Richmond Public Schools
Curriculum Framework
Geometry

<table>
<tr><th colspan="3">Strand: Reasoning, Lines, and Transformations</th></tr>
<tr><td>G.3a</td><td colspan="2">The student will investigate and use formulas for determining distance, midpoint, and slope.</td></tr>
<tr><td>G.3b</td><td colspan="2">The student will apply slope to verify and determine whether lines are parallel or perpendicular.</td></tr>
<tr><td>G.4a</td><td colspan="2">The student will construct and justify the construction of a line segment to a given line segment.</td></tr>
<tr><td>G.4b</td><td colspan="2">The student will construct and justify the construction of the perpendicular bisector of a line segment.</td></tr>
<tr><td>G.4c</td><td colspan="2">The student will construct and justify the construction of a perpendicular to a given line from a point not on the line.</td></tr>
<tr><td>G.4d</td><td colspan="2">The student will construct and justify the construction of a perpendicular to a given line from a point on the line.</td></tr>
<tr><th rowspan="2">Suggested Pacing</th><th colspan="2">Cognitive Demand</th></tr>
<tr><td>G.3a-b</td><td>G.4a-d</td></tr>
<tr><td rowspan="2">First Nine Weeks

4 instructional days (including assessment)</td><td>Apply</td><td>Create</td></tr>
<tr><th>Spiraling Down Standards</th><th colspan="2">Spiraling Up Standards</th></tr>
<tr><td>A.6 The student will
a) determine slope of line given equation of the line, the graph of the line, or two points on the line
8.9 The student will
b) apply the Pythagorean Theorem

6.9 The student will determine congruence of segments, angles, and polygons.</td><td colspan="2">N/A</td></tr>
<tr><th>Essential Questions</th><th colspan="2">Common Misconceptions</th></tr>
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Understanding the Standard	Essential Knowledge and Skills
What is the relationship between the distance formula, the Pythagorean Theorem, and the equation of a circle? The distance formula and the equation of a circle were both derived from the Pythagorean theorem. **Why are constructions important?** The skills you need to figure out how to construct are closely related to the thinking skills you need to prove theorems. **How are constructions justified?** - The construction for a line segment congruent to a given line segment can be justified using properties of a circle. - The construction for the perpendicular bisector of a line segment can be justified using the properties of quadrilaterals or congruent triangles. - The constructions for a perpendicular to a given line from a point on, or not on, the line can be justified using the properties of quadrilaterals or congruent triangles. **How is constructing a perpendicular bisector related to constructing a segment bisector?** The construction of a perpendicular bisector starts with a segment. **How is constructing a perpendicular bisector related to constructing a perpendicular to a point on a line?** The construction of a perpendicular to a point on a line starts with marking equal distances from the point along the line. This creates a segment with the point as the midpoint of the segment.	• Students will still mix up the slope formula by subtracting x values in numerator and y values in denominator. Have students graph points and the line to compare their answers. • Student may forget to subtract in the parentheses of distance formula. Continue to practice distance problems. Also, use a graph to show that they can use Pythagorean Theorem as well. • Students will get midpoint and endpoint questions mixed up. Have students highlight important information in the problem and the questions. Drawing a segment with endpoints and a midpoint and making students label the given information on the drawing can help students visualize if they need to find the endpoint or midpoint. When finding the other endpoint for a line segment given the midpoint and one endpoint, have students graph the points and extend the segment towards the point where they predict the other endpoint will lie. This will help them avoid the error of just using the midpoint formula as if they were finding the midpoint. • A common error students make when finding slopes of perpendicular lines is using the same sign for both slopes. One slope must be the opposite reciprocal of the other, not just the reciprocal of the other, so that the product is -1, not 1.

G.3a-b • The distance formula is an application of the Pythagorean Theorem. • Parallel lines have the same slope. • The product of the slopes of perpendicular lines is -1 unless one of the lines has an undefined slope. **G.4a-d** • Construction techniques are used to solve practical problems in engineering, architectural design, and building construction. • Construction techniques include using a straightedge and compass, paper folding, and dynamic geometry software. • Geometric constructions assist in justifying, verifying, and visually reinforcing geometric relationships. • There are multiple methods to most geometric constructions. Students would benefit from experiences with more than one method and should be able to justify each step of geometric constructions. • Individual steps of constructions can be justified using angle relationships, properties of quadrilaterals, congruent triangles, and/or circles. - The construction for a line segment congruent to a given line segment can be justified using properties of a circle. - The construction for the perpendicular bisector of a line segment can be justified using the properties of quadrilaterals or congruent triangles.	**G.3a-b The students will use problem solving, mathematical communication, mathematical reasoning, connections, and representations to** • Determine the coordinates of the midpoint or endpoint of a segment, using the midpoint formula. (a) • Use a formula to determine the slope of a line. (a) • Apply the distance formula to determine the length of a line segment when given the coordinates of the endpoints. (a) • Compare the slopes to determine whether two lines are parallel, perpendicular, or neither. (b) **G.4a-d The student will use problem solving, mathematical communication, mathematical reasoning, connections, and representations to** ● Construct and justify the constructions of ○ a line segment congruent to a given line segment; (a) ○ the perpendicular bisector of a line segment; (b) ○ a perpendicular to a given line from a point not on the line; (c) ○ a perpendicular to a given line at a given point on the line; (d)

- The constructions for a perpendicular to a given line from a point on, or not on, the line can be justified using the properties of quadrilaterals or congruent triangles.

Vocabulary

Distance	Midpoint	Slope
Endpoint	Center	Length
Parallel Lines	Perpendicular Lines	Integral Points
Equidistant	Coordinates	Pythagorean Theorem
Bisect	Congruent	Perpendicular Bisector

Assessment

1. PowerSchool Assessments

G.3a Distance (E:1VTP9P)
G.3a Midpoint (E:8Y7S7D)
G.3a,b Slope (E:2D3J4R)
G.4a (E:2H085Z)
G.4b (E:1TX4KY)
G.4c (E:671K6B)
G.4d (E:1KC6LX)

2. Mulligan Checkpoint G.3, G.4
Checkpoint G.3
Checkpoint G.4

Instructional Activities Organized by Learning Objective

Virginia Department of Education

- Slope
- Distance and Midpoint Formulas

Textbook

- Geometry, ©2012, Price, et al, McGraw-Hill School Education Group page(s) 14, 25-35, 55, 185-195, and 213-222, 271

Notes and Homework

- G.3a,b Notes and Keys
- G.3a,b Homework and Keys
- G.4a,b Notes and Keys
- G.4c,d Notes and Keys

Resources

- **Print**
  - Coach book, Virginia edition Lessons 10-11 page(s) 76-88
  - Mulligan Math in Minutes
- **Technology**
  - Gizmo
    - Constructing Parallel and Perpendicular Lines

3. Formative Assessments (Paper)
G.3a,b FA
G.4a-d FA

4. Cumulative Assessment #1 (SOLs G.3a-d, G.4a-d)
Cumulative Assessment #1

- Slope - Activity B
- Distance Formula – Activity 1

- TEA Activity
  - Distance Exploration Interactive Activity
  - Midpoint Exploration Interactive Activity
- Youtube videos
  - How to Use Midpoint Mashup Math Youtube video
  - How to Use Distance Mashup Math Youtube video
  - Slope Formula Youtube video
  - Slopes of Parallel and Perpendicular Lines Mashup Math Youtube video
  - How To Copy a Line Segment Youtube video
  - How to Construct a Perpendicular Bisector Youtube video
  - How to Construct a Perpendicular line from a point not on the line Youtube video
  - How to Construct a Perpendicular Line from a point on the line Youtube video
- Quizizz Practice
  - G.3a Distance Practice on Quizizz
  - G.3a Midpoint Practice on Quizizz
  - G.3a,b Slope Practice on Quizizz
  - G.4 a,b,c,d Constructions Practice on Quizizz

Instructional Activities

- Distance formula Investigating Task
- Distance Formula Application Activity
- Distance Formula Application Task
- Midpoint Activity

	• G.3a,b Distance, Midpoint, Slope Practice • Distance, Midpoint, Slope Project**(in part - includes Algebra I review)**
Cross-Curricular Connections	**Tiered Interventions**
Use a map from a nearby Geography class and ask students to find the distances between two places using latitude and longitude. Task 1: The Dream Trip: 1) Creating a trip with at least five stopping points across Europe, researching and justifying the significance of the stopping points. 2) Estimating and calculating the distance of the trip. 3) Making adjustments to the trip based on constraints of time, money, and distance. Explaining the need for these adjustments and why they were chosen. 4) Comparing their results to real data. Reflecting on and explaining the successes and shortcomings of their mathematical procedure. Identifying any constraints that were missing from the problem. Sample Map (Distance & Midpoint) lesson	**Tier 3: Recall and Reproduction** Vocabulary Have students study flashcards, create their own flashcards, play a matching game or test themselves on Quizlet. Quizlet Flashcards Coordinates(card #1-7only) When applying the Distance and Midpoint Formulas, students may benefit from using different colors to represent the coordinates and the operation symbols. This may help them distinguish the operation from the sign of the coordinate. **Tier 2: Basic Skills and Concepts** Practice and Drill Distance Drills Midpoint Drills Slope Drills Construction a-d Drills Have students create foldables for organizing notes on different formulas. Distance foldable Midpoint foldable Slope foldable **Tier 1: Strategic Thinking and Reasoning** Application Give students a piece of graph paper. Ask them to plot two random points and find the distance between them. Then, create a right

	triangle with their two points at the acute angles and use the Pythagorean Theorem to verify the length of their segment.