# Richmond Public Schools
## Curriculum Framework
*Geometry*

| **Strand: Polygons and Circles** | |
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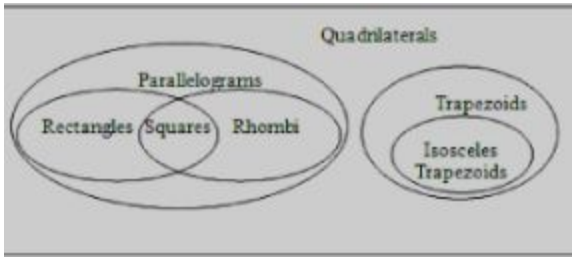
| G.9 | The student will verify and use properties of quadrilaterals to solve problems, including practical problems. |
| **Suggested Pacing** | **Cognitive Demand** |
| Second Nine Weeks<br><br>5 instructional days (including assessment) | G.9<br><br>Analyze |
| **Spiraling Down Standards** | **Spiraling Up Standards** |
| A.4 The student will solve<br>a) multistep linear equations in one variable algebraically<br>b) Quadratic equations in one variable algebraically<br>c) literal equations for a specified variable<br><br>7.6 The student will<br>a) compare and contrast quadrilaterals based on their properties; and<br>b) determine unknown side lengths or angle measures of quadrilaterals. | N/A |
| **Essential Questions** | **Common Misconceptions** |
| **What are the distinguishing features of the different types of quadrilaterals?**<br>*Quadrilateral – polygon with four sides.*<br>*Parallelogram – quadrilateral with opposite sides parallel and congruent. Consecutive angles are supplementary and opposite angles are congruent. Diagonal bisect each other.*<br>*Rectangle – parallelogram with four right angles and diagonals are congruent.* | • Students will need practice classifying quadrilaterals based on their characteristics. Venn diagrams can help, but also using a tree to understand the hierarchy and connection of characteristics.<br>• Students need practice on determining which formulas should be used to prove specific properties of quadrilaterals. An investigation and discussion about which characteristics will prove a specific quadrilateral will help. |

*Rhombus – parallelogram with congruent sides. Diagonals are perpendicular and bisect opposite angles.*
*Square – parallelogram, rectangle, and rhombus.*
*Trapezoid – quadrilateral with exactly one pair of opposite sides parallel.*
*Isosceles trapezoid – trapezoid with congruent legs (non-parallel sides). Both pairs of base angles are congruent. Diagonals are congruent.*
*Kite – quadrilateral with two pairs of congruent adjacent sides.*

**What is the hierarchical nature among quadrilaterals?**
*Can be described as ranking based on characteristics.*




| Understanding the Standard | Essential Knowledge and Skills |
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| • Deductive or inductive reasoning is used in mathematical proofs. In this course, deductive reasoning and logic are used in direct proofs. Direct proofs are presented in different formats (typically two-column or paragraph) and employ definitions, postulates, theorems, and algebraic justifications including coordinate methods.<br>• Quadrilaterals have a hierarchical nature based on the relationships between their sides, angles, and diagonals. | **The student will use problem solving, mathematical communication, mathematical reasoning, connections, and representations to**<br>• Solve problems, including practical problems, using the properties specific to parallelograms, rectangles, rhombi, squares, isosceles trapezoids, and trapezoids.<br>• Prove that quadrilaterals have specific properties, using coordinate and algebraic methods, such as the distance formula, slope, and midpoint formula. |

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| • Properties of quadrilaterals can be used to identify the quadrilateral and to determine the measures of sides and angles.<br>• Given coordinate representation of quadrilaterals, the distance, slope, and midpoint formulas may be used to verify that quadrilaterals have specific properties.<br>• The angle relationships formed when parallel lines are intersected by a transversal can be used to prove properties of quadrilaterals.<br>• Congruent triangles can be used to prove properties of quadrilaterals.<br>• A parallelogram is a quadrilateral with both pairs of opposite sides parallel. Properties of a parallelogram include the following:<br>- Opposite sides are congruent;<br>- Opposite angles are congruent;<br>- Consecutive angles are supplementary; and<br>- Diagonals bisect each other.<br>• A rectangle is a quadrilateral with four right angles. Properties of rectangle include the following:<br>- Opposite sides are parallel and congruent; and<br>- Diagonals are congruent and bisect each other.<br>• A rhombus is a quadrilateral with four congruent sides. Properties of a rhombus include the following:<br>- All sides are congruent;<br>- Opposite sides are parallel;<br>- Diagonals are perpendicular bisectors of each other;<br>- Diagonals bisect opposite angles; and | • Prove the properties of quadrilaterals, using direct proofs. |

- Diagonals divide the rhombus into four congruent right triangles.

- A square is a quadrilateral that is a regular polygon with four congruent sides and four right angles. Properties of a square include the following:
  - Opposite sides are parallel;
  - Diagonals are congruent;
  - Diagonals are perpendicular bisectors of each other; and
  - Diagonals divide the square into four congruent 45°-45°-90° triangles.

- A trapezoid is a quadrilateral with exactly one pair of parallel sides. The parallel sides of a trapezoid are called bases. The nonparallel sides of a trapezoid are called legs.

- An isosceles trapezoid has the following properties:
  - Nonparallel sides are congruent;
  - Diagonals are congruent; and
  - Base angles are congruent.

- The construction of the perpendicular bisector of a line segment can be justified using the properties of quadrilaterals.

**Vocabulary**

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| Base | Base angles | Characteristics |
| Median of a trapezoid | Parallelogram | Quadrilateral |
| Diagonal | Rectangle | Rhombus |
| Isosceles Trapezoid | Trapezoid | Square |
| Legs | | |

**Instructional Activities Organized by Learning Objective**

**Virginia Department of Education**

- Properties of Quadrilaterals

**Textbook**

- Geometry, ©2012, Price, et al, McGraw-Hill School Education Group page(s) 399-444(in part)

| Assessment | Notes and Homework / Resources |
|---|---|
| 1. Powerschool Assessment<br>G.9 (E:0E0SEA)<br><br>2. Mulligan Checkpoint G.9<br>Checkpoint G.9<br><br>3. Formative Assessment (Paper)<br>G.9 FA<br><br>4. Cumulative Assessment #7<br>SOLs (G.1, G.2, G.3, G.5, G.6, G.7, G.8, G.9, G.12)<br>Cumulative Assessment #7 | **Notes and Homework**<br>● G.9 Notes and Keys<br>● G.9 Homework and Keys<br><br>**Resources**<br>● **Print**<br>○ Coach book, Virginia edition Lessons 20 & 23 page(s) 166-173 and 186-192(in part)<br>● **Technology**<br>○ **Gizmo**<br>■ Parallelogram Conditions<br>■ Classifying Quadrilaterals<br>○ **Youtube Videos**<br>■ Classifying Quadrilaterals<br>■ Properties of Rhombi, Rectangles, and Squares<br>■ Classifying Quadrilaterals on Coordinate Plane (Khan Academy)<br>○ **Geogebra**<br>■ Properties of Quadrilaterals(in part)<br>■ Using Coordinate Geometry to prove a quadrilateral is a parallelogram<br>○ **Desmos**<br>■ Investigating Quadrilaterals by Diagonals(in part)<br>■ Quadrilaterals Card Sort(in part)<br>■ Always, Sometimes, Never Quadrilateral Activity<br>■ 2 Truths and a Lie Quad Activity<br>○ **Quizizz Practice**<br>■ G.9 Parallelograms Practice<br>■ G.9 Quadrilaterals Properties Practice(in part) |

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<ul><li>G.9 Quad Proof Practice</li></ul>
Instructional Activities
<ul>
<li>Coordinate Crisis Project Students are given 4 points to plot. Then they must prove which is the best name for the quadrilateral by using distance, midpoint, and slope formulas and their knowledge of properties.</li>
<li>Tic Tac Parallelogram Two students (or two teams) place O or X in turn on vertices of parallelograms. This is similar to Tic-Tac-Toe. The first player (or team) to place her mark on all four vertices of one parallelogram wins.</li>
<li>Venn Diagram Quadrilaterals Activity Sort Students are to cut out the figures and tape or glue them onto the correct place in the Venn diagram according to their properties. Figures for Venn Diagram Activity Sort</li>
<li>Quadrilateral Coordinates Poster Project Students are to create a 3-part poster describing a quadrilateral given to them. One sheet of paper will have the quadrilateral drawn on it. Another sheet of paper will show the data gathered about the shape. The last piece will have arguments explaining what kind of shape it is.</li>
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<tr><th>Cross-Curricular Connections</th><th>Tiered Interventions</th></tr>
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Real-World
<ul><li>Construction</li></ul>
Quadrilaterals are in our everyday life and are often relied up in construction and design. Quadrilaterals are essential in many types of construction projects.
<ul><li>Quilts</li></ul>
The star quilt has and continues to play a very important role in the lives of the Native American people. Their culture holds the star quilt as a symbol of many things and the quilt itself offers many learning
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Tier 3: Recall and Reproduction<br>
Vocabulary<br>
Have students study flashcards, create their own flashcards, play a matching game or test themselves on Quizlet.<br>
Quadrilaterals Flashcards on Quizlet<br>
Have students look at examples of parallelograms and non-parallelograms and create a good definition of parallelogram, rectangle, etc.<br>
Parallelogram Concept Card<br>
Rectangle Concept Card
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| opportunities for the High School students of today and the future. It allows many different curricular disciplines the chance to include the star quilt into teaching concepts and other educational skills. | **Tier 2: Basic Skills and Concepts**<br>Practice and Drill<br>Quadrilaterals Drills<br>Checkpoint Quizzes (Parallelograms)<br>Checkpoint Quizzes (Parallelograms, Rectangles, Rhombi, Squares)<br><br>**Tier 1: Strategic Thinking and Reasoning**<br>Application<br>Have students sort the following cards as being sometimes, always, and never true. Students must defend their answers using properties of quadrilaterals.<br>Always, Sometimes, Never Activity<br>Always, Sometimes, Never Activity Continued |