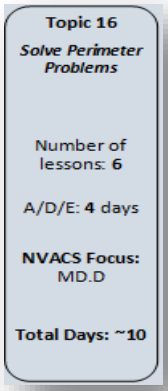
Grade 3 Topic 16: Solve Perimeter Problems



3rd Grade Curriculum Pacing Framework: Balanced Calendar

Big Conceptual Idea: Measurement and Data (Measurement Part) (pp. 16-18)

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. 843A-843F), the Topic Planner (pp.843I-843J), all 6 lessons, and the Topic Performance Assessment (pp. 889-890A).

Mathematical Background: Read Topic 16 Cluster Overview/Math Background (TE, pp. 843A-843F)	Topic Essential Question: How can perimeter be measured and found? *Reference Answering the Topic Essential Question (TE, pp. 887-888) for key elements of answers to the Essential Question.*

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:
Topic 16's big idea is that some attributes of objects are measurable and can be quantified using units. New learning to this topic is perimeter as a measurable unit, while developing a deeper understanding of area through exploring the relationship between area and perimeter.

Perimeter as defined by the Geometric Measurement progression document, "is the boundary of a two-dimensional shape. For a polygon, the length of the perimeter is the sum of the lengths of the sides" (2012, p.16). Students begin to develop understanding of perimeter concepts by finding the perimeter of polygons on a grid. A common misconception when determining the perimeter of shapes on a grid is to count the vertices rather than the unit segments. In such cases, support students by clarifying what/how to count the unit segments to determine the side lengths. See the *Math Background* pages for information regarding this.

Students further develop understanding of perimeter concepts by determining the perimeter of parallelograms when only 2 lengths of adjacent sides are provided. Students may choose to solve by doubling each side's length and adding them together or by adding the adjacent sides' measures and doubling. A common error in these cases is for students to only add the 2 side lengths where the measures are given. In this event, revisit the definition of perimeter and ask students what sides they have found the total length for and what they need to find to get the perimeter of the shape.

In the case where a parallelogram is a square, only 1 side's length may be offered and students will have to reason with what they know about attributes of squares to determine the perimeter of a square. In this case students may choose to add the measure 4 times (repeated addition), double the measure and double it again (a strategy for solve for multiplication facts with 4 as a factor), or multiply the length of the one side times 4 (or 4 times). To connect to previous learning this year, and to revisit understandings of grade 3 critical content area of multiplication, it may be a worthy class discussion on these 3 different solution strategies and why they all work and in what situations or context one may work better than another.

Students also develop understanding of perimeter concepts by exploring how to find perimeter when they have to solve for an unknown side length of polygons. Initially **enVision**math2.0 represents the unknown side length with a question mark (?); however, further in the lesson it is represented with a variable and the unit of measurement. For example, if side lengths were measured in centimeters they identify the unknown side length as "*x* cm." This connects with standard 3.OA.D.8, "Solve 2-step word problems using the four operations. Represent these problems using equations with a letter standing for the unknown quantity" (NVACS, 2010). You may need to clarify the difference between the letter for the unknown and the letters for the abbreviated unit of measurement.

Students also explore the relationship between area and perimeter. Students often confuse perimeter and area measures. The Geometric Measurement progression document states that, "Differentiating perimeter from area is facilitated by having students draw congruent rectangles and measure, mark off, and label the unit lengths all around the perimeter on one rectangle, then do the same on the other rectangle but also draw the square units. This enables students to see the units involved in length and area and find patterns in finding the lengths and areas of non-square and square rectangles (MP 7)" (2012, p. 18). Chapin and Johnson (2006) suggest asking the following questions to facilitate students developing understanding of the relationship between area and perimeter:

- What do all the figures with smaller perimeters have in common?
    - The figures with smaller perimeters are more condensed and compact.
    - The shape of these figures is more closely related to a square.
- What do all the figures with large perimeters have in common?
    - The figures with larger perimeters are elongated. Most of the square tiles are adjacent to another square tile only on one side (p.284-285).

Students do not need to be secure in the responses to these questions, the questions just help to identify that there is a relationship between perimeter and area.

Focus Math Practice 2: Reason abstractly and quantitatively

Focus opportunities for students to develop Mathematical Practice 2 behaviors throughout the entire topic, as this is the focus of the Math Practices and Problem Solving lesson 16-6. Resources to support students' development of MP. 2 include the Teacher's Edition (pp. F22 - F22A) and the Nevada Academic Content Standards for Mathematical Practice. The Nevada Academic Content Standards state that, "Mathematically proficient students make sense of quantities and their relationships in problem situations. … Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects" (2010, SMP 2).

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)
perimeter equilateral triangle	*area* *square units* *unit square* *scale (multiplicative scale)*

Additional terminology that students may need support with: *grid, distance, around, representations,*

*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 questions: "Are students showing understanding that rectangles can have the same area and different perimeters?"
"Are students able to explain the relationship between area and perimeter using rectangles with the same area and different perimeters?"

Lesson	Evidence	Look for
16-2	*Quick Check* (digital platform)	Focus CTC around data analysis and collection of student workspace (scratch paper). Printable version available under "Teacher Resources". • using given measurements to determine the perimeter of a polygon.
16-5	*Solve & Share* (student work samples)	Focus CTC around the big idea: • comparing the relationship between the area and perimeter of rectangles.

Learning Cycle Assessments (summative)	*Topic Assessments* SE pp. 887-890	Use *Scoring Guide* TE pp. 887-890A

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

NVACS (Content and Practices)	Mathematical Development of the Big Idea	Instructional Clarifications & Considerations
Lesson 16-1: Understand Perimeter		
3.MD.D.8 MP.1 MP.2 MP.3 MP.4 MP.6	Access Prior Learning: In Topic 6, Grade 3, students learned how to find area using standard, as well as nonstandard, units of measurement. Students also learned how to count unit squares to determine side length. Developing the Big Idea: Students *begin* to understand perimeter as the distance around a figure and solve for perimeter.	Topic Opener: Introduce the *Topic Essential Question*, "How can perimeter be measured and found?" (TE p. 843). Consider using this question to begin a class anchor chart to which new ideas can be added each day. This allows students to see the development of their own thinking and ideas and make new connections with the content of this topic. Consider having students complete the *Review What You Know* prior to beginning instruction on Topic 16 so that you can respond to students' instructional needs using the *Item Analysis for Diagnosis and Intervention* (TE, pp. 844-846). Consider introducing vocabulary terms as they are encountered in the lessons rather than introducing all terms at the beginning of the topic. Solve & Share: Watch for students that count vertices rather than the unit segments. For ideas on supporting students that are miscounting the unit segments read *Prevent Misconceptions* (TE, p. 848). *-continues on next page-*

		Visual Learning: Consider pausing the *Visual Learning Animation* after it asks, "How do you find the perimeter?" The *Visual Learning Animation* introduces finding perimeter using side measurements without the grid. Consider asking students "How does removing the grid lines change finding the perimeter?" Convince Me: Consider assigning the *Convince Me!* to support students' development of perimeter measurements. Independent Practice/Math Practices and Problem Solving: Consider assigning *Homework and Practice* item 8 to give students the opportunity to create a polygon using a given perimeter measurement. Assess and Differentiate: If time permits, you may consider using the *Math and Science Activity*. Child watch to identify students who need additional support and pull them into a small group to do the *Intervention Activity* (TE, p. 851A).
Lesson 16-2: Perimeter of Common Shapes		
3.MD.D.8 MP.1 MP.2 MP.3 MP.6 MP.7 MP.8	Access Prior Learning: In Topic 15, Grade 3, students learned about sides of polygons as being attributes of polygons. In the previous lesson, students found the perimeter of polygons by counting the unit segments around a figure or adding all the sides' measurements. Developing the Big Idea: Students *develop* perimeter concepts by using reasoning and their knowledge of attributes of polygons, to finding the perimeter of figures with missing side lengths.	Solve & Share: Watch for students that appear to be struggling, help them to apply knowledge of the attributes of rectangles. Support students' problem solving by asking them what they know about rectangles (e.g., opposites sides are the same length, 2 pair of parallel sides, 4 right angles, etc.). Then ask them which of those attributes could help them figure out the perimeter of the rectangle (e.g., opposites sides are the same length). After students have shared their solution methods and reasoning, consider discussing the *Look Back!* to help students focus on how they can use multiplication and addition to find perimeter. Visual Learning: After the *Visual Learning Animation* show how repeated addition can be used to solve for the perimeter of a square. Consider asking, "Is there another way to solve for the perimeter of squares?" Are students connecting using repeated addition to multiplication to find perimeter? Assess and Differentiate: If time permits, teach students how to play *Clip and Cover* (TE, p. 857A). All students should have the opportunity to play this game. Child watch to identify students who need additional support and pull them into a small group to do the *Intervention Activity* (TE, p. 857A). *CTC: *Quick Check* (digital platform)
Lesson 16-3: Perimeter and Unknown Side Lengths		
3.MD.D.8 MP.1 MP.2 MP.3 MP.4 MP.7	Access Prior Learning: In the previous lessons, students solved for perimeter by using attributes of regular polygons where some of the side lengths were not labelled. Developing the Big Idea: Students are further *developing* perimeter concepts by solving for a missing side length in a polygon with a given perimeter.	Solve & Share: Watch for students that incorrectly determine the unknown side as 3 ft. They are likely applying reasoning based on understanding rectangles. Remind students what is known and unknown in this problem. Can they write an equation that represents the known sides, the unknown side (use a variable) and perimeter? How does this expression help to determine the missing side length? Are students able to use an inverse operation to check their solution? Visual Learning: During the *Visual Learning Animation* consider pausing to allow students to solve for x in the equation $x + 18 = 22$. Are they able to use more than one operation to find the value of x? Assess and Differentiate: If time permits, consider having student play *Clip and Cover* (TE, p. 857A) or the *Fluency Practice Activity* (TE p. 883). Child watch to identify students who need additional support and pull them into a small group to do the *Intervention Activity* (TE, p. 863A).
Lesson 16-4: Same Perimeter, Different Area		
3.MD.D.8 3.MD.C.7b MP.1	Access Prior Learning: In previous lessons, students found the perimeter of polygons, in some cases, with an unknown side length.	Solve & Share: To assess student readiness, consider asking students, "What is the difference between perimeter and area?" Are students able to describe area as the measure of space inside a figure and perimeter as the measure of the distance around a figure. Also consider asking students "What is the same?" to remind them that both are measurements. Adding these ideas to the class anchor chart will allow students to revisit these concepts in future lessons. *-continues on next page-*

MP.2 MP.3 MP.6 MP.7 MP.8	Developing the Big Idea: Students further *develop* perimeter and area concepts by using what they know about perimeter and rectangles to discover that polygons with the same perimeter can have different areas.	After students have shared their solution methods and reasoning, use the *Look Back!* to extend thinking about the relationship between perimeter and area. Visual Learning: Consider pausing the *Visual Learning Animation* and giving students time to solve for the area of the shapes. *Prevent Misconceptions* section (TE, p. 866) suggests checking to be sure that students understand how to find perimeter and area. Can students generalize how side length is related to area? Also, consider discussing the *Convince Me!* to extend upon ideas presented in the *Visual Learning Animation*. Independent Practice/Math Practices and Problem Solving: Consider assigning *Math Practices and Problem Solving* item18 to provide students distributed practice with a division situation. Assess and Differentiate: If time permits, teach students how to play *Teamwork* (TE, p. 869A). All students should have the opportunity to play this game. Child watch to identify students who need additional support and pull them into a small group to do the *Intervention Activity* (TE, p. 869A).
Lesson 16-5: Same Area, Different Perimeter		
3.MD.D.8 3.MD.C.7b MP.1 MP.2 MP.3 MP.4 MP.5 MP.7 MP.8	Access Prior Learning: In the previous lesson, students discovered that different rectangles can have the same perimeter and different areas. Developing the Big Idea: Students further *develop* perimeter and area concepts by using what they know about area and rectangles to discover that polygons with the same area can have different perimeters.	Solve & Share: Prior to introducing the *Solve & Share* consider having centimeter grid paper (Teacher Tool 13) and colored tiles available. After introducing the *Solve & Share,* ask students what tool might be helpful in solving the problem. After students have shared their solution methods and reasoning, consider discussing the *Look Back!* if the relationship between area and perimeter was not yet discussed. Visual Learning: Consider pausing and discussing the *Visual Learning Animation* after it asks the question, "Why do the water tiles surround this rectangle?" Convince Me: Consider discussing the *Convince Me!* to support students' development with choosing the appropriate unit of measure (linear vs. square units). Assess and Differentiate: If time permits, consider using the *Math and Science Activity*, games *Clip and Cover* (TE, p. 857A), *Teamwork* (TE, p. 869A), or the *Fluency Practice Activity* (TE, p. 883). Child watch to identify students who need additional support and pull them into a small group to do the *Intervention Activity* (TE, p. 875A). *CTC: *Solve and Share* (student work samples)
Lesson 16-6: Math Practices and Problem Solving- Reasoning		
3.MD.D.8 MP.2 MP.1 MP.3 MP.6 MP.7	Access Prior Learning: In previous lessons, students developed perimeter concepts and learned about the relationship between perimeter and area. Developing the Big Idea: Students are *developing* understanding of perimeter concepts by focusing on MP.2 to understand the relationship between numbers in order to simplify and solve problems involving perimeter.	This lesson provides an opportunity to focus on the Thinking Habits and display the behaviors associated with Math Practice 2. Refer to the *Math Practices and Problem Solving Handbook* for suggestions on how to develop, connect and assess this Math Practice (TE, pp. F22-F22A, F29). Also reference the handbook in the Student Edition (SE, p. F22). Solve & Share: Consider reintroducing MP. 2 Thinking Habits (SE, p. F22) before introducing the *Solve & Share*. Also consider using the time students are working on the *Solve & Share* as an opportunity to child-watch for behaviors associated with MP.2 that are listed in the *Math Practices and Problem Solving Handbook* (TE, p. F22A). After discussing student solution methods and reasoning, have students self-score for the behaviors associated with this math practice. Visual Learning: To support students' development of MP. 2, consider discussing the *Convince Me!* prompt. Assess and Differentiate: If time permits, you consider replacing the *Problem Solving Reading Mat* with the games "*Clip and Cover* (TE, p. 857A), *Teamwork* (TE, p. 869A), or the *Fluency Practice Activity* (TE, p. 883). Child watch to identify students who need additional support and pull them into a small group to do the *Intervention Activity* (TE, p. 881A).

References

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