

### Vertical Progression:

7 <sup>th</sup> Grade	<p><b>7.G.A Draw, construct, and describe geometrical figures and describe the relationships between them.</b></p> <ul style="list-style-type: none"> <li>○ <b>7.G.A.2</b> Draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions. Focus on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle.</li> <li>○ <b>7.G.B</b> Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.</li> <li>○ <b>7.G.B.5</b> Use facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and solve simple equations for an unknown angle in a figure.</li> </ul>
8 <sup>th</sup> Grade	<p><b>8.G.A Understand congruence and similarity using physical models, transparencies, or geometry software.</b></p> <ul style="list-style-type: none"> <li>○ <b>8.G.A.5</b> Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles. <i>For example, arrange three copies of the same triangle so that the sum of the three angles appears to form a line, and give an argument in terms of transversals why this is so.</i></li> </ul> <p><b>8.G.B Understand and apply the Pythagorean Theorem.</b></p> <ul style="list-style-type: none"> <li>○ <b>8.G.A.6</b> Explain a proof of the Pythagorean Theorem and its converse.</li> </ul>
Geometry	<p><b>ELG.MA.HS.G.3 Prove geometric theorems.</b></p> <ul style="list-style-type: none"> <li>○ <b>G-CO.9</b> Prove theorems about lines and angles. <i>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.</i></li> <li>○ <b>G-CO.10</b> Prove theorems about triangles. <i>Theorems include: measures of interior angles of a triangle sum to 180°; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.</i></li> <li>○ <b>G-CO.11</b> Prove theorems about parallelograms. <i>Theorems include: opposite sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals.</i></li> </ul>
Algebra 2	<p><b>ELG.MA.HS.A.5 Use polynomial identities to solve problems.</b></p> <ul style="list-style-type: none"> <li>○ <b>A-APR.4</b> Prove polynomial identities and use them to describe numerical relationships. <i>For example, the polynomial identity <math>(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2</math> can be used to generate Pythagorean triples.</i></li> </ul> <p><b>ELG.MA.HS.F.10 Prove and apply trigonometric identities</b></p> <ul style="list-style-type: none"> <li>○ <b>F-TF.8</b> Prove the Pythagorean identity <math>\sin^2(\theta) + \cos^2(\theta) = 1</math> and use it to find <math>\sin(\theta)</math>, <math>\cos(\theta)</math>, or <math>\tan(\theta)</math> given <math>\sin(\theta)</math>, <math>\cos(\theta)</math>, or <math>\tan(\theta)</math> and the quadrant of the angle.</li> </ul>
	<p><b>ELG.MA.HS.G.8 Apply trigonometry to general triangles</b></p> <ul style="list-style-type: none"> <li>○ <b>G-SRT.10 (+)</b> Prove the Laws of Sines and Cosines and use them to solve problems.</li> </ul>

### Students will demonstrate command of the ELG by:

- Determining and using appropriate geometric theorems and properties of lines and angles to prove theorems about lines and angles.
- Determining and using appropriate geometric theorems and properties of lines, angles, and triangles to prove theorems about triangles.
- Determining and using appropriate geometric theorems and properties of lines, angles, triangles, and parallelograms to prove theorems about parallelograms.

### Vocabulary:

- |                             |                       |                          |
|-----------------------------|-----------------------|--------------------------|
| • alternate exterior angles | • equidistant         | • parallel lines         |
| • alternate interior angles | • exterior angles     | • parallelograms         |
| • angles                    | • interior angles     | • perpendicular bisector |
| • base angles               | • isosceles triangles | • rectangles             |
| • bisect                    | • line segment        | • supplementary          |
| • congruent                 | • lines               | • theorems               |
| • complementary             | • medians             | • transversal            |
| • corresponding angles      | • midpoints           | • triangles              |
| • diagonals                 | • opposite angles     | • vertical angles        |
| • endpoints                 | • opposite sides      |                          |

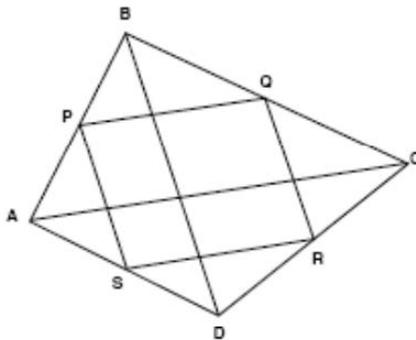
### Sample Instructional/Assessment Tasks:

#### 1) Standard(s): G-CO.9, G-CO.11

Source: <http://www.insidemathematics.org/assets/common-core-math-tasks/quadrilaterals.pdf>

#### Item Prompt:

ABCD is a quadrilateral. The points P, Q, R, S are the midpoints of the sides of the quadrilateral.



- Write two correct statements about the line segments PQ and AC.
- What can you say about the quadrilateral PQRS? Explain your reasoning carefully.
- If PQRS is a square, what can you say about the diagonals of ABCD? Explain how you figured it out.

**Solution:**

- a. Line segments PQ and AC are parallel; line segment PQ is half the length of line segment AC.
- b. PQRS is a parallelogram (with sides half the length of the diagonals of ABCD)
  1. Both of line segments PQ and SR are parallel to the diagonal, segment AC, so they are parallel to each other. The lengths of line segments PQ and SR are half the length of the diagonal, segment AC, so they are equal in length.
  2. OR both line segments PS and QR are parallel to the diagonal, segment BD, so they are parallel to each other. The lengths of both line segments PS and QR are half the length of the diagonal, segment BD.
  3. A quadrilateral with two pairs of parallel sides OR one pair of equal and parallel sides is a parallelogram.
- c. If PQRS is a square, then the diagonals of ABCD meet at right angles and are equal in length (because they are twice the length of sides of PQRS).

## 2) Standard(s): G-CO.10

Source: <https://commoncoregeometry.wikispaces.hcpss.org/file/view/G.CO.C.10+Task+Pennant+Pride.doc>

**Item Prompt:**

**Part A:** You have been chosen to draw a design for a new school pennant that will be presented at the upcoming athletic awards ceremony. *Pennant Pride, LLC* will manufacture the pennant and they have very specific guidelines that must be followed in order for the design to be accepted:

- A minimum of two different designs must be submitted
- Each pennant must be a triangular shape
- Two sides of each pennant must be of equal measure
- Blueprints of your designs will be included that are drawn to scale. All side lengths and angle measurements must be labeled

Use your knowledge of triangles to prepare a blueprint for *Pennant Pride, LLC* in time to meet the manufacturing deadline!

**Part B:** Prepare an explanation in the form of a geometric proof outlining the correlation between the angle measures and the side measures of your pennant.

**\*Remember:** You must clearly tell how the base angles are affected when two sides of a triangle are congruent. (Two-column, flow, or paragraph proofs are accepted forms of explanation.)

**Solution:**

**Student samples will vary.**

\*Pennants must all be isosceles triangles with congruent base angles.

\*Check to ensure that the scale chosen by each student is appropriate for the task and correctly completed.

\*Make sure all side and angle measurements are clearly labeled.

(\*Student example, Facilitator Notes, Follow-up Questions, Extension activities available via the link above)