Classifications of polygons
- Properties of parallelograms and special parallelograms
- Properties of trapezoids
- Similarity
- Triangle proportional theorem and its converse
- Dilation
- Perimeter of a polygon
- Identification of interior and exterior angles of a polygon
- Area of plain figures

Acquired Skills: Students will be able to:

- Identify and classify polygons
- Find angle measures of quadrilaterals
- Use properties of parallelograms and special parallelograms
- Use properties of trapezoids
- Use ratios and proportions
- Identify similar polygons
- Show that two triangles are similar
- Use the triangle proportional theorem and its converse
- Identify and draw dilations
- Find the perimeter of a polygon
- Find the measures of interior and exterior angles of a polygon
- Find the area of plain figures

Differentiation:

Enrichment:

- Identify and apply the use of image, pre-image, mapping, isometry, and congruence mapping

Supplement:

- Investigating Parallelograms activity
- Making Parallelograms activity
- Midsegment of a Trapezoid activity
- Conjectures About Similarity activity
- Dilations Using Coordinates activity
- Tangrams
- Angle Sum of Polygons activity
- Finding Areas of Triangles activity
- Area of Similar Triangles activity
- Designing a Park project

Assessments:

Formative Assessments:

- Assessment Checklist for Properties of 2-dimensinal figures
- Assessment Checklist for Solving for Perimeter
- Assessment Checklist for Area
- Teacher's observation of students at work; anecdotal records
- Individual conferences and group discussions
- Students' recording sheets

Summative Assessments:

- Teacher's observation of students at work
- Individual conferences
- Chapter Assessments

Benchmarks

- 2-Dimensional Geometry Assessment

Alternative Assessments:

- Modified tasks and assessment rubrics
- Performance-based assessment tasks

List of Applicable New Jersey Student Learning Standards Covered in This Unit:

- NJSLS. G-CO 2-6 & 11-13
- NJSLS.G-GPE 4, 7
- NJSLS.MP.1-8

Suggested Learning Experiences and Instructional Activities:

Anticipatory Sets:

- Classifying Shapes
- Investigating Properties of Parallelograms construction
- Making Conjectures About Similarity

In-Class Activities:

- Investigate Shapes to Determine if They are a Polygon
- Investigate Areas of Quadrilaterals
- Investigate Motion in a Plane
- Investigating the Relationship Between the Line of Reflection and the Segment Connecting a Point and its Image
- Investigate Area Relationships in Similar Figures

Technology:

- Using Geometer Sketchpad:
- Explore the Properties of Parallelograms
- Explore Multiple Transformations
- Explore Properties of Dilations
- Explore Perimeters of Regular Polygons

Websites:

- Interactive Quadrilaterals: http://www.mathsisfun.com/geometry/quadrilaterals-interactive.html
- Polygon Flashcards: http://quizlet.com/1375023/quadrilaterals-polygons-polyhedrons-flash-cards/
- Looking at Polygons: http://www.absorblearning.com/mathematics/demo/units/KCA007.html
- Interactive Transformations: http://www.mathsnet.net/transform/index.html :
- Virtual Manipulatives: http://nlvm.usu.edu/en/nav/category_g_4_t_3.html

UNIT 6: CIRCLES (10 DAYS)

Why Is This Unit Important?

How many sides does a circle have? While the answer is none, how can we apply the properties, strategies, and processes used thus far, all of which are based on sides and angles, to the shapes known as circles? In this unit we will explore how what has been learned can be adapted to these special cases. The big ideas embedded in this unit are:

- Basic properties of a circle can be used determine measures in real life situations.
- That pi is the relationship between the circumference and diameter of a circle.

Enduring Understandings: Students will understand:

- Circle Equations
- Property of circles

Essential Questions:

- What will eventually happen to a polygon in which the number of sides is continuously increased but the perimeter remains the same?
- How do scientists calculate the diameters of spatial bodies? (e.g. moon, planets)
- How are circles and their properties used in landscaping?

Acquired Knowledge: After studying the material of this unit, the student will know:

- Properties of a tangent of a circle
- Properties of arcs of a circle
- Properties of chords of circles
- Equations of a circle
- Rotations and rotational symmetry
- Tangents of a circle

Acquired Skills:

- Identify segments and lines related to circles
- Use properties of a tangent of a circle
- Use properties of arcs of a circle
- Use properties of chords of circles
- Use inscribed angles of a circle
- Write and graph the equations of a circle
- Identify rotations and rotational symmetry
- Identify arcs, central and inscribed angles, chords and tangents

Differentiation:

Enrichment:

- Solve problems involving chord lengths, secant segments and tangent segments

Supplement:

- Tangents and Circles activity
- Exploring Inscribed Angles activity
- Intersecting Secants activity
- Reflections and rotations activity
- What Did I Describe game

Assessments:

Formative Assessments:

- Assessment Checklist for Circle Equations
- Assessment Checklist for Properties of Circles
- Teacher's observation of students at work; anecdotal records
- Individual conferences and group discussions
- Students' recording sheets

Summative Assessments:

- Teacher's observation of students at work
- Individual conferences
- Chapter Assessments

Benchmarks

- Circles Assessment

Alternative Assessments:

- Modified tasks and assessment rubrics
- Performance-based assessment tasks

List of Applicable New Jersey Student Learning Standards Covered in This Unit:

- NJSLS. G-CO 12 & 13
- NJSLS.G-C 1-5
- NJSLS.G-GPE 1, 4
- NJSLS.MP.1-8

Suggested Learning Experiences and Instructional Activities:

Anticipatory Sets:

- Comparing Perimeter and Area

In-Class Activities:

- Investigate Inscribed Angles
- Explore Length Segments in a Circle

Technology:

- Using Geometer Sketchpad:
- Investigate Points Equidistant from a Point and a Line

Websites:

- Interactive Area of a Circle: http://www.mathwarehouse.com/geometry/circle/area-of-circle.php
- Circle Flashcards: http://quizlet.com/1317367/circles-flash-cards/
- Approximating Pi: http://www.pbs.org/wgbh/nova/archimedes/pi.html
- Conjectures in Geometry: http://www.geom.uiuc.edu/~dwiggins/mainpage.html
- Virtual Manipulatives: http://nlvm.usu.edu/en/nav/category_g_4_t_3.html

UNIT 7: THREE-DIMENSIONAL GEOMETRY (8 DAYS)

Why Is This Unit Important?

In this culminating unit all the processes, strategies, and properties learned thus far will be applied at a three-dimensional level. This process will start by converting three-dimensional shapes into their corresponding two-dimensional nets. From there we will learn how to derive the mathematical analysis tools needed to work on a three-dimensional structure, which in the real world is often what geometry is applied to. The big ideas embedded in this unit are:

- Nets can be used to build solids.
- The difference between surface area and volume.
- Changing the parameters of a figure affects the surface area and volume and will understand how it is affected.

Enduring Understandings: Students will understand:

- Lateral area versus surface area of three-dimensional figures
- Volume of three-dimensional figures

Essential Questions:

- What life situations might require us to calculate surface area or volume?
- How can we break a three-dimensional object into something we can measure with two-dimensional tools?
- What effects does doubling the dimensions of an object have on the surface area and volume?
- What are some of the stumbling blocks when using nets to calculate surface area? Volume?
- Some of the volume equations have coefficients, where do they come from? Why are some greater than 1 and others less? Do you see patterns in the types of three-dimensional shapes and the coefficients value compared to 1?

Acquired Knowledge: After studying the material of this unit, the student should be able to:

- Classifications of solid figures
- Lateral area of three-dimensional figures
- Surface area of three-dimensional figures
- Volume of three-dimensional figures

Acquired Skills:

- Identify and name solid figures
- Find the lateral area of three-dimensional figures
- Find the surface area of three-dimensional figures
- Find the volume of three-dimensional figures

Differentiation:

Enrichment:

- Apply the properties of similar solids

Supplement:

- Investigating Surface Area activity
- Investigating Volume activity
- Volume War game

Assessments:

Formative Assessments:

- Assessment Checklist for Surface Area
- Assessment Checklist for Volume
- Teacher's observation of students at work; anecdotal records
- Individual conferences and group discussions
- Students' recording sheets

Summative Assessments:

- Teacher's observation of students at work
- Individual conferences
- Chapter Assessments

Benchmarks

- 3-Dimensional Geometry Assessment

Alternative Assessments:

- Modified tasks and assessment rubrics
- Performance-based assessment tasks

List of Applicable New Jersey Student Learning Standards Covered in This Unit:

- NJSLS G-CO 12
- NJSLS.G-GMD 1-4
- NJSLS.G-MG 1-3
- NJSLS.MP.1-8

Suggested Learning Experiences and Instructional Activities:

In-Class Activities:

- Investigating Surface Area
- Relating the Volume of a Pyramid to that of a Prism

Technology:

- Using Geometer Sketchpad:
- Find the minimum surface area of a solid with a given volume

Websites:

- Interactive Surface Area and Volume: http://www.shodor.org/interactivate/activities/SurfaceAreaAndVolume/
- 3-D Geometry Flashcards: http://quizlet.com/2526081/miss-pancoes-chapter-11-3-d-geometry-flash-cards/
- Transforming Platonic Solids: http://www.mathsnet.net/geometry/solid/platonic.html
- Why Do Cells Divide?: http://plaza.ufl.edu/alallen/pgl/modules/rio/stingarees/module/why.html
- Virtual Manipulatives: http://nlvm.usu.edu/en/nav/category_g_4_t_3.html

Sample Standards Integration

21st Century Skills & Career Readiness Practices

CRP4. Communicate clearly and effectively and with reason.

For example, in Unit 3 students will justify their reasoning in their proof of parallelism

CRP6. Demonstrate creativity and innovation.

For example, in Unit 4 students will apply geometric theorems to solve real world complex problems.

CRP7. Employ valid and reliable research strategies.

For example, in Unit 6 students will analyze and interpret data on spherical spatial bodies.

CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.

For example, in Unit 7 students will work to solve and understand real world applications utilizing their understanding of surface area relationship to volume.

CRP12. Work productively in teams while using cultural global competence.

For example, in Unit 7 students will work in small teams to develop arguments relating cell size to function.

8.1 Educational Technology

All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and create and communicate knowledge.

For example, in Unit 5 students will access, manage, evaluate, and synthesize information to develop models for geometric manipulations in 3 dimensions.

Interdisciplinary Connections

SL.9-10.1. Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with peers on *grades 9–10 topics, texts, and issues,* building on others' ideas and expressing their own clearly and persuasively.

A. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.
B. Collaborate with peers to set rules for discussions (e.g. informal consensus, taking votes on key issues, presentation of alternate views); develop clear goals and assessment criteria (e.g. student developed rubric) and assign individual roles as needed.
C. Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions.
D. Respond thoughtfully to various perspectives, summarize points of agreement and disagreement, and justify own views. Make new connections in light of the evidence and reasoning presented.

SL.9-10.3. Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, identifying any false reasoning or distorted evidence.

SL.9-10.4. Present information, findings, and supporting evidence clearly, concisely, and logically. The content, organization, development, and style are appropriate to task, purpose, and audience

These standards are met throughout the course. For example, in Unit 2 students will discuss their solutions to a variety of real world scenarios involving geometric proofs.