### Big Idea/ Topic

- Develop an understanding of the structure of rectangular arrays and of area.
- Measure plane figures and real-world objects using area and perimeter.

### Standard Alignment

- **MGSE3.MD.5** Recognize area as an attribute of plane figures and understand concepts of area measurement. 
  a. A square with side length 1 unit, called “a unit square,” is said to have “one square unit” of area, and can be used to measure area. 
  b. A plane figure which can be covered without gaps or overlaps by $n$ unit squares is said to have an area of $n$ square units.

- **MGSE3.MD.6** Measure areas by counting unit squares (square cm, square m, square in, square ft, and improvised units).

### Diagnostic Assessment

- Provide Odd One Out Assessment (see [appendix](#)) to gauge student thinking on the concept of area.
- An Odd One Out Assessment with anticipated student responses is also available in the [appendix](#).

### Instructional Design

**Overview:** This lesson is designed to give students a representational idea of area with the use of plane figures. Students will understand that square units can be used to measure objects and/or area of a space. Specific domains of area (square feet, square inches, square meters are not addressed in this lesson, only the concept of covering a space with square units.) Teachers will guide students synchronously through the lesson while having rich mathematical discussions along the way. If delivered asynchronously, students may work at their own pace and share their thought processes, while the teacher provides feedback to guide and support student understanding. Additional support materials are provided to ensure a complete understanding of the concept of area at the conclusion of this Learning Plan.

**Instructional Details**

- **Materials:** Electronic device to explore Desmos activity and additional materials. Square tiles (or comparable square tools, such as post-it notes, unifix cubes, or square pieces of paper) for extensions and at home connections.
Teacher Directions: Use the Desmos activity to help guide students to build on the concept of area. Teaching the concept of area leads to the application and implementation of multiplication standards. Synchronously, the teacher will support students through the Desmos slides as students explore these concepts. Teachers may pause along the way to highlight discussion points and big ideas of the intended learning targets.

Description of Learning: In this activity, students will be introduced to plane figures and will see that squares can be used to cover other plane figures, which leads to the representational understanding of the concept of area. Students see the physical covering of squares and work their way into the more abstract concept of visualizing tiles to determine the area of an object or space. This activity may also be used as a prerequisite to teaching multiplication with arrays. Additional practice and engagement with this skill is recommended for students to gain mastery of this standard.

Synchronous – Complete the Desmos activity with a class. Use teacher controls on the teacher dashboard to pause each slide that requires students to explore/problem solve. Allow for student questioning and hands on assistance for students who need support. Also, pause periodically to bring out big ideas and highlight student discoveries. Additional activities will be provided throughout the learning plan to support learning of the intended learning targets.

Asynchronous – Students will navigate through the Desmos slides at their own pace. Students will encounter reflection prompts along the way as they navigate throughout the lesson. The teacher may assess students by their reflections or will be able to see student work on the Teacher Dashboard within the Desmos platform. Teachers can also provide feedback to all students (synchronous or asynchronous) through the Desmos Teacher Dashboard.
**Unplugged/Offline** - Throughout this Learning Plan, students will be provided with a variety of options that can be used to explore the concept of Area. Options include but are not limited to:

- Exploring places in your house that might consist of squares (ie, bathroom tiles, backsplash patterns, rug/carpet/blanket patterns.)

- Using square shaped objects to cover other flat surfaces (legos, building blocks, post-it notes, snap cubes, dice, pieces of paper, etc.)

- Using graph paper to sketch pictures or patterns that can be counted with squares.

(Source: [https://www.weareteachers.com/area-and-perimeter/](https://www.weareteachers.com/area-and-perimeter/))

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**Desmos Activity: Square Units - Desmos**

**Engage**

What do you notice about the pattern?

What might the next picture look like?

What might the 5th picture look like?

How could you figure out what the 10th picture will look like?

**Activity Screenshot - Desmos**
In the screenshot above, from the Desmos activity, students have the opportunity to predict and then check their prediction on the following screen in order to gain familiarity with visualizing how many smaller squares it would take to cover the green rectangle (area).

- **Synchronous** - The Teacher will pace the Desmos lesson for students. Slides can be paused or skipped at teacher discretion using the teacher dashboard. As the slides are navigated, the teacher can share student thinking and address misconceptions accordingly.

- **Asynchronous** - Students may work on the slides at their own pace. The teacher will review/assess student thinking and work to guide and adjust instruction. Feedback can be provided through the teacher dashboard within the Desmos platform.

- **Unplugged/ Offline** - Students may explore places in their home that might contain patterns with squares (i.e., bathroom tiles, backsplash patterns, rug/carpet/blanket patterns.) Students may record patterns they see. Students can determine the number of square objects within the context. Counting patterns may be used to determine the area such as counting by twos or seeing familiar arrays.

**Explore**

Below are images showing some of the tasks in which students will engage during this Desmos activity. Students will visualize and explore areas of shapes in various ways to reach the understanding of identifying area using square units.
● **Synchronous** - Students complete the slides while the teacher paces the lesson accordingly. The class may share responses, thought process, and connections throughout the activities. Students will also have opportunities to reflect on their learning and their understanding of the concept of area.

● **Asynchronous** - Students complete the slides and provide their thought processes in the given response text box. The teacher can determine the concepts that students show mastery of as well as identify misconceptions to help guide instruction in subsequent lessons.

● **Unplugged/ Offline** - Pencil and paper (graph paper preferred) can be used to draw opening engagement activity. Shapes can also be drawn to determine the area of given drawings. Creative shapes/pictures can be drawn by students, then determine the area of the drawings.

**Apply**

Students will apply what they have learned about the concept of area to design a playground for a pet hamster and a colony on the moon. These can be part of a larger design process, where students investigate and research the needs and desires for the playground and the colony.

This portion of the learning plan is separate from the Desmos activity above.
1.) **Scenario:** You are building a playground for your pet hamster to run around and get some exercise. Your parents tell you that it can only take up 12 square feet of your room. What are all of the dimensions you could use to build the hamster playground? Which is the best option? Support your reasoning. Use this [interactive](#) to make 12 squared units in as many ways as possible.

![Interactive](image)

2.) **Consider:** Measuring the area of your various parts of your room: kitchen, living room, or bedroom.

3.) **Explore** [this interactive](#) to further practice the concept of building area.

- **Synchronous** - Complete this activity as a follow-up to the aforementioned Desmos activity. This can be delivered in the class setting at the teacher’s discretion (i.e., math notebook, digital assignment, small group setting, etc.).
- **Asynchronous** - Students can complete the activity(s) assigned independently. Students may need the assistance of a parent when measuring rooms or determining the area of their hamster playground. Graph paper could be utilized to support these applications.
- **Unplugged/ Offline** - Teachers could handwrite the area problem for students and provide square cut outs or square tiles to measure. Teachers could also provide different size sheets of paper or rectangle/square items for those students to measure. Students could also draw given areas on graph paper.

**Reflect**
Students will reflect on their learning on the final slide of Desmos activity.

- **Synchronous** - Students will reflect upon the Desmos lesson on the final slide of the activity. Students will share 1 thing they learned, 1 thing they liked, and 1 question that the student still has. Share reflections anonymously with the class.

- **Asynchronous** - Students will reflect upon the Desmos lesson on the final slide of the activity. Students will share 1 thing they learned, 1 thing they liked, and 1 question that the student still has. Results can be used to guide instruction the following days.

- **Unplugged/ Offline** - A paper copy could be sent to the student to reflect with pencil and paper. If math notebooks are a part of teacher routines, the reflection could be performed here.

### Evidence of Student Success

At the conclusion of exploring area via the Desmos activity and “Apply” resources (mentioned above), provide [Odd One Out Assessment](#) to gauge student growth on meeting the intended learning targets. Compare this assessment to the initial assessment to gauge growth.

Questions and responses are incorporated throughout the guided Desmos lesson which include multiple choice questions, modeling (with the drawing tools provided), and explaining student thinking. These items can be seen from the Desmos Teacher Dashboard. From these items, the teacher will have insight to student thinking and thought processes that can be used to guide instruction for subsequent lessons. Student success can be measured with the formative assessment provided. This assessment allows students to demonstrate their understanding of the concept of area.

### Student Learning Supports

**Student Learning Supports**

Establish mathematics goals to focus learning.

- Make instructions and expectations clear for the activities.
- Make explicit connections between current and prior lessons or units.

Facilitate meaningful mathematical discourse.
Explicitly model and teach good “discussion board” etiquette.

**Pose purposeful questions.**
- Predetermine when you will call on the student or use the pause feature within the activities.
- Break class into small discussion groups to work collaboratively and then have groups report back to the whole group.

**Support productive struggle in learning mathematics.**
- Offer outlines and other scaffolding tools and share tips that might help students learn.
- Provide feedback using the feedback feature within activities and offer corrective opportunities.
- Consider the pacing of the lesson.

**Elicit and use evidence of student thinking.**
- Anticipate any misconceptions or questions students might have about the task, materials or technology. Proactively address them with readily available and accessible resources.

**Additional Technology Supports:**

Area Explorer: [http://www.shodor.org/interactivate/activities/AreaExplorer/](http://www.shodor.org/interactivate/activities/AreaExplorer/)

**Area Builder 1.1.20**

Area Video: [https://gpb.pbslearningmedia.org/resource/fe72b848-75d6-4e92-bdd6-5c2d1a4e20d3/fe72b848-75d6-4e92-bdd6-5c2d1a4e20d3/#.X6iTf2hKhPY](https://gpb.pbslearningmedia.org/resource/fe72b848-75d6-4e92-bdd6-5c2d1a4e20d3/fe72b848-75d6-4e92-bdd6-5c2d1a4e20d3/#.X6iTf2hKhPY)

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**Engaging Families**

Families may wish to engage students in real world applications of area such as measuring the area of a kitchen or bedroom. Students may also look for patterns in which squares without gaps or overlaps occur. Students may think about or explore which professions use area on a daily basis (architecture or real-estate for example). Additionally, building arrays during purposeful problem solving provides students the opportunity to practice and learn their multiplication facts. Building and manipulating arrays will develop the concrete understanding and relationships of area and multiplication facts. This would be a fun, more productive way to practice multiplication facts, rather than drill.
## Odd One Out Formative Assessment

**Area:** In each set, circle the **Odd One Out** and describe why it does not fit with the others.

<table>
<thead>
<tr>
<th>1.) Which Is the Odd One Out?</th>
<th>Why It Is the Odd One Out?</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Grid 1" /></td>
<td><img src="image2.png" alt="Grid 2" /></td>
</tr>
<tr>
<td><img src="image3.png" alt="Grid 3" /></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2.) Which Is the Odd One Out?</th>
<th>Why It Is the Odd One Out?</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Grid 1" /></td>
<td><img src="image2.png" alt="Grid 2" /></td>
</tr>
<tr>
<td><img src="image3.png" alt="Grid 3" /></td>
<td><img src="image4.png" alt="Grid 4" /></td>
</tr>
</tbody>
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<tr>
<th>3.) Which Is the Odd One Out?</th>
<th>Why It Is the Odd One Out?</th>
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</thead>
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<td><img src="image1.png" alt="Grid 1" /></td>
<td><img src="image2.png" alt="Grid 2" /></td>
</tr>
<tr>
<td><img src="image3.png" alt="Grid 3" /></td>
<td><img src="image4.png" alt="Grid 4" /></td>
</tr>
<tr>
<td><img src="image5.png" alt="Grid 5" /></td>
<td></td>
</tr>
</tbody>
</table>
**Anticipated Student Responses**

**Area:** In each set, circle the **Odd One Out** and describe why it does not fit with the others.

<table>
<thead>
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<th>1.) Which Is the Odd One?</th>
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<tbody>
<tr>
<td><img src="image1.png" alt="Image" /></td>
<td><strong>Anticipated Answer</strong>&lt;br&gt; This one has 8 square units while the others have 12 square units.</td>
</tr>
<tr>
<td><img src="image2.png" alt="Image" /></td>
<td></td>
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<th>2.) Which Is the Odd One?</th>
<th>Why It Is the Odd One Out?</th>
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<tbody>
<tr>
<td><img src="image3.png" alt="Image" /></td>
<td><strong>Anticipated Answer</strong>&lt;br&gt; This one has gaps and is not completely filling in the shape.</td>
</tr>
<tr>
<td><img src="image4.png" alt="Image" /></td>
<td></td>
</tr>
</tbody>
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<tbody>
<tr>
<td><img src="image5.png" alt="Image" /></td>
<td><strong>Anticipated Answer</strong>&lt;br&gt; This one has gaps, while the others do not.</td>
</tr>
<tr>
<td><img src="image6.png" alt="Image" /></td>
<td></td>
</tr>
</tbody>
</table>