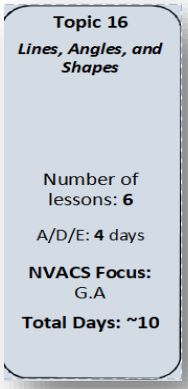
Grade 4 Topic 16: Lines, Angles and Shapes



[4th grade Curriculum Pacing Framework: Balanced Calendar]

Big Conceptual Idea: Geometry (pp. 110-111)

Prior to instruction, view the Topic 16 Professional Development Video located in Pearson Realize online. Read the Teacher's Edition (TE): Cluster Overview/Math Background (pp. 815A-815F), the Topic Planner (pp. 815I-815J), all 6 lessons, and the Topic Assessments (pp. 863-864A).

Mathematical Background: Read Cluster Overview- (TE, pp. 815A-815F)	Topic Essential Questions: How can you classify triangles and quadrilaterals? What is line symmetry? *Reference TE, p. 815 and Answering the Topic Essential Questions (TE, pp. 861-862) for key elements of answers to the Essential Questions.*

The lesson map for this topic is as follows:

16-1	16-2	16-3	16-4	16-5	16-6	Assessment

4 A/D/E days used strategically throughout the topic.

Instructional note:

This topic focuses on lines, angles and shapes. Focus for standard 4.G.A, "Draw and identify lines and angles, and classify shapes by properties of their lines and angles" (Nevada Academic Content Standards (NVACS), 2010). Standards 4.G.A.1-3 focus on 1) drawing points, lines, line segments, rays, angles and perpendicular and parallel lines in two-dimensional figures, 2) classifying two-dimensional figures based on the presence or absence of parallel or perpendicular lines, or the presence or absence of angles of a specified size and 3) recognizing lines of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded along the line into matching parts (NVACS, 2010).

Van de Walle, Karp, Lovin, Bay-Williams (2014) explain, "Geometry is much more than vocabulary and naming shapes, it is the mathematical study of spatial objects, relationships and movements" (p. 345). There are two concepts in geometry; natural and formal. ***Natural concepts*** are formed during everyday activity and are rarely accompanied by concept definitions. Concepts are usually induced from instances and are thought about in terms of visual resemblances to prototypical examples. ***Formal concepts*** are concepts that have definitions that explicitly specify a sufficient set of properties to identify instances. Before being in school, natural concepts are formed when students learn to identify but not define shapes, natural concepts are formed. The names used for natural and formal concepts may be the same, but the underlying cognitive entities are vastly different. For instance, students who may know a natural concept of a square think of a particular image, but formally think of it as a shape that possesses a specific set of properties. Conceptual discussions around geometric properties and exposure to a variety of examples can support students' understanding of formal concepts in geometry.

Trapezoids include exclusive (E) and inclusive (I) definitions. Below are different definitions for trapezoids:

- T(E): a trapezoid is a quadrilateral with exactly one pair of parallel sides (definition used by enVisionmath2.0, GoMath for district alignment)
- T(I): a trapezoid is a quadrilateral with at least one pair of parallel sides.

The Geometry Progression Documents point out the different meanings result in different classifications at the analytic level. "According to the T(E), a parallelogram is not a trapezoid; according to T(I), a parallelogram is a trapezoid." (2014, p. 3). While the WCSD approved instructional materials supports the T(E) definition (which appears to be the most common definition through high school Geometry); the progression document points out that, "'The preponderance of advantages to the inclusive definition of trapezoid has caused all the articles we could find on the subject, and most college-bound geometry books, to favor the inclusive definition.'" (2014, p. 3).

When working with geometric ideas, be sure to use both prototypical (the typical way that shapes are shown such as the yellow hexagon in a pattern block set); in additional to, non-prototypical examples (any closed figure with 6 connected edges also named a hexagon).

Line of symmetry is an attribute of a shape. Any shape that can be folded in half so that two halves match create a line of symmetry, also known as mirror symmetry. This "line of reflection-portion" of the shape on one side of the line is reflected onto the other side. This demonstrates a connection between line symmetry and transformations. Note: A shape may have multiple lines of symmetry.

In this topic, all images should be considered 2-dimensional representations. That is, we are going to be seeking lines of symmetry based upon the image and not as a reference to the actual object. This will be important to point out to students who may consider the visual images as 3-D instead of the 2-D representations being depicted.

Focus Math Practice 3: Critique reasoning
Focus opportunities for students to develop *Mathematical Practice 3* behaviors, as this is the focus of the Math Practices and Problem Solving, lesson 16-6. Reference the Teacher's Edition (pp. F23-F23A) and the NVACS (2010, p. 6).

Note: The purpose of the curriculum guides is for additional considerations. Therefore, not all components may have additional notes included in this guide.

Essential Academic Vocabulary Use these words consistently during instruction.		
New Academic Vocabulary: (First time explicitly taught)		Review Academic Vocabulary: (Vocabulary explicitly taught in prior grades or topics)
parallel lines perpendicular lines intersecting lines right triangle obtuse triangle acute triangle	equilateral triangle isosceles triangle scalene triangle line symmetric line of symmetry	*parallelogram* *rectangle* *square* *rhombus* *trapezoid*

Additional terminology that students may need support with: geometric term, generalize, plane, always true, sometimes true, never true

*Collaborative Team Conversations (CTC)
Consider using *one* of the following as part of the formative assessment process at the lesson level to **collect student work** to analyze for evidence of mathematical understanding:

Guiding question: "Are students able to describe various shapes using accurate mathematical vocabulary?"

Lesson	Evidence	Look for
16-1	*Math Practice and Problem Solving* (student work samples) Item 19	Focus CTC around the big idea: • students describe the relationships between different types of lines through use of vocabulary.
16-3	*Quick Check* (digital platform) Items 1, 2 and 5	Focus CTC around the big idea: • students determine the quadrilateral based on the given attributes Printable version available under "Teacher Resources".

Learning Cycle Assessments (summative)	*Topic Assessments* SE pp. 861-864	Use *Scoring Guide* TE pp. 861-864A

Standards listed in **bold** indicate a focus of the lesson.

NVACS (Content and Math Practices)	Mathematical Development of the Big Idea	Instructional Clarifications & Considerations
Lesson 16-1: Lines		
4.G.A.1 MP.3 MP.4 MP.6	Access Prior Learning: In the previous grade, students used the terms parallel and perpendicular to describe attributes of polygons, particularly quadrilaterals. In Topic 15, students learned that a line is a straight path of points that goes on and on in opposite directions. Developing the Big Idea: In this lesson, students learn about parallel, perpendicular and intersecting lines.	Visual Learning: The *Visual Learning Animation* focus is on mathematical terminology of lines; parallel, perpendicular and intersecting. Consider making an anchor chart with the terminology and pictures of the lines. In the *Visual Learning Animation*, "railroad" example, the perpendicular lines are across two planes. Consider drawing the railroad to visualize it across one plane. Convince Me: Consider having students find examples of parallel, intersecting and perpendicular lines in or outside the classroom. Consider having students make a sketch or write a description of where and what was found based on the type of lines. Students may find examples across planes. For example, the corner of the classroom is across two planes. Guided Practice: In the *Guided Practice*, items 5 and 6, consider facilitating a discussion that parallel and perpendicular lines have to be named in pairs. *-continues on next page-*

		Assess and Differentiate/Intervention Activity: Consider having all students complete the *Intervention Activity*. After students have completed the *Intervention Activity*, have them make their own map of the streets around their neighborhood of parallel, intersecting and perpendicular lines. Have them include the names of the streets. *CTC: *Math Practices and Problem Solving item 19* (student work samples)
Lesson 16-2: Classify Triangles		
4.G.A.2 MP.3 MP.6 MP.8	Access Prior Learning: In third grade, students classified shapes, including triangles, by looking at their attributes such as the length of the sides or whether or not they have a right angle. In Topic 15, students classified angles as right, acute, obtuse or straight. Developing the Big Idea: In this lesson, students classify triangles by their sides and by their angles.	Note: Throughout the rest of the lessons, consider bringing in the language of "always true, sometimes true and never true". Solve & Share: Consider having tools available for students to use as they complete the *Solve & Share*. Visual Learning: In the *Visual Learning Animation*, mathematical terminology is introduced. Consider having students connect back to the sort completed in the *Solve & Share* to see if students can name the different triangles based on what was shown in the animation. Convince Me: Consider facilitating a discussion around the *Convince Me!*. Have students use tools to determine if a triangle can have more than one obtuse angle. Consider having students explain their reasoning using mathematical language. Here is an opportunity to use the language, "always true, sometimes true, and never true." Guided Practice: Consider facilitating a discussion around item 2, as it connects to the work done in the *Convince Me!*. Independent Practice/Math Practices and Problem Solving: Consider reminding students to name a triangle based on both the sides and angles, not just one attribute.
Lesson 16-3: Classify Quadrilaterals		
4.G.A.2 MP.2 MP.3 MP.6 MP.7 MP.8	Access Prior Learning: In third grade, students learned that rhombuses, rectangles, squares, parallelograms and trapezoids are all examples of quadrilaterals. They learned attributes of these different quadrilaterals. Developing the Big Idea: In this lesson, students continue to classify quadrilaterals by their attributes.	Solve & Share: Consider having students complete the *Solve & Share*, or have students sort different quadrilaterals based on the attributes of the quadrilaterals. Look Back: Consider combining the *Look Back!* with the *Solve & Share* so students can explain the attributes of the quadrilaterals and how it relates to the sort. Visual Learning: The *Visual Learning Animation* discusses quadrilaterals; consider making an anchor chart with the various quadrilaterals. Convince Me: As students work on the *Convince Me!*, consider having some rectangles and parallelograms available for students to use to help them decide the similarities and differences between the two types of quadrilaterals. Another Example: Consider comparing the trapezoid from the *Visual Learning Animation* to the trapezoid in the *Another Example!*. Students need exposure to different trapezoids and understand there are two definitions of a trapezoid. See Instructional Note for details regarding the definitions. *CTC: *Quick Check items 1, 2 and 5* (digital platform)
Lesson 16-4: Line Symmetry		
4.G.A.3 MP.2 MP.3 MP.5 MP.7	Access Prior Learning: In the previous grades, students composed and decomposed plane figures to build an understanding of properties of original composite shapes. Beginning of the Big Idea: In this lesson, students analyze figures for line symmetry.	Guided Practice: Read the Error Intervention before teaching the lesson (TE, pp. 841-842). Consider facilitating a discussion around item 3 in the *Guided Practice*; how many lines of symmetry does a circle have. Consider having students figure out how many lines of symmetry a circle has by folding a circle. Homework & Practice: Consider facilitating a discussion whole group around item 15 of the *Homework & Practice*, as students decide how many lines of symmetry the picture of a wagon wheel has. This may develop into an in-depth conversation about circles and the infinite number of line of symmetry.

Lesson 16-5: Draw Shapes with Line Symmetry		
4.G.A.3 MP.1 MP.2 MP.3 MP.4	Access Prior Learning: In the previous lesson, students learned how to find one or more lines of symmetry in a two-dimensional figure and learned what it means for a figure to be line symmetric. Developing the Big Idea: In this lesson, students learn to draw figures with a given number of lines of symmetry.	Visual Learning: Read the Prevent Misconceptions prior to the lesson (TE, p. 846). While students may generate various types of ***transformations (reflection, translation, rotation and dilation),*** explicit instruction for this idea is in later grades. Consider acknowledging the vocabulary used for other types of transformations while reinforcing the idea that ***reflection*** is specifically used for symmetry. Convince Me: Consider facilitating a discussion around the *Convince Me!* as students find line of symmetry across a diagonal line. Consider having students actually fold the shape across a diagonal line. Provide additional examples for students to understand conceptually that lines of symmetry do not always reflect across a vertical or horizontal line.
Lesson 16-6: Math Practices and Problem Solving: Critique Reasoning		
4.G.A.2 MP.3 MP.2 MP.6 MP.7	Access Prior Learning: In previous topics and lessons, students have used MP.3 to critique the reasoning of others. Developing the Big Idea: In this lesson, students will focus on thinking habits good problem solvers use when they critique the reasoning of others related to analyzing two-dimensional figures.	Look Back: Consider facilitating a discussion around the *Look Back!*, as students discover that things can be true without always being true. Challenge the students to draw an example and a non-example. Note: In the *Vocabulary Review*, students are asked to identify if claims as being "always, sometimes or never true". Consider using this language throughout this lesson.

References

Common Core Standards Writing Team. (2011, May 29). *Progressions for the Common Core State Standards in Mathematics (draft). K, Counting and Cardinality; Grades K-5, Geometry.* Tucson, AZ: Institute for Mathematics and Education, University of Arizona.

Council of Chief State School Officers. (2010). The Nevada Academic Content Standards. Retrieved from http://www.doe.nv.gov/uploadedFiles/nde.doe.nv.gov/content/Standards_Instructional_Support/Nevada_Academic_Standards/Math_Documents/mathstandards.pdf.

Van de Walle, J., Karp, K., & Bay-Williams, J. (2010). *Elementary and Middle School Mathematics: Teaching developmentally.* Boston, MA: Pearson.

Van de Walle, J., Karp, K., Lovin, L., & Bay-Williams, J. (2014). *Teaching student-centered mathematics: Developmentally appropriate instruction for grades 3-5* (2nd ed.). New York, NY: Pearson.