Geometry Honors: Unit 1
Congruence, Constructions, and Introduction to Probability
Course Philosophy/Description

Geometry Honors is for our accelerated Math students. It stresses the ability to reason logically and to think critically, using spatial sense. In this course, students will engage in activities that allow them to create geometric understanding. A major part of the course will be devoted to teaching the student how to present a formal proof. Geometric properties of both two and three dimensions are emphasized as they apply to points, lines, planes, and solids. In this course students learn to recognize and work with geometric concepts in various contexts. They build on ideas of inductive and deductive reasoning, logic, concepts, and techniques of Euclidean plane and solid geometry and develop an understanding of mathematical structure, method, and applications of Euclidean plane and solid geometry. Students use visualizations, spatial reasoning, and geometric modeling to solve problems. Topics of study include points, lines, and angles; triangles; quadrilaterals and other polygons; circles; coordinate geometry; three-dimensional solids; geometric constructions; symmetry; similarity; and the use of transformations. Students use tools of geometry to develop, verify and prove geometric principles and relationships. Students extend their knowledge and understanding by solving open-ended real-world problems and thinking critically through the use of high level tasks and long-term projects.

Upon successful completion of this course, students will be able to: Use and prove basic theorems involving congruence and similarity of figures; determine how changes in dimensions affect perimeter and area of common geometric figures; apply and use the properties of proportion; perform basic constructions with straight edge and compass; prove the Pythagorean Theorem; use the Pythagorean Theorem to determine distance and find missing dimensions of right triangles; know and use formulas for perimeter, circumference, area, volume, lateral and surface area of common figures; find and use measures of sides, interior and exterior angles of polygons to solve problems; use relationships between angles in polygons, complementary, supplementary, vertical and exterior angle properties; use special angle and side relationships in special right triangles; understand, apply, and solve problems using basic trigonometric functions; prove and use relationships in circles to solve problems; prove and use theorems involving properties of parallel lines cut by a transversal, quadrilaterals and circles; write geometric proofs, including indirect proofs; construct and judge validity of logical arguments; prove theorems using coordinate geometry including the midpoint of a segment and distance formula; understand transformations in the coordinate plane; construct logical verifications to test conjectures and counterexamples; write basic mathematical arguments in paragraph and statement-reason form; calculate basic probabilities; investigate the role of permutations and combinations in probability; and use probability to make and analyze decisions.
This ESL framework was designed to be used by bilingual, dual language, ESL and general education teachers. Bilingual and dual language programs use the home language and a second language for instruction. ESL teachers and general education or bilingual teachers may use this document to collaborate on unit and lesson planning to decide who will address certain components of the SLO and language objective. ESL teachers may use the appropriate leveled language objective to build lessons for ELLs which reflects what is covered in the general education program. In this way, whether it is a pull-out or push-in model, all teachers are working on the same Student Learning Objective connected to the New Jersey Student Learning Standard. The design of language objectives are based on the alignment of the World-Class Instructional Design Assessment (WIDA) Consortium’s English Language Development (ELD) standards with the New Jersey Student Learning Standards (NJSL). WIDA’s ELD standards advance academic language development across content areas ultimately leading to academic achievement for English learners. As English learners are progressing through the six developmental linguistic stages, this framework will assist all teachers who work with English learners to appropriately identify the language needed to meet the requirements of the content standard. At the same time, the language objectives recognize the cognitive demand required to complete educational tasks. Even though listening and reading (receptive) skills differ from speaking and writing (expressive) skills across proficiency levels the cognitive function should not be diminished. For example, an Entering Level One student only has the linguistic ability to respond in single words in English with significant support from their home language. However, they could complete a Venn diagram with single words which demonstrates that they understand how the elements compare and contrast with each other or they could respond with the support of their native language with assistance from a teacher, para-professional, peer or a technology program.

http://www.state.nj.us/education/modelcurriculum/ela/ELLOverview.pdf
<table>
<thead>
<tr>
<th>#</th>
<th>Student Learning Objective</th>
<th>NJSLS</th>
<th>Big Ideas Math Correlation</th>
<th>Instruction: 8 weeks</th>
<th>Assessment: 1 week</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Use the undefined notion of a point, line, distance along a line and distance around a circular arc to develop definitions for angles, circles, parallel lines, perpendicular lines and line segments.</td>
<td>G.CO.A.1</td>
<td>1.1, 1.2, 1.5, 1.6, 3.1, 10.1, 11.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Represent transformations in the plane using transparencies, describe and explain transformations as functions, and compare rigid transformations to dilations, horizontal stretches and vertical stretches.</td>
<td>G.CO.A.2</td>
<td>4.1, 4.2, 4.3, 4.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself, and identify lines of symmetry.</td>
<td>G.CO.A.3</td>
<td>4.2, 4.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Develop formal definitions of rotations, reflections, and translations.</td>
<td>G.CO.A.4</td>
<td>4.1, 4.2, 4.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Draw transformed figures using graph paper, tracing paper, and/or geometry software and identify a sequence of transformations required in order to map one figure onto another.</td>
<td>G.CO.A.5</td>
<td>4.1, 4.2, 4.3, 4.4, 4.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Use rigid transformations to determine and explain congruence of geometric figures.</td>
<td>G.CO.B.6</td>
<td>4.1, 4.2, 4.3, 4.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Show and explain that two triangles are congruent by using corresponding pairs of sides and corresponding pairs of angles, and by using rigid motions (transformations).</td>
<td>G.CO.B.7</td>
<td>5.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Description</td>
<td>Standards</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>----------------------------------------------------------------------------</td>
<td>------------------------------------</td>
<td>---</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Show and explain how the criteria for triangle congruence extend from the definition of congruence in terms of rigid motion.</td>
<td>G.CO.B.8.</td>
<td>5.3, 5.5, 5.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Make formal constructions using a variety of tools (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.) and methods.</td>
<td>G.CO.D.12, G.CO.D.13</td>
<td>1.2, 1.3, 1.5, 3.3, 3.4, 5.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events (“or,” “and,” “not”).</td>
<td>S.CP.A.1</td>
<td>12.1, 12.2, 12.4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Research about Teaching and Learning Mathematics

Structure teaching of mathematical concepts and skills around problems to be solved (Checkly, 1997; Wood & Sellars, 1996; Wood & Sellars, 1997)

Encourage students to work cooperatively with others (Johnson & Johnson, 1975; Davidson, 1990)

Use group problem-solving to stimulate students to apply their mathematical thinking skills (Artzt & Armour-Thomas, 1992)

Students interact in ways that support and challenge one another’s strategic thinking (Artzt, Armour-Thomas, & Curcio, 2008)

Activities structured in ways allowing students to explore, explain, extend, and evaluate their progress (National Research Council, 1999)

There are three critical components to effective mathematics instruction (Shellard & Moyer, 2002):

- Teaching for conceptual understanding
- Developing children’s procedural literacy
- Promoting strategic competence through meaningful problem-solving investigations

Teachers should be:

- Demonstrating acceptance and recognition of students’ divergent ideas.
- Challenging students to think deeply about the problems they are solving, extending thinking beyond the solutions and algorithms required to solve the problem
- Influencing learning by asking challenging and interesting questions to accelerate students’ innate inquisitiveness and foster them to examine concepts further
- Projecting a positive attitude about mathematics and about students’ ability to “do” mathematics

Students should be:

- Actively engaging in “doing” mathematics
- Solving challenging problems
- Investigating meaningful real-world problems
- Making interdisciplinary connections
- Developing an understanding of mathematical knowledge required to “do” mathematics and connect the language of mathematical ideas with numerical representations
- Sharing mathematical ideas, discussing mathematics with one another, refining and critiquing each other’s ideas and understandings
- Communicating in pairs, small group, or whole group presentations
- Using multiple representations to communicate mathematical ideas
- Using connections between pictures, oral language, written symbols, manipulative models, and real-world situations
- Using technological resources and other 21st century skills to support and enhance mathematical understanding
Mathematics is not a stagnant field of textbook problems; rather, it is a dynamic way of constructing meaning about the world around us, generating knowledge and understanding about the real world every day. Students should be metaphorically rolling up their sleeves and “doing mathematics” themselves, not watching others do mathematics for them or in front of them. (Protheroe, 2007)

### Balanced Mathematics Instructional Model

Balanced math consists of three different learning opportunities; guided math, shared math, and independent math. Ensuring a balance of all three approaches will build conceptual understanding, problem solving, computational fluency, and procedural fluency. Building conceptual understanding is the focal point of developing mathematical proficiency. Students should frequently work on rigorous tasks, talk about the math, explain their thinking, justify their answer or process, build models with graphs or charts or manipulatives, and use technology.

When balanced math is used in the classroom it provides students opportunities to:

- solve problems
- make connections between math concepts and real-life situations
- communicate mathematical ideas (orally, visually and in writing)
- choose appropriate materials to solve problems
- reflect and monitor their own understanding of the math concepts
- practice strategies to build procedural and conceptual confidence

**Teacher builds conceptual understanding by**  
modeling through demonstration, explicit instruction, and think alouds, as well as guiding students as they practice math strategies and apply problem solving strategies. (whole group or small group instruction)

**Teacher and students practice mathematics processes together through interactive activities, problem solving, and discussion.** (whole group or small group instruction)

**Students practice math strategies independently to**  
build procedural and computational fluency. Teacher assesses learning and reteaches as necessary. (whole group instruction, small group instruction, or centers)
<table>
<thead>
<tr>
<th>Effective Pedagogical Routines/Instructional Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collaborative Problem Solving</td>
</tr>
<tr>
<td>Connect Previous Knowledge to New Learning</td>
</tr>
<tr>
<td>Making Thinking Visible</td>
</tr>
<tr>
<td>Develop and Demonstrate Mathematical Practices</td>
</tr>
<tr>
<td>Inquiry-Oriented and Exploratory Approach</td>
</tr>
<tr>
<td>Multiple Solution Paths and Strategies</td>
</tr>
<tr>
<td>Use of Multiple Representations</td>
</tr>
<tr>
<td>Explain the Rationale of your Math Work</td>
</tr>
<tr>
<td>Quick Writes</td>
</tr>
<tr>
<td>Pair/Trio Sharing</td>
</tr>
<tr>
<td>Turn and Talk</td>
</tr>
<tr>
<td>Charting</td>
</tr>
<tr>
<td>Gallery Walks</td>
</tr>
<tr>
<td>Small Group and Whole Class Discussions</td>
</tr>
<tr>
<td>Student Modeling</td>
</tr>
<tr>
<td>Analyze Student Work</td>
</tr>
<tr>
<td>Identify Student’s Mathematical Understanding</td>
</tr>
<tr>
<td>Identify Student’s Mathematical Misunderstandings</td>
</tr>
<tr>
<td>Interviews</td>
</tr>
<tr>
<td>Role Playing</td>
</tr>
<tr>
<td>Diagrams, Charts, Tables, and Graphs</td>
</tr>
<tr>
<td>Anticipate Likely and Possible Student Responses</td>
</tr>
<tr>
<td>Collect Different Student Approaches</td>
</tr>
<tr>
<td>Multiple Response Strategies</td>
</tr>
<tr>
<td>Asking Assessing and Advancing Questions</td>
</tr>
<tr>
<td>Revoicing</td>
</tr>
<tr>
<td>Marking</td>
</tr>
<tr>
<td>Recapping</td>
</tr>
<tr>
<td>Challenging</td>
</tr>
<tr>
<td>Pressing for Accuracy and Reasoning</td>
</tr>
<tr>
<td>Maintain the Cognitive Demand</td>
</tr>
</tbody>
</table>
Educational Technology

Standards

| 8.1.12.B.2, 8.1.12.C.1, 8.2.12.B.4 |

- **Creativity and Innovation**
  - Apply previous content knowledge by creating or piloting a digital learning game or tutorial.

  **Example:** Using Prezzi or Powerpoint, students will use their knowledge to create a tutorial on how to identify lines of symmetry when performing rotations and/or reflections on rectangles, parallelograms, trapezoids and regular polygons.

- **Communication and Collaboration**
  - Develop an innovative solution to a real-world problem or issue in collaboration with peers and experts, and present ideas for feedback through social media or in an online community.

  **Example:** Students will be able to explain and recognize why particular combinations of corresponding parts establish congruence and why others do not through Google classroom. Students can present their solutions and communicate through this platform.

- **Technology and Society**
  - Investigate a technology used in a given time period of history, e.g. stone age, industrial revolution or information age, and identify their impact and how they may have changed to meet human needs and wants.

  **Example:** Students can use graph paper and tracing paper to identify a sequence of transformations required in order to map one figure onto another and then compare it to how they can use dynamic geometric software. Students can discuss how the technology has changed over time and how each was beneficial for specific time periods.
Career Ready Practices

Career Ready Practices describe the career-ready skills that all educators in all content areas should seek to develop in their students. They are practices that have been linked to increase college, career, and life success. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

- **CRP2. Apply appropriate academic and technical skills.**
  Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation.

  **Example:** Students will apply prior knowledge when solving real world problems. Students will make sound judgements about the use of specific tools, such as compass and straightedge, string, reflective devices, folding paper, and dynamic geometric software, to explore and deepen understanding of making formal constructions to show congruence, creating geometric figures, etc.

- **CRP4. Communicate clearly and effectively and with reason.**
  Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others’ time. They are excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.

  **Example:** Students will on a daily basis communicate their reasoning behind their solution paths by making connections to the context and the quantities, using proper vocabulary, along with decontextualizing and/or contextualizing the problem. Students will use rigid transformations to determine and explain congruence of geometric figures. They will also explain the meaning behind the quantities and units involved. Students will also ask probing questions to clarify and improve arguments.
Career Ready Practices

- **CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.**
  Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur and take action quickly to address the problem; they thoughtfully investigate the root cause of the problem prior to introducing solutions. They carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others.

  **Example:** Throughout their daily lessons, students will understand the meaning of a problem and look for entry points into solving their problems by analyzing the relationships of the quantities, constraints and goals of the task. Plans for solution paths will be made and have meaning. Students will self-monitor, evaluate and critique their process and progress as they are working and make changes as necessary.

- **CRP12. Work productively in teams while using cultural global competence.**
  Career-ready individuals positively contribute to every team, whether formal or informal. They apply an awareness of cultural difference to avoid barriers to productive and positive interaction. They find ways to increase the engagement and contribution of all team members. They plan and facilitate effective team meetings.

  **Example:** Students will work in collaborative and whole group settings to develop various solutions to math tasks that are presented to them. They will work together to understand the terms of the problem, ask clarifying and challenging questions among each other, and develop agreed upon solutions using a variety of strategies and models. Students will listen to, read and discuss arguments with each other with respect and courtesy at all times and will be willing to assist those that may need assistance. Students will demonstrate and explain to a peer or small group how they developed formal definitions of rotations, reflections and translations.
WIDA Proficiency Levels

At the given level of English language proficiency, English language learners will process, understand, produce or use

<table>
<thead>
<tr>
<th>Level</th>
<th>Proficiency</th>
</tr>
</thead>
</table>
| 6- Reaching | • Specialized or technical language reflective of the content areas at grade level  
• A variety of sentence lengths of varying linguistic complexity in extended oral or written discourse as required by the specified grade level  
• Oral or written communication in English comparable to proficient English peers |
| 5- Bridging | • Specialized or technical language of the content areas  
• A variety of sentence lengths of varying linguistic complexity in extended oral or written discourse, including stories, essays or reports  
• Oral or written language approaching comparability to that of proficient English peers when presented with grade level material. |
| 4- Expanding | • Specific and some technical language of the content areas  
• A variety of sentence lengths of varying linguistic complexity in oral discourse or multiple, related sentences or paragraphs  
• Oral or written language with minimal phonological, syntactic or semantic errors that may impede the communication, but retain much of its meaning, when presented with oral or written connected discourse, with sensory, graphic or interactive support |
| 3- Developing | • General and some specific language of the content areas  
• Expanded sentences in oral interaction or written paragraphs  
• Oral or written language with phonological, syntactic or semantic errors that may impede the communication, but retain much of its meaning, when presented with oral or written, narrative or expository descriptions with sensory, graphic or interactive support |
| 2- Beginning | • General language related to the content area  
• Phrases or short sentences  
• Oral or written language with phonological, syntactic, or semantic errors that often impede of the communication when presented with one to multiple-step commands, directions, or a series of statements with sensory, graphic or interactive support |
| 1- Entering | • Pictorial or graphic representation of the language of the content areas  
• Words, phrases or chunks of language when presented with one-step commands directions, WH-, choice or yes/no questions, or statements with sensory, graphic or interactive support |
# Language Development Supports For English Language Learners

**To Increase Comprehension and Communication Skills**

## Environment

- Welcoming and stress-free
- Respectful of linguistic and cultural diversity
- Honors students' background knowledge
- Sets clear and high expectations
- Includes routines and norms
- Is thinking-focused vs. answer-seeking
- Offers multiple modalities to engage in content learning and to demonstrate understanding
- Includes explicit instruction of specific language targets
- Provides participation techniques to include all learners
- Integrates learning centers and games in a meaningful way
- Provides opportunities to practice and refine receptive and productive skills in English as a new language
- Integrates meaning and purposeful tasks/activities that:
  - Are accessible by all students through multiple entry points
  - Are relevant to students' lives and cultural experiences
  - Build on prior mathematical learning
  - Demonstrate high cognitive demand
  - Offer multiple strategies for solutions
  - Allow for a language learning experience in addition to content

## Sensory Supports*

- Real-life objects (realia) or concrete objects
- Physical models
- Manipulatives
- Pictures & photographs
- Visual representations or models such as diagrams or drawings
- Videos & films
- Newspapers or magazines
- Gestures
- Physical movements
- Music & songs

## Graphic Supports*

- Graphs
- Charts
- Timelines
- Number lines
- Graphic organizers
- Graphing paper

## Interactive Supports*

- In a whole group
- In a small group
- With a partner such as *Turn-and-Talk*
- In pairs as a group (first, two pairs work independently, then they form a group of four)
- In triads
- Cooperative learning structures such as *Think-Pair-Share*
- Interactive websites or software
- With a mentor or coach

## Verbal and Textual Supports

- Labeling
- Students' native language
- Modeling
- Repetitions
- Paraphrasing
- Summarizing
- Guiding questions
- Clarifying questions
- Probing questions
- Leveled questions such as *What? When? Where? How? Why?*
- Questioning prompts & cues
- Word Banks
- Sentence starters
- Sentence frames
- Discussion frames
- Talk moves, including *Wait Time*

---

BUILDING EQUITY IN YOUR TEACHING PRACTICE

How do the essential questions highlight the connection between the big ideas of the unit and equity in your teaching practice?

**CONTENT INTEGRATION**
Teachers use examples and content from a variety of cultures & groups.

This unit / lesson is connected to other topics explored with students.

There are multiple viewpoints reflected in the content of this unit / lesson.

The materials and resources are reflective of the diverse identities and experiences of students.

The content affirms students, as well as exposes them to experiences other than their own.

---

**KNOWLEDGE CONSTRUCTION**
Teachers help students understand how knowledge is created and influenced by cultural assumptions, perspectives & biases.

This unit / lesson provides context to the history of privilege and oppression.

This unit / lesson addresses power relationships.

This unit / lesson helps students to develop research and critical thinking skills.

This curriculum creates windows and mirrors* for students.

---

**PREJUDICE REDUCTION**
Teachers implement lessons and activities to assert positive images of ethnic groups & improve intergroup relations.

This unit / lesson helps students question and unpack biases & stereotypes.

This unit / lesson helps students examine, research and question information and sources.

The curriculum encourages discussion and understanding about the groups of people being represented.

This unit / lesson challenges dominant perspectives.

---

**EQUITABLE PEDAGOGY**
The instruction has been modified to meet the needs of each student.

Students feel respected and their cultural identities are valued.

Additional supports have been provided for students to become successful and independent learners.

Opportunities are provided for student to reflect on their learning and provide feedback.

---

**EMPOWERING SCHOOL CULTURE**
Using the other four dimensions to create a safe and healthy educational environment for all.

There are opportunities for students to connect with the community.

My classroom is welcoming and supportive for all students?

I am aware of and sensitive to the needs of my students and their families.

There are effective parent communication systems established. Parents can talk to me about issues as they arise in my classroom.

---

### Culturally Relevant Pedagogy Examples

- **Integrate Relevant Word Problems:** Contextualize equations using word problems that reference student interests and cultures.
  
  **Example:** When learning about the definitions of angle, circle, perpendicular line, parallel line, and line segment, incorporate problems that relate to student interests such as music, sports and art enable the students to understand and relate to the concept in a more meaningful way.

- **Everyone has a Voice:** Create a classroom environment where students know that their contributions are expected and valued.
  
  **Example:** Norms for sharing are established that communicate a growth mindset for mathematics. All students are capable of expressing mathematical thinking and contributing to the classroom community. Students learn new ways of looking at problem solving by working with and listening to each other.

- **Run Problem Based Learning Scenarios:** Encourage mathematical discourse among students by presenting problems that are relevant to them, the school and/or the community.
  
  **Example:** Using a Place Based Education (PBE) model, students explore math concepts while determining ways to address problems that are pertinent to their neighborhood, school or culture.

- **Encourage Student Leadership:** Create an avenue for students to propose problem solving strategies and potential projects.
  
  **Example:** Students can deepen their understanding of rotations, reflections, and translations by creating problems together and deciding if the problems fit the necessary criteria. This experience will allow students to discuss and explore their current level of understanding.

- **Present New Concepts Using Student Vocabulary:** Use student diction to capture attention and build understanding before using academic terms.
  
  **Example:** Teach math vocabulary in various modalities for students to remember. Use multi-modal activities, analogies, realia, visual cues, graphic representations, gestures, pictures and cognates. Directly explain and model the idea of vocabulary words having multiple meanings. Students can create the Word Wall with their definitions and examples to foster ownership.
## Differentiated Instruction

**Accommodate Based on Students Individual Needs: Strategies**

<table>
<thead>
<tr>
<th>Time/General</th>
<th>Processing</th>
<th>Comprehension</th>
<th>Recall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extra time for assigned tasks</td>
<td>Extra Response time</td>
<td>Precise processes for balanced math instructional model</td>
<td>Teacher-made checklist</td>
</tr>
<tr>
<td>Adjust length of assignment</td>
<td>Have students verbalize steps</td>
<td>Short manageable tasks</td>
<td>Use visual graphic organizers</td>
</tr>
<tr>
<td>Timeline with due dates for reports and projects</td>
<td>Repeat, clarify or reword directions</td>
<td>Brief and concrete directions</td>
<td>Reference resources to promote independence</td>
</tr>
<tr>
<td>Communication system between home and school</td>
<td>Mini-breaks between tasks</td>
<td>Provide immediate feedback</td>
<td>Visual and verbal reminders</td>
</tr>
<tr>
<td>Provide lecture notes/outline</td>
<td>Provide a warning for transitions</td>
<td>Small group instruction</td>
<td>Graphic organizers</td>
</tr>
<tr>
<td></td>
<td>Partnering</td>
<td>Emphasize multi-sensory learning</td>
<td></td>
</tr>
</tbody>
</table>

### Assistive Technology
- Computer/whiteboard
- Tape recorder
- Video Tape

### Tests/Quizzes/Grading
- Extended time
- Study guides
- Shortened tests
- Read directions aloud

### Behavior/Attention
- Consistent daily structured routine
- Simple and clear classroom rules
- Frequent feedback

### Organization
- Individual daily planner
- Display a written agenda
- Note-taking assistance
- Color code materials
## Differentiated Instruction

### Accommodate Based on Content Specific Needs

- Teacher modeling of thinking processes necessary to determine a series of transformations
- Pre-teach vocabulary using visual models that are connected to real-life situations
- Word wall with visual representations of geometric terms
- Calculator to assist with computations
- Reference sheets that list step-by-step procedures for transformations
- Graph paper, tracing paper, cut out shapes, reflection mirrors or geometry software to represent images or pre-images as a result of dilations, rotations, reflections and translations
- Highlight and label the solution steps for multi-step problems in different colors
- Utilize technology through interactive sites to explore Plane Geometry, Constructions, and Coordinate Geometry
  - [www.mathopenref.com](http://www.mathopenref.com)
  - [https://www.geogebra.org/](https://www.geogebra.org/)
- Use compass and straightedge, string, reflective devices, or paper folding to perform formal constructions and identify the congruencies underlying each construction
Interdisciplinary Connections

_Model interdisciplinary thinking to expose students to other disciplines._

**Art Connection:**
*Name of Task:* Paper Cutting (1.3.12.D.2)
- This task uses lines of symmetry to demonstrate how they can be used in the art of paper cutting.

**ELA Connection:**
*Name of Tasks:* Defining Parallel lines (RL.10.4)
- This task asks students to analyze definitions: Are they mathematically sound, complete, accurate, confusing? This challenges students to look at the concepts more closely and understand how important definitions are.

**Architecture and Construction Career Connection:**
*Name of Task:* Horizontal Stretch of the Plane (9.3.ST-ET.5 and 9.3.ST-SM-2)
- This task asks students to look at the effect of horizontal stretch on an image.
Enrichment

What is the Purpose of Enrichment?

- The purpose of enrichment is to provide extended learning opportunities and challenges to students who have already mastered, or can quickly master, the basic curriculum. Enrichment gives the student more time to study concepts with greater depth, breadth, and complexity.
- Enrichment also provides opportunities for students to pursue learning in their own areas of interest and strengths.
- Enrichment keeps advanced students engaged and supports their accelerated academic needs.
- Enrichment provides the most appropriate answer to the question, “What do you do when the student already knows it?”

Enrichment is…

- Planned and purposeful
- Different, or differentiated, work – not just more work
- Responsive to students’ needs and situations
- A promotion of high-level thinking skills and making connections within content
- The ability to apply different or multiple strategies to the content
- The ability to synthesize concepts and make real world and cross-curricular connections
- Elevated contextual complexity
- Sometimes independent activities, sometimes direct instruction
- Inquiry based or open ended assignments and projects
- Using supplementary materials in addition to the normal range of resources
- Choices for students
- Tiered/Multi-level activities with flexible groups (may change daily or weekly)

Enrichment is not…

- Just for gifted students (some gifted students may need intervention in some areas just as some other students may need frequent enrichment)
- Worksheets that are more of the same (busywork)
- Random assignments, games, or puzzles not connected to the content areas or areas of student interest
- Extra homework
- A package that is the same for everyone
- Thinking skills taught in isolation
- Unstructured free time
Assessments

Required District/State Assessments
- Unit Assessment
- PARCC
- SGO Assessment

Suggested Formative/Summative Classroom Assessments
- Describe Learning Vertically
- Identify Key Building Blocks
- Make Connections (between and among key building blocks)
- Short/Extended Constructed Response Items
- Multiple-Choice Items (where multiple answer choices may be correct)
- Drag and Drop Items
- Use of Equation Editor
- Quizzes
- Journal Entries/Reflections/Quick-Writes
- Accountable talk
- Projects
- Portfolio
- Observation
- Graphic Organizers/Concept Mapping
- Presentations
- Role Playing
- Teacher-Student and Student-Student Conferencing
- Homework
# New Jersey State Learning Standards

<table>
<thead>
<tr>
<th>G.CO.A.1</th>
<th>Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>G.CO.A.2</td>
<td>Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch).</td>
</tr>
<tr>
<td>G.CO.A.3</td>
<td>Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.</td>
</tr>
<tr>
<td>G.CO.A.4</td>
<td>Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.</td>
</tr>
<tr>
<td>G.CO.A.5</td>
<td>Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.</td>
</tr>
<tr>
<td>G.CO.B.6</td>
<td>Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.</td>
</tr>
<tr>
<td>G.CO.B.7</td>
<td>Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.</td>
</tr>
<tr>
<td>G.CO.B.8</td>
<td>Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.</td>
</tr>
<tr>
<td>G.CO.D.12</td>
<td>Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.</td>
</tr>
<tr>
<td>G.CO.D.13</td>
<td>Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.</td>
</tr>
</tbody>
</table>
New Jersey State Learning Standards

S.CP.A.1. Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events (“or,” “and,” “not”).
<table>
<thead>
<tr>
<th>Mathematical Practices</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Make sense of problems and persevere in solving them.</td>
</tr>
<tr>
<td>2. Reason abstractly and quantitatively.</td>
</tr>
<tr>
<td>3. Construct viable arguments and critique the reasoning of others.</td>
</tr>
<tr>
<td>4. Model with mathematics.</td>
</tr>
<tr>
<td>5. Use appropriate tools strategically.</td>
</tr>
<tr>
<td>6. Attend to precision.</td>
</tr>
<tr>
<td>7. Look for and make use of structure.</td>
</tr>
<tr>
<td>8. Look for and express regularity in repeated reasoning.</td>
</tr>
</tbody>
</table>
Geometry Honors | Unit: 1 (One) | Topic: Congruence, Constructions, and Introduction to Probability
---|---|---

**Unit Focus:**
- Experiment with transformations in the plane
- Understand congruence in terms of rigid motions
- Make geometric constructions
- Use set theory to calculate theoretical probabilities

New Jersey Student Learning Standard(s):
G.CO.A.1: Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.

**Student Learning Objective 1:** Use the undefined notion of a point, line, distance along a line and distance around a circular arc to develop definitions for angles, circles, parallel lines, perpendicular lines and line segments.

**Modified Student Learning Objectives/Standards:**
M.EE.G-CO.1. Know the attributes of perpendicular lines, parallel lines, and line segments; angles; and circles.

<table>
<thead>
<tr>
<th>MPs</th>
<th>Evidence Statement Key/Clarifications</th>
<th>Skills, Strategies &amp; Concepts</th>
<th>Essential Understandings/Questions (Accountable Talk)</th>
<th>Tasks/Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>MP 6</td>
<td>G-CO.1</td>
<td>To understand point, line, plane, distance along a line, and distance around a circular arc as indefinable notions.</td>
<td>What are the undefined terms in geometry and why are they undefined?</td>
<td>Type I: Defining Parallel Lines</td>
</tr>
</tbody>
</table>
- Definitions are limited to those in the evidence statement
- Plane is also considered an undefined notion.

**HS.C.14.2**
- Construct, autonomously, chains of reasoning that will justify or refute geometric propositions or conjectures. Content scope: G-CO.A, G-CO.B

<table>
<thead>
<tr>
<th>Use point, line, distance along a line and/or distance around a circular arc to give a precise definition of the following:</th>
</tr>
</thead>
<tbody>
<tr>
<td>o Angle</td>
</tr>
<tr>
<td>o circle (the set of points that are the same distance from a single point - the center)</td>
</tr>
<tr>
<td>o perpendicular line (two lines are perpendicular if an angle formed by the two lines at the point of intersection is a right angle)</td>
</tr>
<tr>
<td>o parallel lines (distinct lines that have no point in common)</td>
</tr>
<tr>
<td>o and line segment</td>
</tr>
</tbody>
</table>

Identify, name and represent points, lines, segments, rays and planes.

Apply basic facts, postulates and theorems about points, lines and planes.

Engage students to investigate more closely the definition that shapes are congruent when they have the same size and shape.

In earlier grades, students experimented with transformations in the plane. They will now build more precise definitions for the rigid motions (rotation, reflection and translation) based on their previously understood terms, such as point, line, between angle, circle, perpendicular, etc.

**SPED Strategies**

<table>
<thead>
<tr>
<th>Can you use these undefined terms to define angles, circles, parallel lines and line segments?</th>
</tr>
</thead>
<tbody>
<tr>
<td>What are the building blocks of geometry and how are they used?</td>
</tr>
</tbody>
</table>

**Type II, III: Defining Perpendicular Lines**
Pre-teach vocabulary using visual and verbal models that are connected to real life situations.

Encourage students to maintain a reference notebook for Geometry by providing them with notes or guiding them in notetaking.

**ELL Strategies**
Build knowledge from real world examples.

Find the distance from one corner of the classroom to the opposite corner.

---

**New Jersey Student Learning Standard(s):**

**G.CO.A.2:** Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch).

**Student Learning Objective 2:** Represent transformations in the plane using transparencies, describe and explain transformations as functions, and compare rigid transformations to dilations, horizontal stretches and vertical stretches.

**Modified Student Learning Objectives/Standards: N/A**

<table>
<thead>
<tr>
<th>MPs</th>
<th>Evidence Statement Key/Clarifications</th>
<th>Skills, Strategies &amp; Concepts</th>
<th>Essential Understandings/Questions (Accountable Talk)</th>
<th>Tasks/Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>MP 5</td>
<td><strong>HS.C.14.2</strong></td>
<td>Identify a transformation as a translation, rotation, reflection, and dilation. Remind students that a translation slides a figure; a reflection flips a figure; a rotation turns a figure.</td>
<td>How can I use transparencies and geometry software to represent transformations?</td>
<td>Type I: Ferris Wheel</td>
</tr>
<tr>
<td>MP 6</td>
<td>• Construct, autonomously, chains of reasoning that will justify or refute geometric propositions</td>
<td></td>
<td>How can I use functions to describe transformations?</td>
<td>Type II, III:</td>
</tr>
<tr>
<td>MP 7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Content scope: G-CO.A, G-CO.B</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Identify transformations that remain the same size and shape as isometries or rigid transformations (translation, rotation, and reflection). Another name for a rigid motion is isometry.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Identify transformations that do not remain the same size and/or shape as non-rigid or nonisometric transformations (dilations and stretches). The only transformation that changes the size of a figure is dilation.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The Scale factor of dilation is the ratio of corresponding sides of the image and preimage. This ratio is used to solve real-life applications.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Represent all types of transformation on graph paper and by using technology.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Represent transformations in the plane using, transparencies and dynamic geometry software.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Describe transformations as functions (points defining the pre-image as the input and the points defining the image as the output).</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Describe a transformation $F$ of the plane as a rule that assigns to each point $P$ in the plane a point $F(P)$ of the plane.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How does a rotation compare to the original figure?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How does a reflection compare to the original figure?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How do translations compare to the original figure?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How do rotations, reflections, and translations compare to horizontal stretch, vertical stretch and dilations?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Which transformations preserve distance and angles? Give an example of a transformation that does not preserve distance and/or angle. Explain why this is the case.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dilations and Distances</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fixed Points of Rigid Motions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Horizontal Stretch of the Plane.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Compare rotations, reflections, and translations to a horizontal stretch, vertical stretch and to dilations, distinguishing preserved distances and angles from those that are not preserved.

Ability to see parallels between function transformations and geometric transformations.

Help students strengthen their understanding of these definitions by transforming figures using tracing paper, transparencies, or geometry software.

Students sometimes think that just a few points are translated, such as endpoints of segments or vertices of a polygon. Help students to understand that a translation is a function that maps all points of preimage in the plane to a new location called the image.

When two or more transformations are combined to form a single transformation, the result is a composition of transformations. Students should note that the order in which transformations are performed generally does matter.

The **Composition Theorem** states that the result of composing two or more rigid motions will be a rigid motion.
<table>
<thead>
<tr>
<th><strong>SPED Strategies</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-teach vocabulary using visual and verbal models that are connected to real life situations.</td>
</tr>
<tr>
<td>Provide students with hands on opportunities to explore and extend their understanding of transformations by using transparencies, graph paper, dry erase markers, cut out shapes.</td>
</tr>
<tr>
<td>Link concepts to everyday examples so that students can visualize the transformations and internalize their distinguishing characteristics.</td>
</tr>
<tr>
<td>Encourage students to add this concept to their reference notebook by providing notes or guiding notetaking.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>ELL Strategies</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Build knowledge from real world examples</td>
</tr>
<tr>
<td>Find the reflex ion of a triangle on a mirror. The scale distance in a local map.</td>
</tr>
<tr>
<td>Find the reflex ion of a photo inside a camera.</td>
</tr>
</tbody>
</table>
**New Jersey Student Learning Standard(s):**

G.CO.A.3. Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.

**Student Learning Objective 3:** Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself, and identify lines of symmetry.

**Modified Student Learning Objectives/Standards: N/A**

<table>
<thead>
<tr>
<th>MPs</th>
<th>Evidence Statement Key/Clarifications</th>
<th>Skills, Strategies &amp; Concepts</th>
<th>Essential Understandings/Questions (Accountable Talk)</th>
<th>Tasks/Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>MP 5 MP 6 MP 7</td>
<td>G.CO.3 HS.C.14.2</td>
<td>In earlier grades, students experimented with transformations in the plane. They will now build more precise definitions for the rigid motions (rotation, reflection and translation) based on their previously understood terms, such as point, line, between angle, circle, perpendicular, etc.</td>
<td>How do I identify lines of symmetry when performing rotations on rectangles, parallelograms, trapezoids and regular polygons?</td>
<td>Type I: Seven Circles II</td>
</tr>
<tr>
<td></td>
<td>Construct, autonomously, chains of reasoning that will justify or refute geometric propositions or conjectures. Content scope: G-CO.A, G-CO.B</td>
<td>Identify lines of symmetry when performing rotations and/or reflections on rectangles, parallelograms, trapezoids and regular polygons.</td>
<td>How do I identify lines of symmetry when performing reflections on rectangles, parallelograms, trapezoids and regular polygons?</td>
<td>Type II, III: Symmetries of a Quadrilateral I</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Describe the rotations and reflections that carry rectangles, parallelograms, trapezoids and regular polygons onto itself.</td>
<td>How do I describe reflections that carry rectangles, parallelograms, trapezoids and regular polygons onto itself?</td>
<td>Symmetries of a Quadrilateral II</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Explain and apply the relationship between symmetry and rigid motions.</td>
<td></td>
<td>Symmetries of Rectangles</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Demonstrate the understanding of symmetry, line symmetry (reflectational symmetry) and point symmetry (rotational symmetry).</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

30 | Page
A figure in the plane has rotational symmetry when the figure can be mapped onto itself by a rotation of 180° or less about the center of the figure. The rotation can be either clockwise or counterclockwise.

Videos on describing the rotations and reflections that carry it onto itself:
https://www.youtube.com/watch?v=O2XvbKmG-tk
https://www.youtube.com/watch?v=qZqQ9kP2wZQ

**SPED Strategies**

Review the meaning of symmetry and use visual and verbal models to demonstrate how to identify lines of symmetry in different figures.

Model the thinking and processes necessary to determine a series of transformations that end up with the figure superimposing on top of itself.

Encourage students to add this concept to their reference notebook by providing notes or guiding notetaking.

**ELL Strategies:**

Provide visual cues, graphic representations, gestures, and pictures. Use the smart board software to visualize the rotations and translations.

Use rigid transformations to determine and explain congruence of geometric figures.

trapezoids and regular polygons onto itself?

How can you determine which rotations and reflections will carry a polygon onto itself?

How is symmetry defined?

Can a figure have more than one type of symmetry?
New Jersey Student Learning Standard(s):  
G.CO.A.4: Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.

Student Learning Objective 4: Develop formal definitions of rotations, reflections, and translations.

Modified Student Learning Objectives/Standards:  
M. EE.G-CO.4–5: Given a geometric figure and a rotation, reflection, or translation of that figure, identify the components of the two figures that are congruent.

<table>
<thead>
<tr>
<th>MPs</th>
<th>Evidence Statement Key/Clarifications</th>
<th>Skills, Strategies &amp; Concepts</th>
<th>Essential Understandings/Questions (Accountable Talk)</th>
<th>Tasks/Activities</th>
</tr>
</thead>
</table>
| MP 6 | HS.C.14.2  
Construct, autonomously, chains of reasoning that will justify or refute geometric propositions or conjectures. Content scope: G-CO.A, G-CO.B | Students will be able to construct a definition for each term based upon a synthesis of experiences.  
Recall definitions of angles, circles, perpendicular and parallel lines and line segments.  
In earlier grades, students experimented with transformations in the plane. They will now build more precise definitions for the rigid motions (rotation, reflection and translation) based on their previously understood terms, such as point, line, between angle, circle, perpendicular, etc.  
Develop formal mathematical definitions of a rotation, reflection, and translation.  
• Rotation: A transformation in which a figure is turned about a fixed point. | What mathematical definitions do we use to rotate, reflect, and/or translate so that we can transform figures?  
Which transformations preserve distance and angles? | Type II, III:  
Defining Reflections  
Defining Rotations  
Identifying Rotations  
Identifying Translations |
• Reflection: A transformation that uses a line like a mirror to reflect a figure.
• Translation: A transformation that moves every point of a figure the same distance in the same direction.

Use prior knowledge and experiences with angles and circles, perpendicular lines, parallel lines, and line segments to develop definitions of rotations, reflections and translations.

Explain how translations move points at a specified distance along a line parallel to a specified line; rotations move objects along a circular arc with a specified center through a specified angle; reflections move objects along a line perpendicular to the line of symmetry.

**Reflections in parallel lines theorem:**

If lines $k$ and $m$ are parallel, then a reflection in line $k$ followed by a reflection in line $m$ is the same as a translation.

If $A''$ is the image of $A$, then

1. $AA'$ is perpendicular to $k$ and $m$, and
2. $AA'' = 2d$, where $d$ is the distance between $k$ and $m$.
Reflections in Intersecting Lines Theorem:

If lines $k$ and $m$ intersect at point $P$, then a reflection in line $k$ followed by a reflection in line $m$ is the same as a rotation about point $P$.

The angle of rotation is $2x\degree$, where $x\degree$ is the measure of the acute or right angle formed by lines $k$ and $m$. 

$m\angle BPB'' = 2x\degree$
Pre-teach vocabulary using visual and verbal models that are connected to real life situations and ensure that students include these definitions in their reference notebook.

Provide students with clues to remember the definitions and know the differences between the terms/concepts.

i.e. translation - slide

Encourage students to verbalize their thinking while working in small groups by asking assessing and advancing questions. Use this information to tailor instruction to student needs.

**ELL Strategies**

Provide visual cues, graphic representations, gestures, and pictures to generate definitions by induction.

Draw transformed figures using graph paper, tracing paper, and/or geometry software and identify a sequence of transformations required in order to map one figure onto another.
New Jersey Student Learning Standard(s):
G.CO.A.5: Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.

Student Learning Objective 5: Draw transformed figures using graph paper, tracing paper, and/or geometry software and identify a sequence of transformations required in order to map one figure onto another.

Modified Student Learning Objectives/Standards:
M.EE.G-CO.4–5: Given a geometric figure and a rotation, reflection, or translation of that figure, identify the components of the two figures that are congruent.

<table>
<thead>
<tr>
<th>MPs</th>
<th>Evidence Statement Key/Clarifications</th>
<th>Skills, Strategies &amp; Concepts</th>
<th>Essential Understandings/Questions (Accountable Talk)</th>
<th>Tasks/Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>MP 5</td>
<td>G-CO.5</td>
<td>Draw the transformed figure using, graph paper, tracing paper, and/or geometry software given a geometric figure and a rotation, reflection, or translation.</td>
<td>How can you determine which transformations will carry a figure onto another figure?</td>
<td>Type I: Reflected Triangles</td>
</tr>
<tr>
<td>MP 6</td>
<td>HS.C.14.2</td>
<td>Identify the sequence of transformations required to carry one figure onto another.</td>
<td></td>
<td>Type II, III: Building a Tile Pattern by Reflecting Hexagons</td>
</tr>
<tr>
<td>MP 7</td>
<td></td>
<td>Perform a composition of transformations.</td>
<td></td>
<td>Building a Tile Pattern by Reflecting Octagons</td>
</tr>
<tr>
<td></td>
<td>• Construct, autonomously, chains of reasoning that will justify or refute geometric propositions or conjectures. Content scope: G-CO.A, G-CO.B</td>
<td>Arrange transformations into a sequence that causes a figure to graph back onto itself (two or more transformations).</td>
<td>How can you determine which transformations will carry a figure onto another figure?</td>
<td>Showing a Triangle Congruence: The General Case.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Accurately use geometric vocabulary to describe the sequence of transformations that will carry a given figure onto another.</td>
<td></td>
<td>Showing a Triangle Congruence</td>
</tr>
</tbody>
</table>

SPED Strategies
Model the thinking and processes necessary to determine a series of transformations that end up with the figure superimposing on top of itself.

Provide students with hands on opportunities to explore and extend their understanding of transformations by using transparencies, graph paper, dry erase markers, cut out shapes.

**ELL Strategies:**

Embed links to websites for additional knowledge.

Resources UDL - Visual and Auditory Learner(s): 7.EE.B.4a
https://youtu.be/WQ8ZWBNVL2g

Solving and Graphing Two-Step Inequalities | 7.EE.B.4b | https://youtu.be/PD8AKEHh1do

Provide Math word bank and math reference sheet /translated/copied for students.

Have students conduct activities in small groups, pairs/triads and share discuss solutions.
New Jersey Student Learning Standard(s):
G.CO.B.6: Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.

Student Learning Objective 6: Use rigid transformations to determine and explain congruence of geometric figures.

Modified Student Learning Objectives/Standards:
M. EE.G-CO.6–8: Identify corresponding congruent and similar parts of shapes.

<table>
<thead>
<tr>
<th>MPs</th>
<th>Evidence Statement Key/Clarifications</th>
<th>Skills, Strategies &amp; Concepts</th>
<th>Essential Understandings/Questions (Accountable Talk)</th>
<th>Tasks/Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>MP 3</td>
<td>G-CO.6 &amp; HS.C.14.2</td>
<td>Understand congruence in terms of rigid motion. Explain how the properties of rigid motion explain congruency. Two figures are congruent if they can be copied onto one another by a finite sequence of rigid transformations. Predict the effect of a transformation that maintains shape and size (given rigid motion on a given figure). Given a description of the rigid motions, transform figures. Write the definition of congruent using the properties of rigid motion. Recognize that congruent figures have the same shape and sizes as preserved in rigid transformations.</td>
<td>Shapes can be transformed in space using the rigid motions of translation, rotation, or reflection. Rigid motion changes position and orientation but preserves length and angle measure within a given shape. Rigid motions can be precisely described using mathematical notation, terms, and conventions, so that the outcome can be predicted. Different rigid motions, or sequences of rigid motion, can sometimes produce the same transformation.</td>
<td>IFL Sets of Related Lessons: “Investigating Congruence in Terms of Rigid Motion” Type I: Building a Tile Pattern by Reflecting Hexagons</td>
</tr>
</tbody>
</table>
Recognize the effects of rigid motion on orientation and location of a figure.

Use rigid motions to map one figure onto another.

Use the definition of congruence as a test to see if two figures are congruent. Recall two geometric figures are congruent if and only if a rigid motion or a composition of rigid motions maps one of the figures onto the other. A rigid motion maps each part of a figure to a corresponding part of its image. Because rigid motions preserve length and angle measure, corresponding parts of congruent figures are congruent. In congruent polygons, this means that the corresponding sides and the corresponding angles are congruent.

Two shapes are congruent if and only if one can be mapped onto the other using a sequence of rigid motions.

How do you determine if two figures are congruent?

What will the transformation of a figure look like given descriptions of rigid motions?

How can congruence be represented through the transformations of figures?
**SPED Strategies**

Pre-teach vocabulary using visual and verbal models that are connected to real life situations and ensure that students include these definitions in their reference notebook.

Extend student thinking from their understanding of conducting a series of transformations that end up with the figure superimposing on top of itself to using rigid transformations as a method of proving congruence.

**ELL Strategies:**

Encourage students to offer bilingual support to each other.

Students can use manipulative to further their understanding of the vocabulary being used to support a certain subject. As students view and manipulate real objects, they are able to better absorb the vocabulary associated with those objects.
New Jersey Student Learning Standard(s):
G.CO.B.7: Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.

Student Learning Objective 7: Show and explain that two triangles are congruent by using corresponding pairs of sides and corresponding pairs of angles, and by using rigid motions (transformations).

Modified Student Learning Objectives/Standards:
M.EE.G-CO.6–8: Identify corresponding congruent and similar parts of shapes.

<table>
<thead>
<tr>
<th>MPs</th>
<th>Evidence Statement Key/Clarifications</th>
<th>Skills, Strategies &amp; Concepts</th>
<th>Essential Understandings/Questions (Accountable Talk)</th>
<th>Tasks/Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>MP 2</td>
<td>HS.C.14.2</td>
<td>Understand triangle congruence in terms of rigid motion. Knowledge of vocabulary, corresponding parts and the connection to the given triangles. Ability to identify the corresponding parts of two triangles. Given that two triangles are congruent based on rigid motion, show that corresponding pairs of sides and angles are congruent. Given that corresponding pairs of sides and angles of two triangles are congruent, show, using rigid motion (transformations) that they are congruent. <strong>Third Angles Theorem:</strong> If two angles of one triangle are congruent to two angles of another triangle, then the third angles are also congruent.</td>
<td>Two shapes are congruent if corresponding pairs of sides and angles are congruent. Mapping one shape onto the other using a sequence of rigid motions can be used to verify congruence if and only if it can be shown that corresponding parts can be mapped onto each other What is required to show that two triangles are congruent? What can we conclude about two triangles that are congruent?</td>
<td>IFL Sets of Related Lessons: “Investigating Congruence in Terms of Rigid Motion” Type II, III: Properties of Congruent Triangles PBA 13</td>
</tr>
<tr>
<td>MP 6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MP 7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Prove triangles are congruent using isometries.

**SPED Strategies**
Review the concept of congruence with respect to triangles and then model how to use rigid transformations to prove or disprove congruence.

Encourage students to add this concept to their reference notebook by providing notes or guiding notetaking.

Provide students with hands on opportunities to explore and extend their understanding.

**ELL Strategies:**
Provide visual cues, graphic representations, gestures, and pictures.

Model geoboard activity to students (make shape with geoboard, copy onto “dot paper” (board), next to pictures, write “_ sides, _ angles, _ vertices each on a new line).

Have students use geoboards to create different 4 sided polygons – must create at least 4 examples (ESL students can be paired with an
Students are to copy their geoboard shapes onto dot paper, and for each write how many sides, angles and vertices there are (criteria written on board – repeat throughout activity).

**New Jersey Student Learning Standard(s):**
G.CO.B.8: Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions

**Student Learning Objective 8:** Show and explain how the criteria for triangle congruence extend from the definition of congruence in terms of rigid motion.

**Modified Student Learning Objectives/Standards:**
M.EE.G.CO.6–8: Identify corresponding congruent and similar parts of shapes.

<table>
<thead>
<tr>
<th>MPs</th>
<th>Evidence Statement Key/Clarifications</th>
<th>Skills, Strategies &amp; Concepts</th>
<th>Essential Understandings/Questions (Accountable Talk)</th>
<th>Tasks/Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>MP 2</td>
<td>HS.C.14.2</td>
<td>Understand criteria for triangle congruence.</td>
<td>Experiments with ASA, SAS, SSS criteria provide convincing evidence, though not proof, that these conditions produce congruent triangles.</td>
<td>IFL Sets of Related Lessons: “Investigating Congruence in Terms of Rigid Motion”</td>
</tr>
<tr>
<td>MP 6</td>
<td>Construct, autonomously, chains of reasoning that will justify or refute geometric propositions or conjectures. Content scope: G-CO.A, G-CO.B</td>
<td>Explain the relation of the criteria for triangle congruence to congruence in terms of rigid motion. Ability to recognize why particular combinations of corresponding parts establish congruence and why others do not. Recall from Grade 8, how to informally use rigid motions to take angles to angles and segments to segments.</td>
<td>Rigid motions and geometric properties can be used to provide a convincing argument that the criteria for triangle congruence are true.</td>
<td>Type II, III:</td>
</tr>
<tr>
<td>MP 7</td>
<td></td>
<td></td>
<td></td>
<td>SSS Congruence Criterion, Why Does SSA Work</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Why Does ASA Work</td>
</tr>
</tbody>
</table>
Formally use dynamic geometry software or straightedge and compass to take angles to angles and segments to segments.

Show and explain the criteria for the following:
- Angle-Side-Angle triangle congruence.
- Side-Angle-Side triangle congruence.
- Side-Side-Side triangle congruence.

**Angle-Side-Angle Congruence Theorem:** If two angles and the included side of one triangle are congruent to two angles and the included side of a second triangle, then the two triangles are congruent.

**Side-Angle-Side Congruence Theorem:** If two sides and the included angle of one triangle are congruent to two sides and the

Three pairs of congruent measures will not always ensure that two triangles are congruent because a counterexample can be found for some of the pairs.

Criteria for triangle congruence and other properties can be used to develop a convincing argument that two triangles are congruent.

What is the relationship of the criteria for triangle congruence to congruence in terms of rigid motion?

How can the properties of rigid motion be used to prove that two triangles are congruent (Angle Side Angle, Side Angle Side, Side Side Side)?

Why does SAS Work

Why does SSS Work

Why do particular combinations of corresponding parts establish congruence?
<table>
<thead>
<tr>
<th>Side-Side-Side Congruence Theorem: If three sides of one triangle are congruent to three sides of a second triangle, then the two triangles are congruent.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypotenuse-Leg Congruence Theorem: If the hypotenuse and a leg of a right triangle are congruent to the hypotenuse and a leg of a second right triangle, then then two triangles are congruent.</td>
</tr>
</tbody>
</table>

How do rigid motions lead to an understanding of congruence criteria for triangles?
Example of writing a proof:

Write a proof.
Given $BC \parallel DA, BC \parallel AD$
Prove $\triangle ABC \cong \triangle CDA$

<table>
<thead>
<tr>
<th>Statements</th>
<th>Reasons</th>
</tr>
</thead>
<tbody>
<tr>
<td>S 1. $BC \equiv DA$</td>
<td>1. Given</td>
</tr>
<tr>
<td>2. $BC \parallel AD$</td>
<td>2. Given</td>
</tr>
<tr>
<td>A 3. $\angle BCA \equiv \angle DAC$</td>
<td>3. Alternate Interior Angles Theorem</td>
</tr>
<tr>
<td>S 4. $\overline{AC} \equiv \overline{CA}$</td>
<td>4. Reflexive Property of Congruence</td>
</tr>
</tbody>
</table>
SPED Strategies

Review the concept of congruence with respect to triangles and then model how to use rigid transformations to prove or disprove congruence.

Encourage students to add this concept to their reference notebook by providing notes or guiding notetaking.

Provide students with hands on opportunities to explore and extend their understanding.

ELL Strategies:
Create posters to visualize the geometric concept.
Provide students with hands on opportunities to explore and extend their understanding of constructions using tools such as compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.
New Jersey Student Learning Standard(s):

**G.CO.D.12:** Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.

**G.CO.D.13:** Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.

**Student Learning Objective 9:** Make formal constructions using a variety of tools (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.) and methods.

**Modified Student Learning Objectives/Standards: N/A**

<table>
<thead>
<tr>
<th>MPs</th>
<th>Evidence Statement Key/Clarifications</th>
<th>Skills, Strategies &amp; Concepts</th>
<th>Essential Understandings/Questions (Accountable Talk)</th>
<th>Tasks/Activities</th>
</tr>
</thead>
</table>
| MP 3 MP 5 MP 6 | **G-CO.D**  
- About 75% of the tasks align to G.CO.12.  
- Tasks may include requiring students to justify steps and results of a given construction.  
**HS.C.14.3**  
- Construct, autonomously, chains of reasoning that will justify or refute geometric propositions or conjectures. Content scope: G-CO.D  
**HS.D. 3-2a** | A construction is a geometric drawing that uses a limited set of tools, usually a compass and a straightedge.  
Congruence underlies formal constructions.  
When performing constructions, remind students that they are making congruent segments when and arc intersects a line in two locations. This is not obvious because the congruent segments are not drawn.  
Perform formal constructions using a variety of tools and methods including: copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines; constructing the | How can I use constructions to show congruence in geometric figures?  
What is the purpose of creating constructions of geometric figures?  
How can tools and techniques be used to illustrate geometric concepts?  
Why do you think we use a straightedge rather than a | Type I:  
Origami Silver Rectangle  
Type II, III:  
Angle Bisection and Midpoints  
Bisecting an Angle  
Construction of Perpendicular Bisector  
Inscribing a Hexagon in a Circle |
- Micro-models: Autonomously apply a technique from pure mathematics to a real-world situation in which the technique yields valuable results even though it is obviously not applicable in a strict mathematical sense (e.g., profitably applying proportional relationships to a phenomenon that is obviously nonlinear or statistical in nature).

  **Content Scope:** Knowledge and skills articulated in the Geometry Type I, Sub-Claim A, Evidence Statements.

  **HS.D. 3-4a**

- Reasoned estimates: Use reasonable estimates of known quantities in a chain of reasoning that yields an estimate of an unknown quantity.

  **Content Scope:** Knowledge and skills articulated in the Geometry Type I, Sub-

<table>
<thead>
<tr>
<th>perpendicular bisector of a line segment; constructing a line parallel to a given line through a point not on the line; constructing an equilateral triangle; constructing a square; and constructing a regular hexagon inscribed in a circle.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identify the congruency underlying each construction.</td>
</tr>
<tr>
<td>Use the understanding of geometric concepts to establish a rationale for the steps and/or procedures used in completing a construction. Apply the definitions, properties, and theorems about line segments, rays and angles to support geometric constructions.</td>
</tr>
<tr>
<td>Line segments that have the same length are called congruent segments.</td>
</tr>
<tr>
<td><strong>Segment addition postulate:</strong> If B is between A and C, then ( AB + BC = AC ). If ( AB = BC = AC ), then B is between A and C.</td>
</tr>
<tr>
<td>Spiral back to a discussion about deductive reasoning and proof. The list of properties, definitions, theorems, and postulates is starting to get long and these are the tools that students have in constructing a logical argument.</td>
</tr>
<tr>
<td>Apply properties and theorems about parallel and perpendicular lines to support constructions.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Inscribing an Equilateral Triangle in a Circle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Locating Warehouse</td>
</tr>
<tr>
<td>Origami Equilateral Triangle</td>
</tr>
<tr>
<td>Origami Silver Rectangle</td>
</tr>
<tr>
<td>Paper Cutting</td>
</tr>
<tr>
<td>Reflected Triangles</td>
</tr>
</tbody>
</table>
Claim A Evidence Statements.

**Linear Pair of Perpendicular Theorem:** If two lines intersect to form a linear pair of congruent angles, then the lines are perpendicular.

![Image of two lines forming a linear pair with congruent angles](image1)

If $\angle 1 \equiv \angle 2$, then $g \perp h$.

**Perpendicular Transversal Theorem:** In a plane, if a transversal is perpendicular to one of two parallel lines, then it is perpendicular to the other line.

![Image of a transversal perpendicular to two parallel lines](image2)

If $h \parallel k$ and $j \perp h$, then $j \perp k$.

**Lines Perpendicular to a Transversal Theorem:** In a plane, if two lines are perpendicular to the same line, then they are parallel to each other.

![Image of two lines perpendicular to the same line](image3)

If $m \perp p$ and $n \perp p$, then $m \parallel n$. 
**Transitive Property of Parallel lines:** If two lines are parallel to the same line, then they are parallel to each other.

![Parallel Line Diagram]

**SPED Strategies**

Provide students with hands on opportunities to explore and extend their understanding of constructions using tools such as compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.

Model the thinking behind the constructions stressing the definitions of the figures and the necessary characteristics to adhere to those definitions.

Connect the importance of this practice to real life careers such as engineering, graphic design, manufacturing etc.

**ELL Strategies:**

Provide visual cues, graphic representations, gestures, and pictures.

Have students conduct activities in small groups, pairs/triads and share discuss.
solutions. Create math journals for students, who can write meaning.

When partner work is used, students work with each other to complete a task. One student can be paired with another student who has a similar English proficiency, different English proficiency, or the same native language. The goal of partner work is to help students support their partners’ language and assist in filling in background knowledge gaps. In pairs, students are able to explain language and ideas to each other which they may not understand individually.

**New Jersey Student Learning Standard(s):**
S.CP.A.1: Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events (“or,” “and,” “not”).

**Student Learning Objective 10:** Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events (“or,” “and,” ”not”).

**Modified Student Learning Objectives/Standards:**
M.EE.S-CP.1–5: Identify when events are independent or dependent.

<table>
<thead>
<tr>
<th>MPs</th>
<th>Evidence Statement Key/Clarifications</th>
<th>Skills, Strategies &amp; Concepts</th>
<th>Essential Understandings/Questions (Accountable Talk)</th>
<th>Tasks/Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>MP 1</td>
<td>N/A</td>
<td>Events are described as subsets of a sample space.</td>
<td>In what ways does one event impact the probability of another event occurring?</td>
<td>Type II, III: The Titanic 1</td>
</tr>
<tr>
<td>MP 2</td>
<td></td>
<td>Identify a sample space, recognizing it as the set of all possible outcomes.</td>
<td>Give an example of a sample space and describe</td>
<td></td>
</tr>
<tr>
<td>MP 4</td>
<td></td>
<td>Identify and describe subsets of a sample space as events.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MP 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MP 6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Type II, III:** Describing Events
Describe unions, intersections and complements of events.

Visualize unions, intersections and complements of events with Venn diagrams.

Establish events as subsets of a sample space.

**SPED Strategies:**
Pre-teach vocabulary using visual and verbal models that are connected to real life situations.

Create a reference document for students that highlights the characteristics of outcomes, unions, intersections and complements with clear examples depicted verbally and pictorially.

Provide students with opportunities to practice the skills learned by working with sample problems in small groups with peers.

Encourage students to verbalize their thinking by asking assessment and advancing questions. Based on the information gleaned from these questions, tailor instructional strategies to meet needs.

several events based on that sample space.

Explain the connection between unions, intersections, and complements of sets and the probabilities of events.
**ELL Strategies:**

Describe orally and/or in written form the events as subsets of a sample space using characteristics of the outcomes, or as unions, intersections, or complements of other events in the student’s native language and/or use gestures, examples and selected technical words.

Use a graphic calculator and use “the dice rolling apps” to explore experiment and evaluate sample space.

Use a Venn diagram to represent and display outcomes data in an intersection, union or complement.
### Honors Projects (must complete all)

<table>
<thead>
<tr>
<th>Project 1</th>
<th>Project 2</th>
<th>Project 3</th>
</tr>
</thead>
</table>
| **Origami**  
*G.CO.D12 and G.CO.D13*  
**Essential Question:**  
How do geometric principles affect the construction of objects?  
**Skills:**  
1. Understand effect of geometry in the construction of an object using paper folding techniques.  
2. Follow directions and steps precisely to accurately construct the object.  |
| **Construction – Mystery Quadrilateral**  
*G.CO.A.1, G.CO.D.12 and G.CO.D.13*  
**Essential Question:**  
What does the inscription of a quadrilateral inside of a circle tell us about the inherent qualities of a circle and a quadrilateral?  
**Skills:**  
1. Accurately calculate and draw the figures.  
2. Analyze the relationship and draw conclusions about geometric principles.  |
| **Geometry Scrapbook**  
*G.CO.A.1 and G.CO.A.4*  
**Essential Question:**  
What are the essential elements of geometric figures and why are they important?  
**Skills:**  
Develop a deeper and more complex understanding of geometric figures by visualizing them in the world.  |
### Integrated Evidence Statements

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>G-CO.C:</strong> Prove geometric theorems as detailed in G-CO.C.</td>
<td></td>
</tr>
<tr>
<td>- About 75% of tasks align to G.CO.9 or G.CO.10.</td>
<td></td>
</tr>
<tr>
<td>- Theorems include but are not limited to the examples listed in standards G-CO.9, 10,11.</td>
<td></td>
</tr>
<tr>
<td>- Multiple types of proofs are allowed (e.g., two-column proof, indirect proof, paragraph proof, and flow diagram.</td>
<td></td>
</tr>
<tr>
<td><strong>G-CO.D:</strong> Make and understand geometric constructions as detailed in G-CO.D.</td>
<td></td>
</tr>
<tr>
<td>- About 75% of tasks align to G.CO.12.</td>
<td></td>
</tr>
<tr>
<td>- Tasks may include requiring students to justify steps and results of a given construction.</td>
<td></td>
</tr>
<tr>
<td><strong>HS.C.14.2:</strong> Construct, autonomously, chains of reasoning that will justify or refute geometric propositions or conjectures. Content scope: G-CO.A, G-CO.B.</td>
<td></td>
</tr>
<tr>
<td><strong>HS.C.14.3</strong> Construct, autonomously, chains of reasoning that will justify or refute geometric propositions or conjectures. Content scope: G-CO.D.</td>
<td></td>
</tr>
<tr>
<td><strong>HS.D.1-2:</strong> Solve multi-step contextual problems with degree of difficulty appropriate to the course, requiring application of knowledge and skills articulated in 6.G, 7.G, and/or 8.G.</td>
<td></td>
</tr>
<tr>
<td>Unit 1 Vocabulary</td>
<td></td>
</tr>
<tr>
<td>------------------</td>
<td></td>
</tr>
<tr>
<td>• acute angle</td>
<td>• line of reflection</td>
</tr>
<tr>
<td>• adjacent angles</td>
<td>• line of symmetry</td>
</tr>
<tr>
<td>• angle</td>
<td>• line segment</td>
</tr>
<tr>
<td>• Angle-Side-Angle Congruence Theorem</td>
<td>• Hypotenuse-Leg Congruence Theorem</td>
</tr>
<tr>
<td>• center of a circle</td>
<td>• image</td>
</tr>
<tr>
<td>• circle</td>
<td>• input</td>
</tr>
<tr>
<td>• circular arc</td>
<td>• inscribed</td>
</tr>
<tr>
<td>• compass</td>
<td>• intersection</td>
</tr>
<tr>
<td>• Composition Theorem</td>
<td>• isometry</td>
</tr>
<tr>
<td>• construction</td>
<td>• line</td>
</tr>
<tr>
<td>• corresponding angles</td>
<td>• Linear Pair of Perpendicular Theorem</td>
</tr>
<tr>
<td>• corresponding sides</td>
<td>• Lines Perpendicular to a Transversal Theorem</td>
</tr>
<tr>
<td>• corresponding parts</td>
<td>• parallel lines</td>
</tr>
<tr>
<td>• dilation</td>
<td>• parallel planes</td>
</tr>
<tr>
<td>• distance</td>
<td>• parallelogram</td>
</tr>
<tr>
<td>• distance from a point to a line</td>
<td>• perpendicular</td>
</tr>
<tr>
<td>• element</td>
<td>• perpendicular lines</td>
</tr>
<tr>
<td>• empty set</td>
<td>• Perpendicular Transversal Theorem</td>
</tr>
<tr>
<td>• equilateral polygon</td>
<td>• plane</td>
</tr>
<tr>
<td>• equilateral triangle</td>
<td>• point</td>
</tr>
<tr>
<td>• figure</td>
<td>• postulate</td>
</tr>
<tr>
<td>• function</td>
<td>• pre-image</td>
</tr>
<tr>
<td>• horizontal stretch</td>
<td>• ray</td>
</tr>
<tr>
<td>• line of reflection</td>
<td>• reflection</td>
</tr>
<tr>
<td>• line of symmetry</td>
<td>• Reflections in Intersecting Lines Theorem</td>
</tr>
<tr>
<td>• line segment</td>
<td>• Reflections in Parallel Lines Theorem</td>
</tr>
<tr>
<td>• Hypotenuse-Leg Congruence Theorem</td>
<td>• rectangle</td>
</tr>
<tr>
<td>• image</td>
<td>• rigid motion</td>
</tr>
<tr>
<td>• input</td>
<td>• rotation</td>
</tr>
<tr>
<td>• inscribed</td>
<td>• set</td>
</tr>
<tr>
<td>• intersection</td>
<td>• Segment addition postulate</td>
</tr>
<tr>
<td>• isometry</td>
<td>• Side- Angle-Side Congruence Theorem</td>
</tr>
<tr>
<td>• line</td>
<td>• Side-Side-Side Congruence Theorem</td>
</tr>
<tr>
<td>• Linear Pair of Perpendicular Theorem</td>
<td>• Straightedge</td>
</tr>
<tr>
<td>• Lines Perpendicular to a Transversal Theorem</td>
<td>• subset</td>
</tr>
<tr>
<td>• parallel lines</td>
<td>• symmetry</td>
</tr>
<tr>
<td>• parallel planes</td>
<td>• theorem</td>
</tr>
<tr>
<td>• parallelogram</td>
<td>• theoretical probability</td>
</tr>
<tr>
<td>• perpendicular</td>
<td>• Third Angles Theorem</td>
</tr>
<tr>
<td>• perpendicular lines</td>
<td>• Transformation</td>
</tr>
<tr>
<td>• Perpendicular Transversal Theorem</td>
<td>• Transitive Property of Parallel lines</td>
</tr>
<tr>
<td>• plane</td>
<td>• translation</td>
</tr>
<tr>
<td>• point</td>
<td>• transversal</td>
</tr>
<tr>
<td>• postulate</td>
<td>• trapezoids</td>
</tr>
<tr>
<td>• pre-image</td>
<td>• universal set</td>
</tr>
<tr>
<td>• ray</td>
<td>• union</td>
</tr>
</tbody>
</table>
## References & Suggested Instructional Websites

- [https://hcpss.instructure.com/courses/162](https://hcpss.instructure.com/courses/162)
- [https://www.desmos.com/](https://www.desmos.com/)
- [http://www.cpalms.org/Public/ToolkitGradeLevelGroup/Toolkit?id=14](http://www.cpalms.org/Public/ToolkitGradeLevelGroup/Toolkit?id=14)
- [www.corestandards.org](http://www.corestandards.org)
- [www.nctm.org](http://www.nctm.org)
- [https://www.khanacademy.org](https://www.khanacademy.org)
- [http://achievethecore.org](http://achievethecore.org)
- [https://www.illustrativemathematics.org/](https://www.illustrativemathematics.org/)
- [www.insidemathematics.org](http://www.insidemathematics.org/)
- [https://learnzillion.com/resources/75114-math](https://learnzillion.com/resources/75114-math)
- [http://maccss.nedpi.wikispaces.net/](http://maccss.nedpi.wikispaces.net/) (Choose your grade level on the left.)
- [http://nrich.maths.org](http://nrich.maths.org)
- [https://www.youcubed.org/week-of-inspirational-math/](https://www.youcubed.org/week-of-inspirational-math/)
- [http://illuminations.nctm.org/Lessons-Activities.aspx](http://illuminations.nctm.org/Lessons-Activities.aspx) (choose grade level and connect to search lessons)
- [www.ck12.org](http://www.ck12.org)


Field Trip Ideas

**SIX FLAGS GREAT ADVENTURE**- This educational event includes workbooks and special science and math related shows throughout the day. Your students will leave with a better understanding of real world applications of the material they have learned in the classroom. Each student will have the opportunity to experience different rides and attractions linking mathematical and scientific concepts to what they are experiencing.

[www.sixflags.com](http://www.sixflags.com)

**MUSEUM of MATHEMATICS**- Mathematics illuminates the patterns that abound in our world. The National Museum of Mathematics strives to enhance public understanding and perception of mathematics. Its dynamic exhibits and programs stimulate inquiry, spark curiosity, and reveal the wonders of mathematics. The Museum’s activities lead a broad and diverse audience to understand the evolving, creative, human, and aesthetic nature of mathematics.

[www.momath.org](http://www.momath.org)

**LIBERTY SCIENCE CENTER** - An interactive science museum and learning center located in Liberty State Park. The center, which first opened in 1993 as New Jersey's first major state science museum, has science exhibits, the largest IMAX Dome theater in the United States, numerous educational resources, and the original *Hoberman sphere.*

[http://lsc.org/plan-your-visit/](http://lsc.org/plan-your-visit/)