### Big Idea(s)/ Topic(s)
- Reason with and interpret measurement data involving length measurements

### Standard(s) Alignment

**MGSE3.MD.4** Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units— whole numbers, halves, or quarters

### Diagnostic Assessment

In the attached diagnostic assessment, students will be asked to determine whether or not a statement is true or false. These statements focus on measurement and data presented in dot plots. In addition to determining whether a statement is true or false, students must justify their choice. Teachers may choose to give this diagnostic assessment to pairs of students in order to collect anecdotal data from student conversations.
Instructional Design

**Desmos Activity: 3rd Grade Hands-On Measurement and Data**
In this activity, students begin with an investigation of a broken ruler and use it to measure. Next, students collect and share hand span length measurement data and build a dot plot. Students will engage in discussions about the data, beginning with what they notice about it, then following up with answering some questions about the data.

Materials: Students will need a ruler that measures to the nearest quarter inch. A printable version of this tool can be found [here](#).

**Engage**
Show students the image below and ask students to share what is the same and what is different about the measurement of the Post-it note. More examples to use for this Same-Different Math routine can be found [here](#).

![Image of measurement and Post-it note]

- **Synchronous**: Share the image above and ask students to share what they think is the same and what they think is different about the measurement of the Post-it note. Record student responses in a table and use these responses to facilitate a discussion about measurement and units on a ruler.
- **Asynchronous**: Share the image above with students in a virtual platform; this can be done via e-document or video. Allow students to share responses within the virtual platform and provide feedback. Additionally, students could use an audio/video to share. Provide feedback to individual student responses and highlight multiple strategies used by students.
- **Unplugged/ Offline**: Provide the opening image for students to engage in the task. Have students share ideas through email/text/phone. Provide feedback to students and share other students’ ideas before engaging in the remaining sections.
Explore

2. Here is part of a 12 inch ruler. What do you notice?

Teacher Tips:
Accept all student responses. Some possible responses that could be used to build rich conversations about measurement:
- I notice the 0 on the ruler is not at the end of the ruler.
- I notice that the ruler can measure up to 8 inches.
- I notice that there are marks between the numbers.
- I notice that there are three sections between each number.

3. It broke again. Can I still use this to measure?

Teacher Tips:
Whether students answer yes or no to this question about the broken ruler, facilitate a discussion about what a ruler is and how it is used. Draw students’ attention to the units and ask questions such as, "How long is it from the 2 inch mark to the 5 inch mark?" If possible, provide "broken" paper rulers for students to use to measure small items in the classroom or, if teaching remotely, around the home. The important take-away here is not that students answer this question correctly, but that they understand that measuring with a ruler involves the distance between the units that are marked rather than the numbers themselves.

4. Use this broken ruler and the sketch tools to sketch a line that is 5 \frac{1}{4} inches long.

Teacher Tips:
Here, students have an opportunity to construct a line that is 5 1/4 inches long. A common error students may make might be to draw a line from the 2 on the ruler to the 5 1/4 mark on the ruler. This error, shows a misunderstanding about how units work on a ruler. Other students may draw the line to the incorrect fraction of an inch on the ruler. It might be helpful to support students with the fractional parts by having a discussion as a group. Students can use the sketch tools to mark some of the hash marks on the ruler to help with measuring their line.

- **Synchronous**: Using the teacher dashboard, restrict the activity to screens 1-5. Complete Desmos activity during synchronous learning, either face to face, virtual, or blended using the teacher tips presented above.
- **Asynchronous**: Using the teacher dashboard, restrict the activity to screens 1-5. Give students time to complete the screens and provide feedback. Ensure that enough time is provided for students to participate and respond to your feedback and edit responses as needed.
- **Unplugged/ Offline**: Provide paper/electronic versions of the rulers presented on screens two through four. Allow students time to complete the work and submit through email/text or other.
means. Provided feedback and share with other students and provide access to other students' thinking.

Apply

6 Hand Span

Teacher Tips:

An interesting way to introduce the idea of measuring hand spans might be to show some hand span data from another country. Our friends to the north, in Canada, have a Census at School where a lot of data is collected that can be used for real data discussions. I've found that introducing this type of data collection with some Canadian data instantly engages students in wanting to see how their hand-span measurements compare. While Canada measures with metric units and this activity uses inches, converting the Canadian data to inches prior to introducing this lesson makes the lesson go much smoother and allows students to make comparisons and connections between the two data sets without confusion between the two measurement systems.

Students will need a ruler marked with quarters of an inch. It would be best, if possible, to find a ruler with only these markings. A printable ruler with quarter inch marks can be found here. Before students begin to measure their hand spans, discuss with them that they are collecting data, and that the data they collect should be clean and accurate, so develop a set of parameters for student use to make sure everyone measures the same way. For example, students may want to measure in pairs, so that everyone measures the same way. Another idea is to make sure that students spread their fingers as far apart as they can when they measure. You may want to measure the dominant hand or everyone measures their right hand. These should be decided by the class but should be posted somewhere so students can refer back to it as needed.

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Teacher Tips:

Here, students are plotting their handspan length on the dot plot. This involves dragging the dot to the correct measurement and seems trivial, it does provide an opportunity to see how to plot the data on a dot plot. On the next screen, students will see all of the data from every student in the class plotted on one dot plot.
This dot plot shows the data for the hand spans of you and your classmates.

What do you notice?

**Teacher Tips:**

Screens 8-13 offer an opportunity for students to answer questions about the data represented in the dot plot. These questions have been generalized for most data sets. Screen 8 does offer a unique opportunity for teachers to use what students notice to guide discussions. The openness of the “What do you notice?” question provides a low risk opportunity for students to really look at the data and how it’s represented in the dot plot and share what they truly notice without being saddled with finding the “correct answer.” This opens the door to a potentially rich mathematical discussion.

Highlight student responses regarding what they notice about the data using the teacher dashboard. Use these notices when appropriate while discussing screens 9-13.

Which hand span, in inches, has more data points than the rest?

**Teacher Tips:**

Screens 8-13 offer an opportunity for students to answer questions about the data represented in the dot plot. These questions have been generalized for most data sets. Screen 8 does offer a unique opportunity for teachers to use what students notice to guide discussions. The openness of the “What do you notice?” question provides a low risk opportunity for students to really look at the data and how it’s represented in the dot plot and share what they truly notice without being saddled with finding the “correct answer.” This opens the door to a potentially rich mathematical discussion.

Highlight student responses regarding what they notice about the data using the teacher dashboard. Use these notices when appropriate while discussing screens 9-13.
How many students have submitted their hand spans to create this graph?

Teacher Tips:

Screens 8-13 offer an opportunity for students to answer questions about the data represented in the dot plot. These questions have been generalized for most data sets. Screen 8 does offer a unique opportunity for teachers to use what students notice to guide discussions. The openness of the “What do you notice?” question provides a low risk opportunity for students to really look at the data and how it’s represented in the dot plot and share what they truly notice without being saddled with finding the “correct answer.” This opens the door to a potentially rich mathematical discussion.

Highlight student responses regarding what they notice about the data using the teacher dashboard. Use these notices when appropriate while discussing screens 9-13.

Compare your hand span to the hand span with the most data points.

What do you notice?

Teacher Tips:

Screens 8-13 offer an opportunity for students to answer questions about the data represented in the dot plot. These questions have been generalized for most data sets. Screen 8 does offer a unique opportunity for teachers to use what students notice to guide discussions. The openness of the “What do you notice?” question provides a low risk opportunity for students to really look at the data and how it’s represented in the dot plot and share what they truly notice without being saddled with finding the “correct answer.” This opens the door to a potentially rich mathematical discussion.

Highlight student responses regarding what they notice about the data using the teacher dashboard. Use these notices when appropriate while discussing screens 9-13.

What is a hand span length that you wouldn’t expect to see for a 3rd grade class?

Teacher Tips:

Screens 8-13 offer an opportunity for students to answer questions about the data represented in the dot plot. These questions have been generalized for most data sets. Screen 8 does offer a unique opportunity for teachers to use what students notice to guide discussions. The openness of the “What do you notice?” question provides a low risk opportunity for students to really look at the data and how it’s represented in the dot plot and share what they truly notice without being saddled with finding the “correct answer.” This opens the door to a potentially rich mathematical discussion.

Highlight student responses regarding what they notice about the data using the teacher dashboard. Use these notices when appropriate while discussing screens 9-13.
● **Synchronous** Using the teacher dashboard, unrestrict screens 6 through 13. Complete Desmos activity during synchronous learning, either face to face, virtual, or blended using the teacher tips presented above.

● **Asynchronous** Using the teacher dashboard, unrestrict screens 6 through 13. Give students time to complete the screens and provide feedback. Ensure that enough time is provided for students to participate and respond to your feedback and edit responses as needed.

● **Unplugged/ Offline** Provide students with access to the content presented on screens 6-13, including the graph generated by the student data within Desmos. Students working offline can use the image of the class dot plot and add their data point to the hard copy provided. Ask students to complete the questions and have them submit responses via email/text/phone. Provide feedback, share these responses with other students, and share other students’ responses with them.

**Reflect**

Drag the point to show how you're feeling after today's lesson.

Please share more about where you placed your point below.

● **Synchronous 3-2-1.** Using the teacher dashboard, unrestrict all screens so students have access to review their work in order to complete the 3-2-1 framework. First, students drag the point on the graph to show where they are in their understanding of these ideas as well as how they feel about learning more at this time. Next, students are asked to share more about where they placed the point on the graph using a 3-2-1 framework. Students share 3 things they learned, 2 things they want to know more about, and 1 thing they still feel confused about.
● **Asynchronous Virtual 3-2-1.** Using the teacher dashboard, unrestrict all screens so students have access to review their work in order to complete the 3-2-1 framework. Provide time for students to complete the reflection and offer feedback and suggestions based on their words as well as where they placed the point. First, students drag the point on the graph to show where the are in their understanding of these ideas as well as how they feel about learning more at this time. Next, students are asked to share more about where they placed the point on the graph using a 3-2-1 framework. Students share 3 things they learned, 2 things they want to know more about, and 1 thing they still feel confused about.

● **Unplugged/ Offline** Provide students a [hard copy of the graph](#) and have them place a point, then complete the 3-2-1 framework and submit both via email or text. Provide time for students to complete the reflection and offer feedback and suggestions based on their words as well as where they placed the point. Students should share 3 things they learned, 2 things they want to know more about, and 1 thing they still feel confused about.

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### Evidence of Student Success

**Formative Assessment Questions:**

- What do you notice about the data in the dot plot?
- What do you wonder about the data in the dot plot?
- How can you determine the difference between your handspan length and the greatest (or least) handspan length?
- How far away is your hand span length from the length that had the most data points?

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### 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.

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## Engaging Families

Students can deepen their understanding of measurement and data by completing the following activities. Students may find it helpful to review the concepts alongside their parents, siblings, or friends at home.

- **In this measuring game**, students measure objects to the nearest whole, quarter, or half inch while on a stroll with a garden gnome.

- **In this measuring game**, students use an on screen ruler and click at measurement points on the ruler to answer questions about length. When using this game, first click on settings. Next to “Questions” select quarters. Next to “Ruler Markings” select quarters. Finally, next to “Ruler Length” select 12 inches.
## Justified True/False Statements

<table>
<thead>
<tr>
<th>STATEMENT</th>
<th>T</th>
<th>F</th>
<th>WHY I (or WE) THINK SO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The pencil below is 5 inches long.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><img src="image1.png" alt="Pencil Image" /></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. This ruler can be used to measure to the nearest quarter inch.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><img src="image2.png" alt="Ruler Image" /></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. The dot plot below shows that the difference between the longest baby and the shortest baby is 9 inches.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><img src="image3.png" alt="Dot Plot Image" /></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. In the dot plot above, more babies were 20 inches long than any other length.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Images from Screens 2 – 4

Here is part of a 12 inch ruler that broke.

What do you notice?

It broke again!

Can I still use this to measure?

Yes  No

Explain your choice.

Use this broken ruler and the sketch tools to sketch a line that is \(5 \frac{1}{4}\) inches long.
For screens 8-13, provide a screenshot of the class dot plot generated through the Desmos activity. Students working offline can add their data point by drawing a dot on the dot plot corresponding to their hand span.