

7-1: Shapes and Designs

Unit Goals, Focus Questions, and Mathematical Reflections

Unit Goals

Properties of Polygons Understand the properties of polygons that affect their shape

- Explore the ways that polygons are sorted into families according to the number and length of their sides and the size of their angles
- Explore the patterns among interior and exterior angles of a polygon
- Explore the patterns among side lengths in a polygon
- Investigate the symmetries of a shape—rotation or Reflections
- Determine which polygons fit together to cover a flat surface and why
- Reason about and solve problems involving various polygons

Relationships Among Angles Understand special relationships among angles

- Investigate techniques for estimating and measuring angles
- Use tools to sketch angles
- Reason about the properties of angles formed by parallel lines and transversals
- Use information about supplementary, complementary, vertical, and adjacent angles in a shape to solve for an unknown angle in a multi-step problem

Constructing Polygons Understand the properties needed to construct polygons

- Draw or sketch polygons with given conditions by using various tools and techniques such as freehand, use of a ruler and protractor, and use of technology
- Determine what conditions will produce a unique polygon, more than one polygon, or no polygon, particularly triangles and quadrilaterals
- Recognize the special properties of polygons, such as angle sum, side-length relationships, and symmetry, that make them useful in building, design, and nature
- Solve problems that involve properties of shapes

7-1 Shapes and Designs: Focus Questions (FQ) and Mathematical Reflections

Investigation 1 The Family of Polygons	Investigation 2 Designing Polygons: The Angle Connection	Investigation 3 Designing Triangles and Quadrilaterals
<p>Problem 1.1 Sorting and Sketching Polygons FQ: What properties do all polygons share? What properties do some sub-groups of polygons share?</p> <p>Problem 1.2 In a Spin: Angles and Rotations FQ: What are some common benchmark angles? What part of a full turn is each angle equal to?</p> <p>Problem 1.3 Estimating Measures of Rotations and Angles FQ: When a drawing shows two rays with a common endpoint, how many rotation angles are there? How would you estimate the measure of each angle?</p> <p>Problem 1.4 Measuring Angles FQ: How do you measure an angle with an angle ruler and a protractor?</p> <p>Problem 1.5 Design Challenge I: Drawing With Tools—Ruler and Protractor FQ: In a triangle, what measures of sides and angles give just enough information to draw a figure that is uniquely determined?</p>	<p>Problem 2.1 Angle Sums of Regular Polygons FQ: What is the size of each angle and the sum of all angles in a regular polygon with n sides?</p> <p>Problem 2.2 Angle Sums of Any Polygon FQ: What is the angle sum of any polygon with n sides? How do you know that your formula is correct?</p> <p>Problem 2.3 The Bees Do It: Polygons in Nature FQ: Which regular polygons can be used to tile a surface without overlaps or gaps, and how do you know that your answer is correct?</p> <p>Problem 2.4 The Ins and Outs of Polygons FQ: What is an exterior angle of a polygon, and what do you know about the measures of exterior angles?</p>	<p>Problem 3.1 Building Triangles FQ: What combinations of three side lengths can be used to make a triangle? How many different shapes are possible for such a combination of side lengths?</p> <p>Problem 3.2 Design Challenge II: Drawing Triangles FQ: What is the smallest number of side and angle measurements that will tell you how to draw an exact copy of any given triangle?</p> <p>Problem 3.3 Building Quadrilaterals FQ: What combinations of side lengths can be used to make a quadrilateral? How many different shapes are possible for any such combination of side lengths?</p> <p>Problem 3.4 Parallel Lines and Transversals FQ: When two parallel lines are cut by a transversal, what can be said about the eight angles that are formed?</p> <p>Problem 3.5 Design Challenge III: The Quadrilateral Game FQ: How are squares, rhombuses, rectangles, and trapezoids similar? How are they different?</p>
<p>Mathematical Reflections</p> <ol style="list-style-type: none"> 1. What are the common properties of all polygons? 2. What does the measure in degrees tell you about an angle? What are some common benchmark angles? 3. What strategies can be used to estimate angle measures? To deduce angle measures from given information? To find accurate measurements with tools? 	<p>Mathematical Reflections</p> <ol style="list-style-type: none"> 1. How is the number of sides related to the sum of the interior angles in a polygon? What about the sum of the exterior angles? 2. How is the measure of each interior angle related to the number of sides in a regular polygon? What about the measure of each exterior angle? 3. Which polygons can be used to tile a flat surface without overlaps or gaps? Why are those the only figures that work as tiles? 	<p>Mathematical Reflections</p> <ol style="list-style-type: none"> 1. What information about combinations of angle sizes and side lengths provide enough information to copy a given triangle exactly? A quadrilateral? 2. Why are triangles so useful in building structures? What are the problems with quadrilaterals for building structures? 3. If two parallel lines are intersected by a transversal, which pairs of angles will have the same measure? 4. What does it mean to say a figure has symmetry? Provide examples with your explanation.