Orange Public Schools

Office of Curriculum & Instruction

2020-2021 Mathematics Curriculum Guide

Geometry

Unit1: Geometric Transformation

September 9, 2020 –November 13, 2020

Board Approved: 1.14.2020

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Contents

A STORY OF UNITS (Yearlong Pacing Guide)				
Marking Period	MP 1 (9/9/20 – 11/13/20)	MP 2 (11/14/20- 1/30/21)	MP 3 (1/31/21-4/9/21)	MP 4 (4/10/21-6/22/21)
Unit Topic	Geometric Transformation	Reasoning with Angles & Lines	Similar & Congruent Triangles	Right Triangle Relationships and Trigonometry
Description	Using inductive reasoning and conjecture to performance rigid transformations for coordinate geometry.	Using deductive reasoning, logic statement and proof to understand angle relationships for parallel lines with transversals	Using dilation to define similarity of geometric figures and use the properties of similarity to solve problems	Using Pythagorean Theorem and the distance formula to understand the trig. ratios and use trig. ratios to solve problems

Unit Overview

Unit 1: Geometric Transformations

Overview

This course uses Agile Mind as its primary resource, which can be accessed at the following URL:

- www.orange.agilemind.com

Each unit consists of 1-3 topics. Within each topic, there are "Exploring" lessons with accompanying activity sheets, practice, and assessments. The curriculum guide provides an analysis of each topic, detailing the standards, objectives, skills, and concepts to be covered. In addition, it provides suggestions for pacing, sequence, and emphasis of the content.

Essential Questions

- What is inductive reasoning and how do I use it?
- What are rigid transformations?
- How can rigid transformations be used to discover and prove geometric properties?
- What is coordinate geometry?

Enduring Understandings

- Inductive reasoning is the process of observing and forming conclusions about patterns.
- Rigid transformations of a geometric shape do not change length, area, or angle measure.
- Coordinate geometry is a tool for discovering and verifying properties of geometric shapes;

NJSLS

1) G.CO.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~~.
2) G.CO.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).~~
3) G.CO.3: Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.
4) G.CO.4: Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.
5) G.CO.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.
6) G.CO.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~~.
7) G.CO.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.~~
8) G.C.3: Construct the inscribed and circumscribed circles of a triangle, and ~~prove properties of angles for a quadrilateral inscribed in a circle~~.

9) *G.CO.9: Prove theorems about lines and angles. Theorems include: ~~vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent;~~ points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.*

These standards support other standards in this unit, but is not a main focus

10) *G.GPE.4: Use coordinates to prove simple geometric theorems algebraically. ~~For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point (1, √3) lies on the circle centered at the origin and containing the point (0, 2).~~*

11) *G.GPE.5: ~~Prove the~~ slope criteria for parallel ~~and perpendicular~~ lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point).*

Major Content
Supporting Content
Additional Content
~~Parts of standard not contained in this unit~~

21st Century Career Ready Practice

CRP1. Act as a responsible and contributing citizen and employee.
CRP2. Apply appropriate academic and technical skills.
CRP3. Attend to personal health and financial well-being.
CRP4. Communicate clearly and effectively and with reason.
CRP5. Consider the environmental, social and economic impacts of decisions.
CRP6. Demonstrate creativity and innovation.
CRP7. Employ valid and reliable research strategies.
CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
CRP9. Model integrity, ethical leadership and effective management.
CRP10. Plan education and career paths aligned to personal goals.
CRP11. Use technology to enhance productivity.
CRP12. Work productively in teams while using cultural global competence.

Overview			
Topic	Name	NJSLS	Suggesting Pacing
1	Using Inductive Reasoning and Conjectures	G.CO. 1, G.CO.12, G.C.3	5 Periods
2	Rigid Transformations	G.CO.2, G. CO.3, G. CO.5 G. CO.6	7 Periods
3	Transformations and Coordinate Geometry	G.CO.2, G. CO.5, G.CO.9 G.GPE.4, G.GPE.5	14 periods

Summary:

26 days on new content (3 topics)
2 task days
1 review day
1 test day
3 NWEA days
2 Benchmark day

35 days in Unit 1

Note: Geometry Period (45 minutes per day)

Pacing Guide

Calendar:

Please create a pacing calendar for your classes based on the suggested scope and sequence.

September 2020						
Sun	Mon	Tue	Wed	Thu	Fri	Sat

October 2020						
Sun	Mon	Tue	Wed	Thu	Fri	Sat

November 2020						
Sun	Mon	Tue	Wed	Thu	Fri	Sat

Student Learning Material

Agile Mind Geometry: https://orange.agilemind.com/LMS/lmswrapper/LMS.html

Drawing on more than twenty-five hundred years of mathematical work, Geometry introduces the tools central to the study of space and spatial relationships. Students began their study of geometric concepts in elementary and middle school mathematics. In middle school, they studied area, surface area, and volume and informally investigated lines, angles, and triangles. Students in middle school also explored transformations, including translations, reflections, rotations, and dilations. The Charles A. Dana Center and Agile Mind have intentionally designed this Geometry course to begin with developing the tools of geometry, including transformations, proof, and constructions. These tools are used throughout the course as students formalize geometric concepts studied in earlier courses and extend those ideas to new concepts presented in the high school standards.

Once students have some tools with which to explore geometry, they begin to formalize geometric relationships involving angles, lines, triangles, quadrilaterals, and circles. Respecting a deeply rooted tradition, Geometry provides for students a first introduction to formal mathematical reasoning, logic, and proof, in which they are introduced to what constitute the standards of evidence in modern mathematics. Students spend time creating viable arguments around triangle congruence and similarity, using transformations as the key underlying definition of congruence and similarity.

Their study of triangles includes trigonometric ratios and right triangle relationships. Students create arguments and solve problems with shapes represented both on and off the coordinate grid. Coordinate geometry provides a connection and reinforcement to ideas studied in Algebra I. Students extend their understanding of plane geometry to model the world they live in using three-dimensional shapes. Extending their understanding of area and volume from middle school, students are able to solve geometric modeling problems and analyze characteristics of three-dimensional shapes, including plane sections and solids of revolution. Throughout the course, students focus on developing logical arguments and using geometry to model their world

There is a focus throughout the course on the Mathematical Practice Standards. These practices should become the natural way in which students come to understand and do mathematics. While—depending on the content to be understood or on the problem to be solved—any practice might be brought to bear, some practices may prove more useful than others. In a high school geometry course, communication, reasoning, and justification are particularly important, as are modeling, the strategic use of appropriate tools, and precision of language.

Modifications	
Special Education/ 504:	**English Language Learners:**
-Adhere to all modifications and health concerns stated in each IEP. -Give students a MENU options, allowing students to pick assignments from different levels based on difficulty. -Accommodate Instructional Strategies: reading aloud text, graphic organizers, one-on-one instruction, class website (Google Classroom), handouts, definition list with visuals, extended time -Allow students to demonstrate understanding of a problem by drawing the picture of the answer and then explaining the reasoning orally and/or writing , such as Read-Draw-Write -Provide breaks between tasks, use positive reinforcement, use proximity -Assure students have experiences that are on the Concrete- Pictorial- Abstract spectrum by using manipulatives -Common Core Approach to Differentiate Instruction: Students with Disabilities (pg 17-18) -Strategies for Students with 504 Plans	- Use manipulatives to promote conceptual understanding and enhance vocabulary usage - Provide graphic representations, gestures, drawings, equations, realia, and pictures during all segments of instruction - During ALEKS lessons, click on "Español" to hear specific words in Spanish - Utilize graphic organizers which are concrete, pictorial ways of constructing knowledge and organizing information - Use sentence frames and questioning strategies so that students will explain their thinking/ process of how to solve word problems - Utilize program translations (if available) for L1/ L2 students - Reword questions in simpler language - Make use of the ELL Mathematical Language Routines (click here for additional information) -Scaffolding instruction for ELL Learners -Common Core Approach to Differentiate Instruction: Students with Disabilities (pg 16-17)
Gifted and Talented:	**Students at Risk for Failure:**
- Elevated contextual complexity - Inquiry based or open ended assignments and projects - More time to study concepts with greater depth - Promote the synthesis of concepts and making real world connections - Provide students with enrichment practice that are	- Assure students have experiences that are on the Concrete- Pictorial- Abstract spectrum - Modify Instructional Strategies, reading aloud text, graphic organizers, one-on-one instruction, class website (Google Classroom), inclusion of more visuals and manipulatives, Field Trips, Google Expeditions, Peer Support, one on one instruction - Assure constant parental/ guardian contact throughout

imbedded in the curriculum such as: ● Application / Conceptual Development ● Are you ready for more? - Common Core Approach to Differentiate Instruction: Students with Disabilities (pg. 20) - Provide opportunities for math competitions - Alternative instruction pathways available	the year with successes/ challenges - Provide academic contracts to students and guardians - Create an interactive notebook with samples, key vocabulary words, student goals/ objectives. - Always plan to address students at risk in your learning tasks, instructions, and directions. Try to anticipate where the needs will be and then address them prior to lessons. -Common Core Approach to Differentiate Instruction: Students with Disabilities (pg 19)

21st Century Life and Career Skills:

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.

https://www.state.nj.us/education/cccs/2014/career/9.pdf

- **CRP1**. Act as a responsible and contributing citizen and employee.
- **CRP2**. Apply appropriate academic and technical skills.
- **CRP3**. Attend to personal health and financial well-being.
- **CRP4**. Communicate clearly and effectively and with reason.
- **CRP5**. Consider the environmental, social and economic impacts of decisions.
- **CRP6**. Demonstrate creativity and innovation.
- **CRP7**. Employ valid and reliable research strategies.
- **CRP8**. Utilize critical thinking to make sense of problems and persevere in solving them.
- **CRP9**. Model integrity, ethical leadership and effective management.
- **CRP10**. Plan education and career paths aligned to personal goals.
- **CRP11**. Use technology to enhance productivity.
- **CRP12**. Work productively in teams while using cultural global competence.

Students are given an opportunity to communicate with peers effectively, clearly, and with the use of technical language. They are encouraged to reason through experiences that promote critical thinking and emphasize the importance of perseverance. Students are exposed to various mediums of technology, such as digital learning, calculators, and educational websites.

Technology Standards:

All students will be prepared to meet the challenge of a dynamic global society in which they participate, contribute, achieve, and flourish through universal access to people, information, and ideas.

https://www.state.nj.us/education/cccs/2014/tech/

8.1 Educational Technology:	8.2 Technology Education, Engineering, Design, and Computational Thinking - Programming:
All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge. A. **Technology Operations and Concepts:** Students demonstrate a sound understanding of technology concepts, systems and operations. B. **Creativity and Innovation:** Students demonstrate creative thinking, construct knowledge and develop innovative products and process using technology. C. **Communication and Collaboration:** Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others. D. **Digital Citizenship:** Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior. E. **Research and Information Fluency:** Students apply digital tools to gather, evaluate, and use of information. F. **Critical thinking, problem solving, and decision making:** Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.	All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment. A. **The Nature of Technology: Creativity and Innovation-** Technology systems impact every aspect of the world in which we live. B. **Technology and Society:** Knowledge and understanding of human, cultural, and societal values are fundamental when designing technological systems and products in the global society. C. **Design:** The design process is a systematic approach to solving problems. D. **Abilities in a Technological World:** The designed world in a product of a design process that provides the means to convert resources into products and systems. E. **Computational Thinking: Programming-** Computational thinking builds and enhances problem solving, allowing students to move beyond using knowledge to creating knowledge.

Interdisciplinary Connections:
English Language Arts:

ELA.Literacy.RI-9-10.4	Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze the cumulative impact of specific word choices on meaning and tone (e.g., how the language of a court opinion differs from that of a newspaper).
ELA-LITERACY.SL.9-10.4	Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.
ELA-LITERACY.W.9-10.2.A	Introduce a topic; organize complex ideas, concepts, and information to make important connections and distinctions; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.

Geometry Unit

Assessment Framework

Assessment	Assignment Type	Grading	Source	Estimated in-class time	When?
Diagnostic Assessment *Unit 1 Diagnostic*	Diagnostic Assessment	Traditional (zero weight)	Curriculum Dept. created – see Dropbox	1 period	Beginning of unit
Mid-Unit Assessment	Formative Assessment	Traditional	Teacher created using "Assessments" in Agile Mind	1-2 periods	Mid unit (optional, must have 3 tests per MP)
Benchmark Assessment	Summative Assessment	Traditional	Curriculum Dept. created	2 periods	End of unit
ECRs	Performance Assessment	Rubric	Curriculum Dept. Created	½ period for each ECR	Last week of each month
Performance Task *Unit 1 Performance Tasks*	Performance Assessment	Rubric	Teacher co-created Assessment	2 periods	In topic 3
Quizzes	Formative Assessment	Rubric or Traditional	Teacher created or "Practice" in Agile Minds	< ½ block	Varies (must have 3 quizzes per MP)

NWEA Map Test Window: September 21 – Oct. 2, 2020

Benchmark Assessment Window: Oct. 28 -- Nov. 13, 2020

Topic 1: Using Inductive Reasoning and Conjectures

Topic Objectives (Note: these are not in 3-part or SMART objective format)

1. Know precise definitions of angle, perpendicular line, and line segment
2. Make the following constructions: bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment, and inscribed and circumscribed circles of a triangle
3. Write conjectures based on observations, and use them to write informal arguments

Focused Mathematical Practices

- MP 2: Reason abstractly and quantitatively
- MP 3: Construct viable arguments and critique the reasoning of others
- MP 5: Use appropriate tools strategically
- MP 6: Attend to precision
- MP 7: Look for and make use of structure
- MP 8: Express regularity in repeated reasoning

Vocabulary

- Inductive reasoning, point, line, plane, line segment, angle, vertex, ray, collinear, coplanar, conjecture, angle bisector, incenter, inscribed circle, perpendicular bisector, circumcenter, *and* circumscribed circle.

Fluency

- Plotting points on a coordinate grid
- Using correct notation when naming angles, lines, line segments, rays, etc.
- Solving linear equations (i.e. 2x = x + 10)
- Use of a compass

Suggested Topic Structure and Pacing

Block	**Objective(s) covered**	**Agile Mind "Blocks"** (see Professional Support for further lesson details)	**MP**	**Additional Notes**
1	1	*Period 1* *Period 2*	2, 3, 8	Since inductive reasoning appears later in the topic, spend the majority of time focuses on Agile Mind "Block" #2
2-3	2, 3	*Period 3* *Period 4* *Period 5*	2, 3, 5, 6	

NJSLS	**Concepts** What students will know	**Skills** What students will be able to do
G.CO.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~~. G.CO.12: Make formal geometric constructions with a variety of tools	***Review*** • Classifications/terminology of triangles, circles, and segments ***New*** • Inductive reasoning is the process of observing and forming conclusions about patterns and relationships • A conjecture is based upon the observations and relationships. • If you have not yet shown or proven that your conjecture is true for all cases, it remains a conjecture.	***Review*** • Measure segments with a ruler • Measure angles with a protractor ***New*** • Describe points, lines, and planes using physical models in our world • Write conjectures based on observations of patterns and relationships • Define and use correct notation for line, segment, ray, angle, angle bisector, and collinear points • Make constructions using paper folding and drawing (see exactly constructions above)

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.C.3: Construct the inscribed and circumscribed circles of a triangle, and ~~prove properties of angles for a quadrilateral inscribed in a circle~~.	• Conjectures can be used to build logical explanations and justifications in mathematics • Knowing and using precise definitions and notations will be the basic building blocks of geometry • If a point is on an angle bisector, then it is equidistant from both sides of the angle. • The three angle bisectors of a triangle interest at a single point, called the triangle's incenter. • IF a point is on a segment's perpendicular bisector, then that point is equidistant from each of the segment's endpoints.	

Topic 2: Rigid Transformations

Topic Objectives (Note: these are not in 3-part or SMART objective format)

4. Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments; understand the definition of a rigid transformation.
5. Use translations, rotations, and reflections to write and justify conjectures about geometric properties

Focused Mathematical Practices

- MP 2: Reason abstractly and quantitatively
- MP 5: Use appropriate tools strategically
- MP 6: Attend to precision

Vocabulary

- transformation, rigid, isometry, pre-image, image, betweenness, composition, composite, tessellation, reflectional (or line) symmetry, rotational symmetry, bilateral symmetry, and n-fold rotational symmetry

Fluency

- Knowledge and application of definitions from Topic 1
- Solving linear equations and using properties to justify steps
- Measuring angles with a protractor

Suggested Topic Structure and Pacing

Block	**Objective(s) covered**	**Agile Mind "Blocks"** (see Professional Support for further lesson details)	**MP**	**Additional Notes**
1-2	4-5	*Period 1* *Period 2* *Period 3*	5, 6	
3	5	*Period 4* *Period 5* *Period 6*	2, 5, 6	Topics regarding tessellations and symmetry are optional and should be skipped if there are time constraints.
		Period 7		Skip this block and use these practice questions embedded in other lessons, as homework assignments, or as a review for the End of Unit Assessment.

NJSLS	**Concepts** What students will know	**Skills** What students will be able to do
G.CO.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).~~	***Review*** • Definition of perpendicular bisector ***New*** • Translations, reflections, and rotations are all rigid transformations • A rigid transformation does not change the size or shape of an object • Measurements such as distance, angle measure, and area do not move when an object is moved with a rigid transformation	***Review*** • Identify translations, rotations, and reflections in images • Measure angles with a protractor ***New*** • Understand a geometric definition of a reflection • Understand a geometric definition of a translation as the composition of two reflections across parallel lines • Understand a geometric definition of a rotation as the composition of two reflections across intersecting lines

G.CO.3: Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself. G.CO.4: Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments. G.CO.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. G.CO.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~~.	• Rigid transformations also preserve collinearity and betweenness of points • Because they preserve shape and size, rigid transformations are often useful in proving geometric properties • A reflection can be described as the "flipping" of an object across a line. A reflection of a point P across a line m is defined as the point P' if line m is the perpendicular bisector of segment • A translation can be described as "sliding" an object a certain distance in a certain direction. A translation of a point A to point A' can be defined as the composition of two reflections over parallel lines. • A rotation can be described as "turning" an object a certain number of degrees about a fixed point, called the center of MM'.	• Use rigid transformations to write conjectures about geometric properties

Topic 3: Transformations and Rigid Geometry

Topic Objectives (Note: these are not in 3-part or SMART objective format)

6. Use coordinate representations of figures and transformations in the coordinate plane to investigate and solve application problems
7. Given a geometric figure and a rigid transformation, draw the transformed figure; specify a sequence of transformations that will carry a figure onto another.
8. Describe transformations as functions and ordered pair rules

Focused Mathematical Practices

- MP 2: Reason abstractly and quantitatively
- MP 4: Model with mathematics
- MP 5: Use appropriate tools strategically
- MP 6: Attend to precision
- MP 8: Express regularity in repeated reasoning

Vocabulary

- Ordered pair rule, vector, matrix, equidistant, transversal, corresponding angles, and matrices

Fluency

- Reading coordinates on a coordinate plane
- Tracing using patty paper

Suggested Topic Structure and Pacing

Block	**Objective(s) covered**	**Agile Mind "Blocks"** (see Professional Support for further lesson details)	**MP**	**Additional Notes**
1	7-8	*Period 1- 4*	2, 5, 8	
2	7-8	*Period 5 -8*	2, 5, 8	If time is an issue, do not emphasize the topic of vectors.
3	6-7	Period 9-12	2, 4, 5, 6	Also give the Topic 3 constructed response question as the Unit 1 Performance Task in this block.
		Period 13-14		Use assessment questions (automatically scored) embedded in other lessons, as homework, Mid Unit Assessment questions, or as a review for the End of Unit Assessment

NJSLS	**Concepts** What students will know	**Skills** What students will be able to do
G.CO.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~~	***Review*** • Slope formula • Relationships between slopes and parallel/perpendicular lines • Pythagorean's Theorem • Definitions of translations, rotations, and reflections ***New*** • In the coordinate plane, reflections, translations, and rotations of a figure (pre-image)	***Review*** • Plotting a reading points on a coordinate plate • Using the slope formula • Find the midpoint of a segment on a coordinate plane ***New*** • Represent transformations in the coordinate plane • Describe transformations given two figures • Specify a sequence of transformations that will carry a figure onto another

~~angle to those that do not (e.g., translation versus horizontal stretch).~~ G.CO.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.	can be described with ordered pair rules. (function input/output rules) • Translations and rotations can be defined by compositions of reflections	• Describe transformations as functions and ordered pair rules • Use rigid transformations to solve application problems
G.CO.9: Prove theorems about lines and angles. Theorems include: ~~vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent;~~ points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints. *G.GPE.4: Use coordinates to prove simple geometric theorems algebraically.* *G.GPE.5: ~~Prove the~~ slope criteria for parallel ~~and perpendicular~~ lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point)*	***Review*** • Slope formula • Relationships between slopes and parallel/perpendicular lines • Pythagorean's Theorem ***New*** • Rigid transformations can be used to solve real world problems.	***Review*** • Plotting a reading points on a coordinate plate • Using the slope formula • Find the midpoint of a segment on a coordinate plane ***New*** • Use rigid transformations to solve applicatio problems

5 Practices for Orchestrating Productive Mathematics Discussions	
Practice	Description/ Questions
1. Anticipating	What strategies are students likely to use to approach or solve a challenging high-level mathematical task? How do you respond to the work that students are likely to produce? Which strategies from student work will be most useful in addressing the mathematical goals?
2. Monitoring	Paying attention to what and how students are thinking during the lesson. Students working in pairs or groups Listening to and making note of what students are discussing and the strategies they are using Asking students questions that will help them stay on track or help them think more deeply about the task. (Promote productive struggle)
3. Selecting	This is the process of deciding the *what* and the *who* to focus on during the discussion.
4. Sequencing	What order will the solutions be shared with the class?
5. Connecting	Asking the questions that will make the mathematics explicit and understandable. Focus must be on mathematical meaning and relationships; making links between mathematical ideas and representations.

Ideal Math Block

The following outline is the department approved ideal math block for grades 9-12.

1) Fluency Practice (5 min) (see focused fluency skills in each curriculum unit plan)

2) Do Now (7-10 min)
   a. Serves as review from last class' or of prerequisite material
   b. Provides multiple entry points so that it is accessible by all students and quickly scaffolds up

3) Starter/Launch (5 min)
   a. Designed to introduce the lesson
   b. Uses concrete or pictorial examples
   c. Attempts to bridge the gap between grade level deficits and rigorous, on grade level content
   d. Provides multiple entry points so that it is accessible by all students and quickly scaffolds up

4) Mini-Lesson (15-20 min)
   a. Design varies based on content
   b. May include an investigative approach, direct instruction approach, whole class discussion led approach, etc.
   c. Includes CFU's
   d. Anticipates misconceptions and addresses common mistakes

5) Class Activity (25-30 min)
   a. Design varies based on content
   b. May include partner work, group work/project, experiments, investigations, game based activities, etc.

6) Independent Practice (7-10 min)
   a. Provides students an opportunity to work/think independently

7) Closure (5-10 min)
   a. Connects lesson/activities to big ideas
   b. Allows students to reflect and summarize what they have learned
   c. May occur after the activity or independent practice depending on the content and objective

8) DOL (5 min)
   a. Exit slip

Idea Math Block with Intervention Stations

Whole Group Instruction	50 min	INSTRUCTION (Grades 9 – 12) Daily Routine: Mathematical Content or Language Routine Anchor Task: Anticipate, Monitor, Select, Sequence, Connect Collaborative Work* Guided Practice Independent Work (Demonstration of Student Thinking)	TOOLS Manipulatives RESOURCES Agile Mind	
Rotation Stations (Student Notebooks & Chromebooks Needed)	1-2X 35 min	STATION 1: Focus on current Grade Level Content STUDENT EXPLORATION* Independent or groups of 2-3 Emphasis on MP's 3, 6 (Reasoning and Precision) And MP's 1 & 4 (Problem Solving and Application) TOOLS/RESOURCES Agile Mind Math Journals	STATION 2: Focus on Student Needs TECH STATION Independent TOOLS/ RESOURCES Khan Academy Approved Digital Provider Fluency Practice	TEACHER STATION: Focus on Grade Level Content; heavily scaffolded to connect deficiencies TARGETED INSTRUCTION 4 – 5 Students TOOLS/ RESOURCES Agile Homework Manipulatives
	5 min	INSTRUCTION Exit Ticket (Demonstration of Student Thinking) TOOLS/RESOURCES Notebooks or Exit Ticket Slips		

Sample Lesson Plan

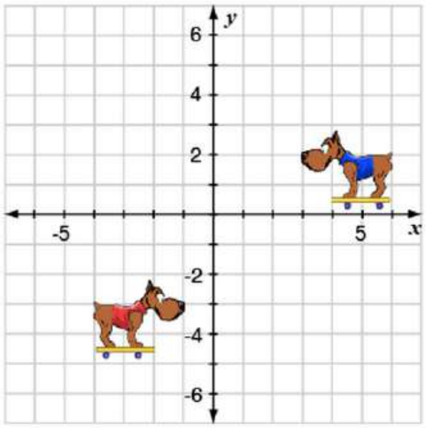
Lesson	Topic 1, blocks 3-4	**Days**	1
Objective	By making constructions and observations, students will make a conjecture about angle bisectors and the incenter of a triangle with 4/4 correct on the exit ticket.	**NJSLS**	G.CO.12 G.C.3
Learning activities/strategies	**Materials needed:** patty paper, ruler, protractor, pencil **Fluency Practice:** (5 minutes) ∠K and ∠L are supplementary angles, m∠K = (2x + 13)°, and m∠L = (5x – 8)°. What are the measures of the two angles? **Do Now (8 minutes):** 1) Fluency check 2) Construct an angle on a piece of patty paper. Label the angle A 3) Predict: Write down what you THINK an angle bisector is. • Observe responses for #1 and only go over if necessary. #'s 2 and 3 lead into the lesson. **Starter/Launch (2 minutes):** • Use #3 from the Do Now to discuss what an angle bisector is. The prefix "bi" has to do with why it is a segment that divides the angle into TWO angles with equal measure. • Introduce objective **Mini lesson and exploration (30 minutes):** • Students follow along with the steps to the construction on Exploring "The language of geometry", Page 5. Class verifies that each person measured angles of equal measure. • Students follow along with the steps on Page 6. Students pair off and do a turn and talk about what they have noticed. Students write down their observations. • Teacher explains that, with observations, you can write a conjecture. Teacher defines a conjecture using page 7. Students then write their own conjecture about points on an angle bisector. Class uses page 7 and 8 to check and summarize. (MP 6) • Teacher explains that the class will now use angle bisectors to make another conjecture about a triangle. • Using page 1 from Exploring "Angle bisectors and the incenter," students complete problem #1 from SAS 3. • As a group, students use #2 from SAS 3 and pages 2-3 to follow the steps and make a conjecture. Each group of 2-3 should have 1 laptop to move through the steps themselves and manipulate the animations as needed. • Teacher uses page 4 to discuss possible conjectures. Students complete #3 on SAS 3. • Group uses #4 from SAS 3 and page 5 to follow steps and manipulate animations as needed. Students are asked to WRITE down observations BEFORE completing the puzzle on page 6. Students also complete #5-8 from SAS 3. **Practice (20 minutes):** • Students work Guided Practice #'s 10-11 and More Practice #'s 4, 11, 12 as a group/pairs		

	• Students work on SAS 2 #'s 20-21, 23-25 independently; they may move on to HW if they complete these problems **Closure (6 minutes):** • Spend ~2 minutes assigning HW and allowing students to ask any questions (HW is SAS 2 #'s 26-28 and SAS 3 #'s 10-11) • Teacher uses pages 1-2 from "Summary" to summarize lesson. Before showing pages, teacher can ask: • What do we know about conjectures? • What conjectures did we make today? **DOL (5 minutes):** • Automatically Scored assessment questions #11-14

Sample Performance Assessment

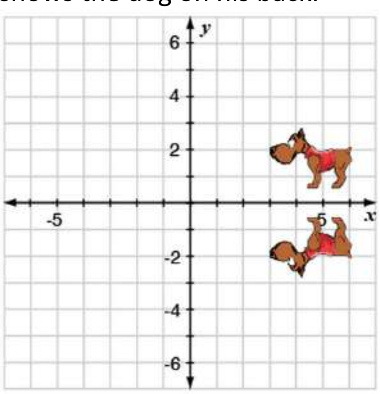
Unit 1 Performance Task – Rigid Transformation **Name:** ___________________________________ **Date**

Alicia is working on a computer animation project for her programming class. She needs to move a dog on a skateboard around the computer screen. a. Alicia's first task is to move the dog from a starting position in quadrant I to an ending position in quadrant III.
Describe, in words, what transformations Alicia will need to use to move the dog.

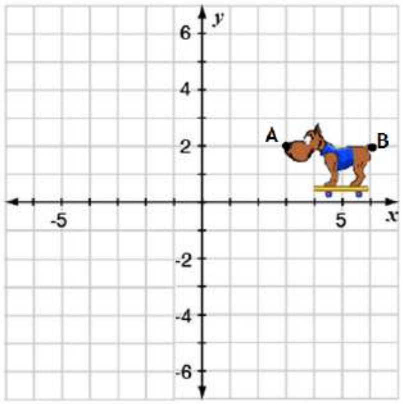


Help Alicia write an ordered pair rule that can be programmed into a computer to move ***the dog in quadrant I*** to ***the dog in quadrant III***.

Alicia needs to show the dog doing a trick. She wants to show the dog rolling over. Write a transformation rule that shows the dog on his back.



Draw and label the location of A’ and B’ if the dog is rotated 270° clockwise about the origin. Point A is located at (3, 2) and Point B is located at (6, 2).



For your transformed dog in Part D (with points A’ and B’), determine which of the following remain unchanged (as compared to the dog with Points A and B).

	Changed	Unchanged
The area of the dog		
The direction the dog is facing		
The distance between A and B		
The location of A and B		
The length of the skateboard		

Is Parts a, c, and d examples of rigid transformations? Explain why or why not.

Link of Performance Assessment

NJSLA	SMP	Dropbox location and filename	Link (original task and answer key)
H.G.CO4	MP 4 MP 7	Orange 9-12 Math > Geometry > Unit 1 >Performance task >Major work**> unit 1 performance task major work**	https://www.dropbox.com/work/Orange%209-12%20Math%202016-17/Curriculum%20Geometry/Unit%201/Performance%20Assessment/Major%20Work?preview=Unit+1+Performance+Task+-+Major+Work.docx
HS.C.14.2		Orange 9-12 Math > Geometry > Unit 1 >r performance work>reasoning>unit 1 **performance task reasoning**	https://www.dropbox.com/work/Orange%209-12%20Math%202016-17/Curriculum%20Geometry/Unit%201/Performance%20Assessment/Reasoning?preview=Unit+1+Performance+Task+-+Reasoning.docx

ELL/SWD supplements

http://nlvm.usu.edu/en/nav/vlibrary.html
http://www.explorelearning.com/index.cfm?method=cResource.dspBrowseCorrelations&v=s&id=USA-000
http://www.thinkingblocks.com/
IXL
http://www.ixl.com/

Geometry Major Work Performance Task (Rigid Transformations) – Rubric

Name: ____________________ Date: _______

NJSLS: G.CO.2, G.CO.5, G.CO.6 ***SMP***: MP 5, MP 6 Type:___________

Teacher: ____________________

Task Description	➢ Transforms figures ➢ Describes a series of rigid transformations that maps one figure on to another ➢ Writes a transformation as an ordered pair rule ➢ Predicts the effect of rigid transformations on a transformed figure ➢ Understands characteristics of rigid transformations				
Command Level Description	***Level 5: Distinguished Command*** Perform the task items accurately or with minor computation errors.	***Level 4: Strong Command*** Perform the task items with some non-conceptual errors	***Level 3: Moderate Command*** Perform the task items with minor conceptual errors and some computation errors.	***Level 2: Partial Command*** Perform the task items with some errors on both math concept and computation.	***Level 1:*** Perform the task items with serious errors on both math concept and computation.
Score range	10-11 pts	8-9 pts	5-7 pts	3-4 pts	0-2 pts
Task Score & PLD Assigned	Genesis: 100	Genesis: 89	Genesis: 79	Genesis:69	Genesis: 59
Teacher Feedback					

Extended Constructed Response (ECR)

Math Department ECR Protocol

ECR Protocol

(Extended Constructed Response)

Issuing

- Moving forward ECR'S will be disseminated by the first of each month and collected by the end of each month
- Method of Issuing: email and post on the website

Dissemination

- Teachers can elect to print copies for each student or use the Smartboard to project the ECR. (Note: Student work will be included in Student Portfolios)
- Students should be given up to 30 minutes depending on the complexity of the ECR
- Assure appropriate testing environment
- ECR should be completed independently

Scoring

- Conversion tables are available in the *Assessment & Data in Mathematics Bulletin* for genesis inputting purposes
- ECR's will count as Authentic Assessments
- Naming Protocol "Course Month ECR" (ex: Grade 6 October ECR)

Collection

- ECR's will be collected & kept in student portfolios
- Student work will be reviewed during CPT's

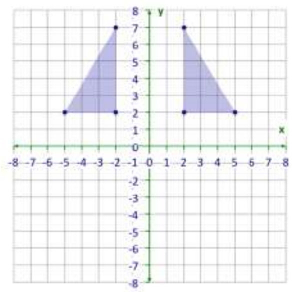
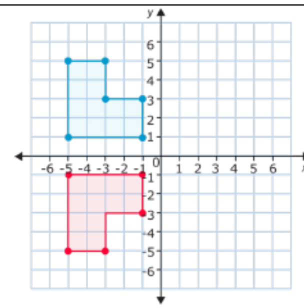
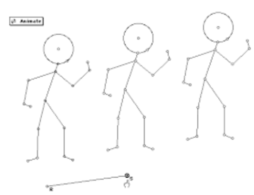
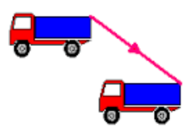
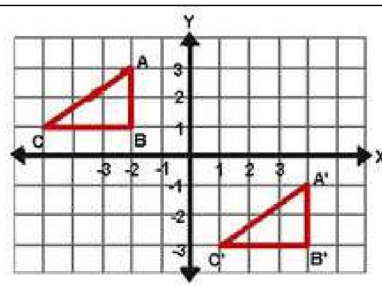
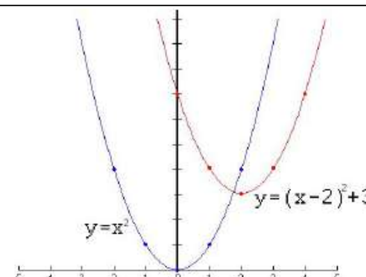
Link of Unit 1 ECRs

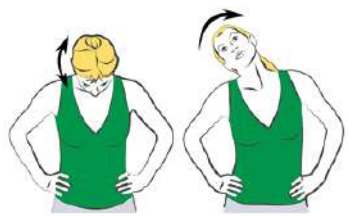
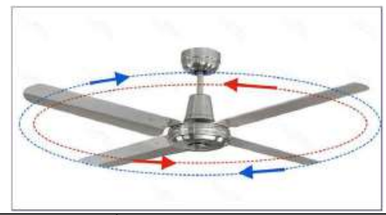
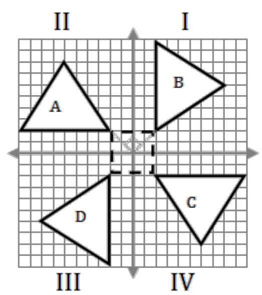
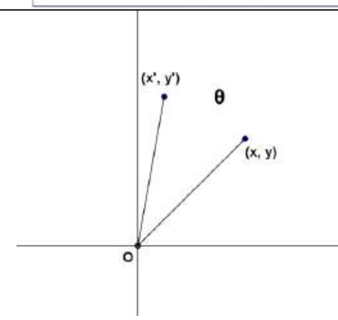
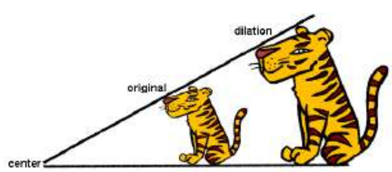
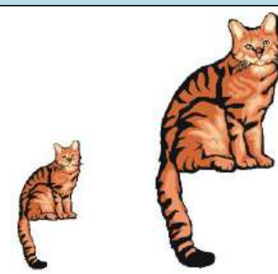
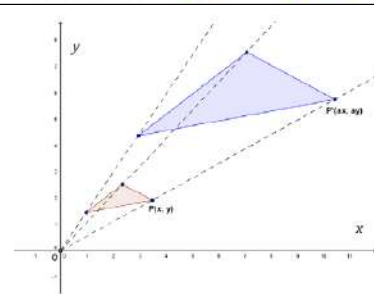
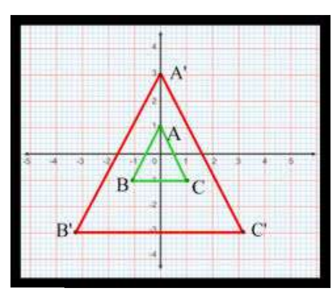
https://www.dropbox.com/sh/yujzxex28eebxsj/AAD99HcYHhjEQ_ym1FnfXcTRa?dl=0

Geometry Unit
ECR Conversion Chart

Points	Genesis Conversion	Points	Genesis Conversion	Points	Genesis Conversion
0	55	0	55	0	55
1	59	1	69	1	69
2	69	2	79	2	89
3	79	3	89	3	100
4	89	4	100		
5	100				

Multiple Representations

Types of Transformation	Rigid Transformation A rigid transformation is one in which the image is congruent to the original figure. (i.e. Reflection, Translation, & Rotation)		
Reflection	Real Life Image		
	Pictorial (Coordinate Plane)	 (Reflected over y-axis)	 (Reflected over x-axis)
	Rules/Function	Original → Image r_y: (x, y) → (-x, y)	Original → Image r_x: (x, y) → (x, -y)
Transformation	Real Life Image		
	Pictorial (Coordinate Plane)		
	Rule/Function	Rule: Original → Image	Function Original(Parent) → Image

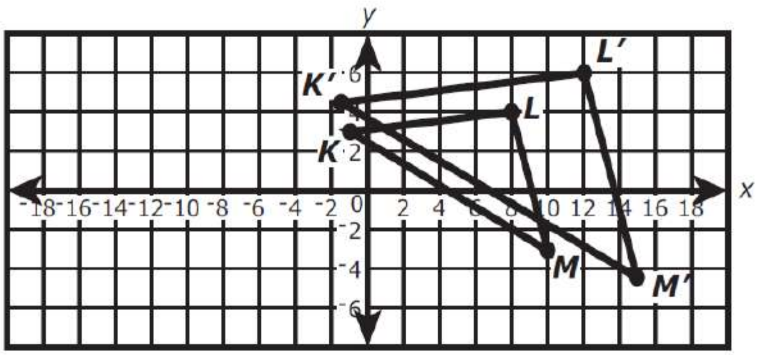
		$T_{a,b}$: (x, y) → (x+a, y+b) $T_{a,b}$ y= f(x) → y= f(x-a)+b $T_{6,-4}$: (x, y) → (x +6, y-4)
Types of Transformation	Rigid Transformation A rigid transformation is one in which the image is congruent to the original figure. (i.e. Reflection, Translation, & Rotation)	
Rotation	Real Life Image	 
	Pictorial (Coordinate Plane)	 
	Rules/Function	Rule Original → Image $R_{0,\theta}$: (x, y) → (x', y') = $(x\cos(\theta) - y\sin(\theta), x\sin(\theta) + y\cos(\theta))$
Types of Transformation	Non-Rigid Transformation is one that does not preserve the size and shape of the original figure (i.e. Dilation)	
Dilation	Real Life Image	 
	Pictorial (Coordinate Plane)	  Dilation with origin as center and scale factor *a*

	Rules/Function	Rule (Dilation with origin as center and scale factor a) Original → Image $D_{0,a}$: (x, y) → (ax, ay)

NJSLA Sample Items

Line segment AB with endpoints A(4, 16) and B(20,4) lies in the coordinate plane. The segment will be dilated with a scale factor of ¾ and a center at the origin to create $\overline{A'B'}$. What will be the length of $\overline{A'B'}$? A. 15 B. 12 C. 5 D. 4

Triangle KLM is the pre-image of $\triangle K'L'M'$, before a transformation. Determine if these two figures are similar.



Which statements are true?

Select **all** that apply.

Ⓐ Triangle KLM is similar to $\triangle K'L'M'$.

Ⓑ Triangle KLM is not similar to $\triangle K'L'M'$.

Ⓒ There was a dilation of scale factor 0.5 centered at the origin.

Ⓓ There was a dilation of scale factor 1 centered at the origin.

Ⓔ There was a dilation of scale factor 1.5 centered at the origin.

Ⓕ There was a translation left 0.5 and up 1.5.

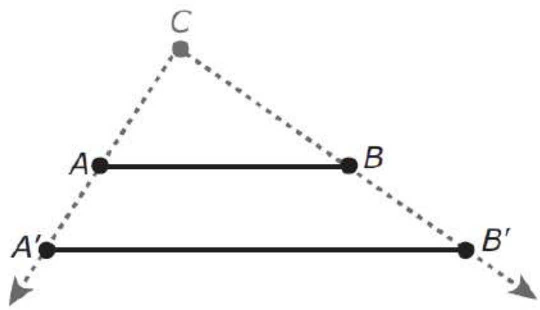
Ⓖ There was a translation left 1.5 and up 0.5.

A dilation centered at point C with a scale factor of k, where $k > 0$, can be defined as follows:

1. The image of point C is itself. That is, $C' = C$.
2. For any point P other than C, the point P' is on $\overrightarrow{CP}$, and $CP' = k \cdot CP$.

Use this definition and the diagram shown to prove the following theorem:

If $\overline{A'B'}$ is the image of $\overline{AB}$ after a dilation centered at point C with a scale factor of k, where $k > 0$, then $A'B' = k \cdot AB$.



Be sure to explain how you would use the diagram to prove the theorem, and show justifications for each statement in the proof.

Enter your proof, your explanation, and your justifications in the space provided.

Curriculum Resources Links

Big Rock Lesson Materials:
https://www.dropbox.com/s/n8iuqhpih6jb1s6/2018%20Geometry%20Unit%201%20Curriculum%20Plan.docx?dl=0

Unit 1 diagnosis Assessment: https://www.dropbox.com/sh/kd7st9xt281eqhm/AACPMerkf1I1vUckITlA33TGa?dl=0

Extra Credit Question: https://www.dropbox.com/sh/sot7cmbw7qpdrxn/AAAU__s7E_xiesNIvmc1Pubea?dl=0

Supplemental Material: https://www.dropbox.com/sh/aqn1ya7hhtaziu5/AACEgvdHpGNuOJCfeSjzpNTaa?dl=0