Focus Questions

Background
The student book is organized around three to five investigations, each of which contain three to five problems and a Mathematical Reflection that students explore during class.

In the Teacher Guide the Goals for each unit include two to four big concepts with an elaboration of the essential understandings for each.

In the Teacher Guide, a Focus Question is provided for each problem in an investigation. The Focus Question collapses the mathematical understandings and strategies embedded in the problem into one overarching question. The teacher can use the Focus Question to guide his/her instructional decisions throughout his/her planning, teaching, and reflections on student understanding.

Description
The Goals of the unit describe the mathematics content developed in the unit. The Focus Questions provide a story line for the mathematical development of an investigation. The set of Mathematical Reflections in the student book provide a story line for the mathematical development of the unit. The following contain all of the Goals, Focus Questions and Mathematical Reflections for each unit in CMP3.

Purpose
These stories can serve as an overview of the unit and as a guide for planning, teaching and assessing.

The Goals, Mathematical Reflections, and Focus Questions can be laminated and used a bookmark for the Teacher.
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
### Investigation 1
**The Family of Polygons**

**Problem 1.1**
**Sorting and Sketching Polygons**
FQ: What properties do all polygons share? What properties do some sub-groups of polygons share?

**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?

**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?

**Problem 1.4**
**Measuring Angles**
FQ: How do you measure an angle with an angle ruler and a protractor?

**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?

### Investigation 2
**Designing Polygons: The Angle Connection**

**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?

**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?

**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?

**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?

### Investigation 3
**Designing Triangles and Quadrilaterals**

**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?

**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?

**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?

**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?

**Problem 3.5**
**Design Challenge III: The Quadrilateral Game**
FQ: How are squares, rhombuses, rectangles, and trapezoids similar? How are they different?

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### Mathematical Reflections

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 measurements from given information? To find accurate measurements with tools?

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?
4. What does it mean to say a figure has symmetry? Provide examples with your explanation.