Enduring Understanding:
(5)ME01: Demonstrate understanding of the concept of area

(5)ME02: Demonstrate understanding of the differences between length units and area (square) units using the U.S. or metric system

(5)ME03: Use systematic procedures to measure, describe, and compare the area of rectangles – identify area as the attribute to be measured, select and use appropriate units of measurement for area, select and use tools that match the unit chosen, count to determine the number of units

(7) ME01: Demonstrate understanding of how a change in one linear dimension affects other linear and area measurements of rectangles, triangles, and circles; demonstrate understanding of the concepts of volume and surface area of rectangular prisms (GLE 1.2.1) (Attributes and Dimensions)

Essential Questions:
1. What is the difference between area and perimeter?
2. How is area used to describe an object?
3. How is perimeter used to describe an object?
4. Why is perimeter measured in linear units?
5. Why is area measured in square units?
6. What is the difference between linear and square units?
7. What are some real life examples of how area and perimeter are used?

Prerequisites for Lesson:

Vocabulary:
1. area: number of square units needed to cover a 2-d shape
2. perimeter: the number of units needed to “surround” a 2-d shape. Students will often view the perimeter as a fence that surrounds the shape.
3. rectangle: a quadrilateral with two pairs of congruent, parallel sides and four right angles.
4. factor: An integer that divides evenly into another, one or two or more numbers that are multiplies to get a product.. Example: 1,2, 3 and 6 are factors of 6
5. factor pairs: two numbers (usually integers) having a specific product. Example: 6 = 3 x 2 so, factors of 6 are 3 and 2
6. Square unit: a unit such as square meter that is used to measure area.
7. Volume: refers to the total space contained within a three-dimensional figure. Volume is expressed in cubic denominations, such as cubic feet or cubic inches.
Other possible vocabulary
1. **Maximum**: the largest possible
2. **Minimum**: the smallest possible

Skills:
- ME02 Students should be able to select or describe appropriate units, standard or non-standard, for measuring length
- ME03 Students should be able to determine the perimeter of a triangle or rectangle
- ME03 (Procedures): Use systematic procedures to measure, describe, and compare angle measurements or the volumes of rectangular prisms - identify the attribute to be measured, select and use appropriate unit of measurement, select and use a tool that matches the unit chosen, compare attribute to units on tool or count to determine the number of units; use formulas to determine missing measurements for circles, triangles, and rectangular prisms (GLE 1.2.4 and 1.2.5)
- ability to create tables: Strand 5: Algebraic Sense (AS)

(7) AS01 (Patterns and Functions) Recognize, extend, or represent linear patterns and sequences using **tables**; recognize or extend patterns and sequences that use two different arithmetic operations to move, alternating, from one term to the next; describe a rule and/or construct a table to represent a pattern with combinations of two arithmetic operations in the rule (GLE 1.5.1 and 1.5.2)

Related GLEs:
- **EALR 1.2**: Understand and apply concepts and procedures from measurement.
  - GLE 1.2.1: Understand the concept of area.
    - The students will develop and reinforce the concept of area throughout the entire lesson. **For example students will be asked to change the perimeter, but keep the area constant. One misconception of students is that if the perimeter increases then the area of the shape must also increase.**
  - GLE 1.2.2: Understand the differences between length (linear) units and area (square) units in the U.S. or metric system.
    - **The students will understand the differences between linear and square units throughout the lessons when student are asked to measure and describe areas, perimeters, lengths, widths, heights and volumes of various shapes.**
EALR 3: The student uses mathematical reasoning.
GLE 3.3.3: Understand how to validate thinking about measurement ideas.
The students will use reasoning to validate thinking about measurement ideas when they answer the discussion questions.

EALR 4: The student communicates knowledge and understanding in both everyday and mathematical language.
GLE 4.2.3: Use mathematical language to explain or describe measurement ideas and information in ways appropriate for audience and purpose.
The students will be communicating when they explain their rationales such as measurement strategies in writing and in discussions during the lessons.

Materials Needed:
- 1-inch tiles (24 per pair)
- 3X3 Post-Its, note cards, or ½ sheets of paper (one per student)
- Student handouts for each student

Modifications for Differentiated Instruction:
- **Simplifications:** Some students will have a difficult time recognizing and finding all of the factor pairs and creating all the appropriate rectangles. Consider having students work independently for the first 10-15 minutes and if needed have students work together in pairs to support one another or have small groups.

- **Extensions:** Some students might recognize quickly that if an area is constant then the perimeter can change based on shape. Have these students also try and find rectangles that have a constant perimeter, but varying area. One can also consider having students generalize their knowledge and skills (area and perimeter) with other shapes such as circles, triangles and even irregular shapes.

Suggested Future Experiences:

- **GLE 1.2.1:** Understand how changes in one linear dimension affect other linear measurements and area of rectangles, triangles, and circles.

- **GLE 1.2.2:** Understand the differences between area (square) units and volume (cubic) units.

Assessments: See attached
Lesson 1: Area and Perimeter

Purpose: To assess student understanding of area and the concepts related to area

Suggested Teaching Sequence:

Goal
- Students will be able to understand that the perimeters of rectangles can vary considerably even when area is constant.
- Understand and examine the relationships of area and perimeter. Students should be asked and told explicitly what the goal of the lesson is so that they will have a focus throughout the lesson.

Synopsis
Lesson 1
- Students will construct diagrams and tables to organize their work and better find patterns and relationships
- Students will make a conjecture of the relationship between area and perimeter (i.e. the increase in perimeter results in ________ for area…) in journals
- Students will use manipulates such as 1 inch x 1 inch tiles to create all possible rectangles for a certain area.
- Students will also sketch all the possible rectangles finding a connection between pairs of the area and rectangles
- Students will find the maximum and minimum perimeter for the areas of 24 and 12 square units with integer dimensions.
- Students should either “discover” or have the rule for area reinforced (length x width = units squared)
- Students will revise their previous journal about area and perimeter
- Students will discuss in pairs, groups or as a class their conclusions and rationales

Beginning
1. Quick Preassessment: Students will do a “quick write” reflection on the relationship of area and perimeter… Ask the students to respond in their journals to the statement and provide reasons for their thinking using numbers, words and pictures.

   Stem-question:
   “If the perimeter of a rectangle increases, what happens to the area?” (TC-1)
Additional questions can be required and chosen from the essential questions. Consider which questions best meet the needs of students within the class.

- What is the difference between area and perimeter?
- How is area used to describe an object?
- How is perimeter used to describe an object?
- Why is perimeter measured in linear units?
- Why is area measured in square units?
- What is the difference between linear and square units?
- What are some real life examples of how area and perimeter are used?
- How do the linear measurements of height, length and width relate to volume?
- How do you find the area of a circle, rectangle and or triangle? (TC-2)

Please note that each reflection should be numbered 1 for prelesson journal and 2 for summative journal

Anticipatory Set: Have students consider what a new puppy would need. (TC-3)

Lesson Body
1. Give students 24 (1 inch) square tiles

2. Have students set up a table that would fit the task (TC-4)

3. Have students find and build all the possible rectangles for 12 sq. feet and then 24 sq. feet – noting that 6*4 is different than 4*6 (TC-5)

4. Students should build the rectangles and measure the perimeter of the rectangle and record it on their tables.

5. Students should note that all the rectangles (length and width) are factor pairs of 12 or 24 (TC-6)

6. It is a necessity that students constantly look for patterns while working. For example the perimeter is the sum of the L and W multiplied by 2 and that the area is constant, but the perimeter changes. The “skinnier” the rectangle, the larger the perimeter. Consider using the attached worksheet for Lesson 1.
Example Table
Area = 12 squares

<table>
<thead>
<tr>
<th>Length (feet)</th>
<th>Width (feet)</th>
<th>Perimeter (feet)</th>
<th>Area (feet squared)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>12</td>
<td>26</td>
<td>12</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>16</td>
<td>12</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>14</td>
<td>12</td>
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<td>4</td>
<td>3</td>
<td>14</td>
<td>12</td>
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<td>6</td>
<td>2</td>
<td>16</td>
<td>12</td>
</tr>
<tr>
<td>12</td>
<td>1</td>
<td>26</td>
<td>12</td>
</tr>
</tbody>
</table>

8. Students will then make conjectures about the outcome of their work with 24 square tiles using their experiences with 12 tiles and reflections.

9. Repeat steps 1-6

<table>
<thead>
<tr>
<th>Length (feet)</th>
<th>Width (feet)</th>
<th>Perimeter (feet)</th>
<th>Area (feet squared)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>24</td>
<td>50</td>
<td>24</td>
</tr>
<tr>
<td>2</td>
<td>12</td>
<td>28</td>
<td>24</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
<td>22</td>
<td>24</td>
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<tr>
<td>4</td>
<td>6</td>
<td>20</td>
<td>24</td>
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<tr>
<td>6</td>
<td>4</td>
<td>20</td>
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<td>8</td>
<td>3</td>
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<td>12</td>
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<td>28</td>
<td>24</td>
</tr>
<tr>
<td>24</td>
<td>1</td>
<td>50</td>
<td>24</td>
</tr>
</tbody>
</table>

10. Have students then reread their original journal entry and rewrite, reevaluate, reinforce and/or rethink their previous thoughts on in their math journals. (TC-7)

11. Class or small group discussion on student conclusions on the measures of area and perimeter and their relationship. (TC-8)

12. Have students on a large post-it write down with their name on one side and their ideas on the back of the post-it what they have learned or been reminded about. Have students write the three most important things they learned or were reminded of today. Also allow the students to write any questions they have about the lesson or concepts related to the lesson. (TC-9)
Modifications for Differentiated Instruction:

Simplifications: Some students will have a difficult time coming up with a strategy on their own to find the area and perimeter of rectangles. Identify these students, and pull them into a small group to provide additional scaffolding. In the group, the teacher can model appropriate strategies to find the area and perimeter of each rectangle.

- Use of student worksheet is optional, but recommended. If students need the extra support you may use the attached worksheet for lesson 1. This worksheet will guide students by providing cues such as the number of possible rectangles for each area (i.e. see number of space provided) and setting up a table for each student. (TC-10)

Extensions: Allow some students to do the same task but with various shapes such as triangles, rectangles, circles or irregular shapes. If they cannot give you reasoning as to why the formulas work, have them continue the assignment, asking questions as they go, until they can tell you the reasoning behind the formulas.

Possible Student Examples
Have student try and find various triangles dimensions that have the same area. Students should know that the formula for a triangle is base X height divided by 2.
Formula for a triangle
Base multiplied by height divided by 2 = the area of a triangle

Height = 5 units
Base = 6 units

6 × 5 = 30 units square is the area of the rectangle

Then you must divide the area of the rectangle by two to get the area of the white triangle

30 units square divided by 2 = 15 units square

Even though the perimeter of each triangle is different I kept the area the same by keeping the base and the height the same.
Lesson 2: Surface Area

Enduring Understanding:
(5)ME01: Demonstrate understanding of the concept of area

(5)ME02: Demonstrate understanding of the differences between length units and area (square) units using the U.S. or metric system

(5) ME03: Use systematic procedures to measure, describe and compare the area of rectangles. Figures composed of rectangles and right triangles – identify area as the attribute to be measured, select and use appropriate units of measurement for area, select and use tools that match the unit chosen, count to determine the number of units; use formulas to find the perimeter and area of rectangles and right triangles (1.2.4, 1.2.5) (Procedures)

(6) ME01: Demonstrate understanding of the concepts of surface area of rectangular prisms (1.2.1) (Attributes and Dimensions)

(7) ME01: Demonstrate understanding of how a change in one linear dimension affects other linear and area measurements of rectangles, triangles, and circles; surface area of rectangular prisms (1.2.1) (Attributes and Dimensions)

Essential Questions:
1. What is the difference between linear and square units?
2. How do the linear measurement of length and width relate to area?
3. How does area of a rectangle relate to the measure of surface area?

Prerequisites for Lesson:
Vocabulary:
1. Area: number of square units needed to cover a 2-d shape
2. Perimeter: the number of units needed to “surround” a 2-d shape. Students will often view the perimeter as a fence that surrounds the shape.
3. Rectangle: a quadrilateral with two pairs of congruent, parallel sides and four right angles.
4. Square unit: a unit such as square meter that is used to measure area.
5. Prism: a 3-dimensional figure that has two congruent and parallel faces that are polygons. The rest of the faces are parallelograms.
6. Face: a plane figure that serves as one side of a solid figure.
7. Surface area: the total area of the faces and curved surfaces of a solid figure. Surface area is simply the sum of all the areas of the faces. (TC-1)
Skills:
- Students should be able to select or describe appropriate units, standard or non-standard, for measuring length (ME02)
- Understanding for how to find the area of a rectangle.
- Understanding of how to find surface area of a rectangular prism.

Materials Needed:
- Worksheet
- Rulers
- Box

Suggested Lesson Sequence:
- Ask students to write large in the corner of their math journals the formula for finding the area of a two-dimensional shape, such as a square.
- Give the students 20-30 seconds then have students raise their journals at your mark and quickly assess if students know the formula for area of a rectangle. (TC-2)
- Display a cube or some rectangular prism such as a gift box and ask students to journal about how they might find the surface area of the box.
- Have a quick discussion of surface area if needed. (TC-3)
- Have students share their ideas with classmates using class discussions.
- Have students work either independently or in pairs on the worksheet.
- As students are working walk around the room and question, redirect, assist or extend the learning as needed.
- When students are finished have a class or small group discussion on student conclusions on the surface area.
- Reinforce and explain that surface area of a prism is the sum of all the faces including the base. (TC-4)

Modifications for Differentiated Instruction:
- **Simplifications**: Some students will have a difficult time coming up with a strategy on their own to find surface area of rectangular prisms. Identify these students, and pull them into a small group to provide additional scaffolding. In the group, the students can assist one another with teacher support or the teacher can model appropriate strategies.
- **Extensions**: Some students who already know how to find the surface area of rectangular prisms can instead find the surface areas of other shapes such as triangular prisms.
**Suggested Future Experiences: Volume**

GLE 1.2.1(6) Understand the concepts of surface area and volume of rectangular prisms. (Attributes, units, and systems)

GLE 1.2.1 (8) Understand how a change in one linear dimension affects surface area and volume of rectangular prisms and cylinders and how changes in two linear dimensions affect perimeter and area of rectangles. (Attributes, units, and systems)

GLE1.2.1 (9/10) Understand the relationship between change in one or two linear dimension(s) and corresponding change in perimeter, area, surface area, and volume. (Attributes, units, and systems)

**Assessments: See attached**