

**Cluster 8: Applying geometric concepts**

**Duration:** 2-3 weeks

**Content Standards**

This list includes standards that will be addressed in this cluster, but not necessarily mastered, since all standards are benchmarks for the end of the year. Please note strikethroughs and recommendations in the Important Considerations section for more information.

**Classify shapes based on lines and angles in two-dimensional figures.**

**NC.4.G.1**

Draw and identify points, lines, line segments, rays, angles, and perpendicular and parallel lines.

**NC.4.G.2**

Classify quadrilaterals and triangles based on angle measure, side lengths, and the presence or absence of parallel or perpendicular lines.

**NC.4.G.3**

Recognize symmetry in a two-dimensional figure, and identify and draw lines of symmetry.

**Understand concepts of angle and measure angles.**

**NC.4.MD.6**

Develop an understanding of angles and angle measurement.

- Understand angles as geometric shapes that are formed wherever two rays share a common endpoint, and are measured in degrees.
- Measure and sketch angles in whole-number degrees using a protractor.
- Solve addition and subtraction problems to find unknown angles on a diagram in real-world and mathematical problems.

**Supporting Standards**

Use the four operations with whole numbers to solve problems.

**NC.4.OA.3**

Solve two-step word problems involving the four operations with whole numbers.

- Use estimation strategies to assess reasonableness of answers.
- Interpret remainders in word problems.
- Represent problems using equations with a letter standing for unknown quantity.

**Generate and analyze patterns.**

**NC.4.OA.5**

Generate and analyze a number or shape pattern that follows a given rule.

**Mathematical Practices**



1. Make sense of problems and persevere in solving them
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others
4. Model with mathematics
5. Use appropriate tools strategically
6. Attend to precision
7. Look for and make use of structure
8. Look for and express regularity in repeated reasoning.

**What is the mathematics?**

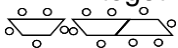
This cluster focuses on geometry and measurement. Students build spatial sense by noticing symmetry and attributes of two-dimensional shapes and using these attributes to identify them. They use tools to draw, sketch, and measure lines, angles, and shapes. Students build connections between geometry and number by generating and analyzing shape patterns to find a rule and by estimating and assessing the reasonableness of their measurements.

- Students use geometric vocabulary in explorations and tasks to identify points, lines, line segments, rays, angles, parallel and perpendicular lines (ex. Scavenger hunt in the school, on the playground; artwork; architecture; quilts; quick draw warm-ups, shape patterns, etc.)
- Students use rulers, protractors, and other tools (isometric drawing paper, patty paper, construction tools on apps, etc.) to draw lines, angles, and shapes.
- Students reason about the size of angles, using the right angle as a benchmark to determine if an angle is acute, obtuse, or right. They work on their number sense by reasoning about the size of an angle and making a reasonable estimate of its size (ex. A right angle is 90 degrees and this angle is about half way. It will be around 45 degrees; This angle is a little more than a right angle. My estimate is 100 degrees.)
- Students assess the reasonableness of their angle measurements using benchmark angles. (ex: A student uses a protractor to measure an angle to be 120 degrees. Student then uses benchmarks and notices that it is an acute angle and determines 120 degrees isn't reasonable.)
- Students solve for unknowns with angle measures. (A student noticed the clock hand rotated 45 degrees. If the next time they looked at the clock it formed a right angle, how far had it rotated between measures?)
- Students identify and draw right, obtuse, and acute angles.
- Students explore, identify, and draw lines of symmetry in 2-D figures.
- Students use attributes to identify quadrilaterals and triangles. Students create minimal defining lists (what the shape must have to be that shape) to distinguish between shapes that have much in common (ex. rhombuses, squares, and rectangles have two sets of parallel lines, but a square must have four congruent sides and four right angles).

**Important Considerations:**

- Memorizing names of shapes without understanding the attributes that define the shape can leave students with misconceptions. (ex: many students think that  is a triangle and that this  is not because it doesn't look like the triangle they had once identified.)
- In order for students to develop language with understanding, students need opportunities to explore (to see, to notice, and to discriminate between) shapes, to describe and categorize their results, to justify their thinking (ex: How do you know that is true? Is your thinking true for every triangle?), and make conjectures based on their thinking.
- Developing spatial sense and geometric reasoning can help prepare students for success in further mathematics. Spatial sense includes the ability to mentally visualize objects and special relationships. Specific spatial reasoning skills like mental rotation and visual spatial reasoning can be strengthened with meaningful experiences over the course of the year (ex: "quick image activity" the teacher flashes a design made with pattern blocks. Students see it for a couple seconds and then try to recreate the design with their own blocks. Create opportunities for students to build structures from Legos<sup>®</sup> or other blocks and challenge students with tangram puzzles and/or origami activities).
- Classroom instruction needs to include a variety of each type of shape (ex: triangles should include isosceles, scalene, and be shown in different orientations) to encourage students to focus on relevant properties rather than irrelevant properties.

- In fourth grade, the focus is on classifying and identifying quadrilaterals and triangles, but not the hierarchy of shapes. In the process of exploring attributes and sorting and identifying shapes, they may start to notice and discuss whether a shape can have more than one name (ex. A square is a rectangle). These conjectures can be discussed and explored, but students do not focus heavily on the hierarchy of triangles and quadrilaterals until fifth grade.
- Shape and number patterns provide rich contexts for students to use vocabulary, practice angle measures, develop spatial sense, and connect back to perimeter work from Cluster 2 (ex. As the number of sides increase, how does the sum of the angle measures increase? How many people can be seated at a single trapezoid table, two trapezoid tables pushed together, three trapezoid tables, ten trapezoid tables pushed together?)



- In addition to recognizing and identifying lines of symmetry, problem solving tasks involving symmetry provide a meaningful opportunity to engage in reasoning and communication of thinking. (ex: Create a design with pattern blocks that has exactly two lines of symmetry. Three lines of symmetry.; What design can you make that has more than 4 lines of symmetry? Explain how you determined your design has more than 4 lines of symmetry.)

