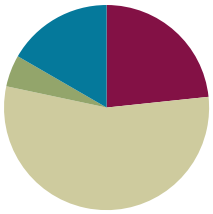
Lesson 8

Objective: Represent measurement data with line plots.

Suggested Lesson Structure



Fluency Practice	(14 minutes)
Application Problem	(3 minutes)
Concept Development	(33 minutes)
Student Debrief	(10 minutes)
Total Time	**(60 minutes)**

Fluency Practice (14 minutes)

- Group Counting **3.OA.1** (3 minutes)
- Multiply by 7 **3.OA.7** (7 minutes)
- Count by Halves and Fourths **3.MD.4** (4 minutes)

Group Counting (3 minutes)

Note: This group counting activity reviews the relationship between counting by a unit and multiplying and dividing with that unit.

T: Count by eights to 80.
S: 8, 16, 24, 32, 40, 48, 56, 64, 72, 80.
T: (Write 4 × 8 = ___.) What is the value of 4 eights? Count by eights if you are unsure.
S: 32.
T: Say the multiplication sentence.
S: 4 × 8 = 32.

Continue the process for 7 × 8 and 9 × 8.

T: (Write 24 ÷ 8 = ___.) What is 24 ÷ 8? Count by eights if you are unsure.
S: 3.

Continue the process for 40 ÷ 8, 48 ÷ 8, and 64 ÷ 8.

T: Count by nines to 90.
S: 9, 18, 27, 36, 45, 54, 63, 72, 81, 90.
T: (Write 2 × 9 = ___.) What is the value of 2 nines? Count by nines if you are unsure.
S: 18.

T: Say the multiplication sentence.

S: 2 × 9 = 18.

Continue the process for 4 × 9, 6 × 9, and 8 × 9.

T: (Write 27 ÷ 9 = ___.) What is 27 ÷ 9? Count by nines if you are unsure.

S: 3.

Continue the process for 45 ÷ 9, 63 ÷ 9, and 81 ÷ 9.

Multiply by 7 (7 minutes)

Materials: (S) Multiply by 7 (1–5) (Pattern Sheet)

Note: This activity builds fluency with multiplication facts using units of 7. It works toward students knowing from memory all products of two one-digit numbers. See Lesson 6 for the directions for administration of a Multiply-By Pattern Sheet.

T: (Write 5 × 7 = ___.) Let's skip-count up by sevens to find the answer. I'll raise a finger for each seven. (Raise a finger for each number to track the count. Record the skip-count answers on the board.)

S: 7, 14, 21, 28, 35.

T: (Circle 35 and write 5 × 7 = 35 above it. Write 3 × 7 = ___.) Let's skip-count up by sevens again. (Track with fingers as students count.)

S: 7, 14, 21.

T: Let's see how we can skip-count down to find the answer, too. Start at 35 with 5 fingers, 1 for each seven. (Count down with your fingers as students say numbers.)

S: 35 (5 fingers), 28 (4 fingers), 21 (3 fingers).

Repeat the process for 4 × 7.

T: (Distribute the Multiply by 7 Pattern Sheet.) Let's practice multiplying by 7. Be sure to work left to right across the page.

Count by Halves and Fourths (4 minutes)

Note: This fluency activity reviews Lesson 6.

T: Count by halves to 12 halves as I write. Please do not count faster than I can write. (Write as students count.)

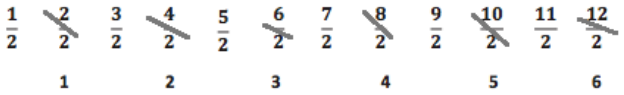
S: 1 half, 2 halves, 3 halves, 4 halves, 5 halves, 6 halves, 7 halves, 8 halves, 9 halves, 10 halves, 11 halves, 12 halves.

T: (Point to $\frac{2}{2}$.) Say 2 halves as a whole number.

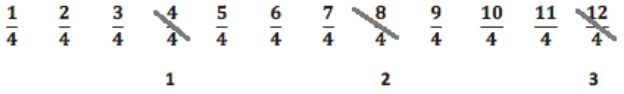
S: 1.

T: (Lightly cross out $\frac{2}{2}$, and write 1 beneath it.)

Halves:



Fourths:



Continue the process for the following sequence: $\frac{4}{2}, \frac{6}{2}, \frac{8}{2}, \frac{10}{2}$, and $\frac{12}{2}$.

T: Count by halves, saying whole numbers when you arrive at whole numbers. Try not to look at the board. (Direct students to count forward and backward on the number line, occasionally changing directions.)

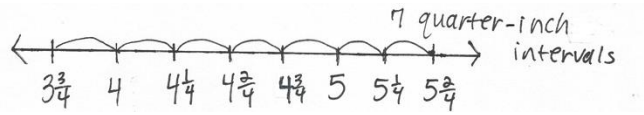
Repeat the process for fourths.

NOTES ON MULTIPLE MEANS OF REPRESENTATION:

Although the term *interval* was introduced in Module 2 and has been used earlier in this module, it may be appropriate to revisit its meaning for English language learners and others. Use drawings, gestures, and examples to explain the meaning of *interval.* Offer explanations in students' first language, if possible. Link vocabulary to synonyms they may be more familiar with, such as *space, period, distance,* and *gap* (on the number line).

Application Problem (3 minutes)

Mrs. Byrne's class is studying worms. They measure the lengths of the worms to the nearest quarter inch. The length of the shortest worm is $3\frac{3}{4}$ inches. The length of the longest worm is $5\frac{2}{4}$ inches. Kathleen says they need 8 quarter-inch intervals to plot the lengths of the worms on a line plot. Is she right? Why or why not?



No, Kathleen is not right because they will need 7 quarter-inch intervals, not 8.

Note: This problem reviews Lesson 7, specifically using a quarter-inch scale to create a line plot. Invite students to discuss what Kathleen did wrong in her calculations. (She counted the numbers, not the intervals.) This problem provides an opportunity to discuss the number of tick marks versus the number of intervals.

Concept Development (33 minutes)

Materials: (S) Heights of Sunflower Plants chart (Template) pictured to the right, personal white board, straightedge

Problem 1: Plot a large data set to the nearest half inch.

Students start with the Heights of Sunflower Plants Template in their personal white boards.

T: What data is shown in the chart?

S: The heights of sunflower plants.

Template

Mrs. Schaut measures the heights of the sunflower plants in her garden. The measurements are shown in the chart below.

Heights of Sunflower Plants (in inches)				
61	63	62	61	$62\frac{1}{2}$
$61\frac{1}{2}$	$61\frac{1}{2}$	$61\frac{1}{2}$	62	60
64	62	$60\frac{1}{2}$	$63\frac{1}{2}$	61
63	$62\frac{1}{2}$	$62\frac{1}{2}$	64	$62\frac{1}{2}$
$62\frac{1}{2}$	$63\frac{1}{2}$	63	$62\frac{1}{2}$	$63\frac{1}{2}$
62	$62\frac{1}{2}$	62	63	$60\frac{1}{2}$

T: How does the **measurement data** in this chart compare to the measurement data we plotted yesterday?

S: There is a lot more data to plot! → The numbers are bigger too!

T: Let's make a line plot to display it. With a partner, discuss the steps you should take to create a line plot of the data.

S: (Discuss.)

T: What number does the first tick mark on your line plot represent? How do you know?

S: 60 inches because it is the smallest measurement.

T: And the last tick mark? How do you know?

S: 64 inches because it is the biggest measurement.

T: What interval should you use to draw the tick marks between 60 and 64? How do you know?

S: Half inches because that is what a lot of the measurements are. → I should use half inches because it is a common unit in the chart. → Half inches because it is the smallest unit in the chart.

T: Go ahead and create your line plot. (Circulate to check student work.)

NOTES ON MULTIPLE MEANS OF REPRESENTATION:

Give explicit prompts to students working below grade level for each step in the process of making a line plot for the Heights of Sunflower Plants data. Make a poster, or speak the following:

- Find and record the smallest and largest measurements as endpoints.
- Choose the scale. Ask, "What interval should I use—whole numbers, halves, or quarters?"
- Count by half inches from the smallest measurement to the largest measurement to find the number of tick marks to draw. Draw.
- Plot the data on the line plot. Check off each point along the way.
- Title the line plot (e.g., Heights of Sunflower Plants), and specify the units (e.g., inches).

Problem 2: Observe and interpret data on a line plot.

T: Tell me a true statement about the heights of the sunflower plants in Mrs. Schaut's garden.

S: The most common height is $62\frac{1}{2}$ inches. → There is only 1 plant that is 60 inches tall. → 61, $61\frac{1}{2}$, and $63\frac{1}{2}$ inches all have the same number of plants. → There are more plants that are $62\frac{1}{2}$ inches tall than 60, $60\frac{1}{2}$, and 61 inches combined.

T: Are these statements true of the data in the chart?

S: Yes because it is the same data. We just displayed it differently.

T: How does having the data displayed as a line plot help you to think and talk about the data?

S: I can easily see the number of plants for each measurement. → I can quickly see the most common and least common measurements.

T: What are the three most frequent measurements in order from shortest to tallest?

S: 62, $62\frac{1}{2}$, and 63 inches.

T: What is the total number of plants that measure 62, $62\frac{1}{2}$, and 63 inches?

S: 16 plants!

T: How many plants were measured in all?

S: 30 plants.

T: Write a number sentence to show how many plants do not measure 62, $62\frac{1}{2}$, or 63 inches.

S: (Write 30 – 16 = 14.)

T: (Write or say, "Most of the sunflower plants measure between 62 and 63 inches.") True?

S: Yes! → Yes because 16 plants measure between 62 and 63 inches, and 14 plants do not. Sixteen is more than 14.

T: What do you notice about the location of the three most frequent measurements on the line plot?

S: They are right next to each other. → The most frequent measurement is in between the second and third most frequent measurements.

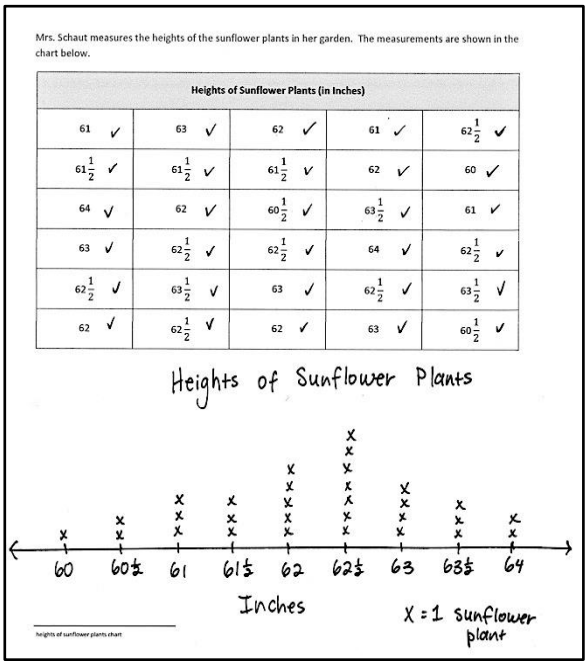
T: What do you notice about the data before the three most frequent measurements?

S: It goes 1, 2, 3, 3. → Hey, the number of plants goes up and then stays the same. → The number of plants increases or stays the same as it gets close to the most frequent measurement.

T: How about the data after the three most frequent measurements?

S: It goes 3, 2. → It starts to go back down! → After the most frequent measurement, the number of sunflower plants decreases for each measurement.

MP.7


Mrs. Schaut measures the heights of the sunflower plants in her garden. The measurements are shown in the chart below.

Heights of Sunflower Plants (in Inches)				
61 ✓	63 ✓	62 ✓	61 ✓	$62\frac{1}{2}$ ✓
$61\frac{1}{2}$ ✓	$61\frac{1}{2}$ ✓	$61\frac{1}{2}$ ✓	62 ✓	60 ✓
64 ✓	62 ✓	$60\frac{1}{2}$ ✓	$63\frac{1}{2}$ ✓	61 ✓
63 ✓	$62\frac{1}{2}$ ✓	$62\frac{1}{2}$ ✓	64 ✓	$62\frac{1}{2}$ ✓
$62\frac{1}{2}$ ✓	$63\frac{1}{2}$ ✓	63 ✓	$62\frac{1}{2}$ ✓	$63\frac{1}{2}$ ✓
62 ✓	$62\frac{1}{2}$ ✓	62 ✓	63 ✓	$60\frac{1}{2}$ ✓

T: (Cover up the bottom three rows of data in the chart.) Erase the Xs on your line plot and create a new line plot with this data. (Allow students time to work.) Did the three most frequent measurements change when you plotted less data?

S: Yes, now the three most frequent measurements are 61, $61\frac{1}{2}$, and 62 inches.

T: That means that most of the sunflowers in Mrs. Schaut's garden are between 61 and 62 inches tall.

S: No, that is not right! → No, we saw earlier that most of the sunflowers are between 62 and 63 inches tall.

T: How did using less data change how we can talk about the heights of most of the sunflowers? Discuss with your partner.

S: When we used less data, it changed the most frequent measurements. → Yeah, with more data we said most sunflowers were between 62 and 63 inches tall. But with less data, that changed to between 61 and 62 inches.

T: How did the shape of the line plot change when we used less data? Talk to a partner.

S: The height of the line plot changed because with more data, the most X's for a measurement was 7, but with less data, the most X's is 3. → The three most frequent measurements shifted to the left on the number line. → It does not really follow the same pattern as increasing before the three most frequent measurements and decreasing after the three most frequent measurements. → Except for the three most frequent measurements, all other measurements only have one X.

MP.7

Problem Set (10 minutes)

Students should do their personal best to complete the Problem Set within the allotted 10 minutes. For some classes, it may be appropriate to modify the assignment by specifying which problems they work on first. Some problems do not specify a method for solving. Students solve these problems using the RDW approach used for Application Problems.

Student Debrief (10 minutes)

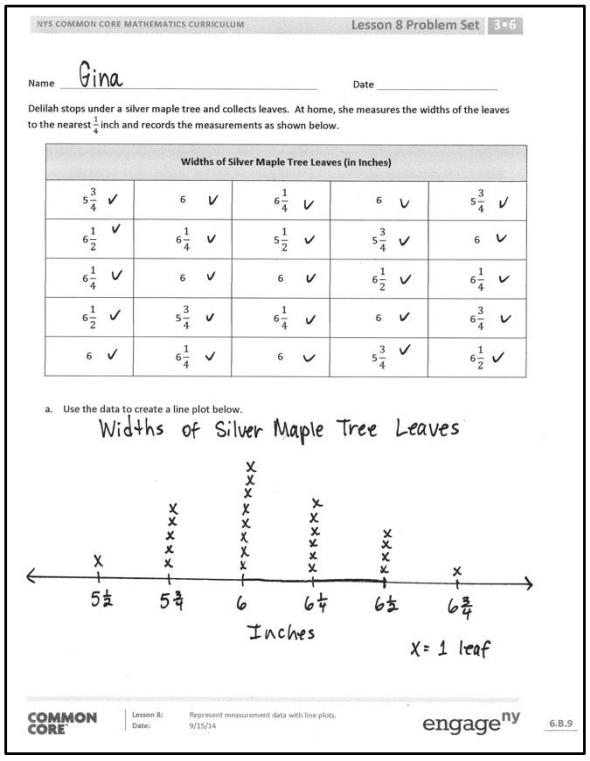
Lesson Objective: Represent measurement data with line plots.

The Student Debrief is intended to invite reflection and active processing of the total lesson experience.

Invite students to review their solutions for the Problem Set. They should check work by comparing answers with a partner before going over answers as a class. Look for misconceptions or misunderstandings that can be addressed in the Debrief. Guide students in a conversation to debrief the Problem Set and process the lesson.

Any combination of the questions below may be used to lead the discussion.

- Look at Problem (b). With a partner, compare the steps you took to create the line plot.
- (Invite students to share thinking for Problem (d).) What can you say about most of the leaves from Delilah's tree?



NYS COMMON CORE MATHEMATICS CURRICULUM Lesson 8 Problem Set 3•6

Name Gina Date

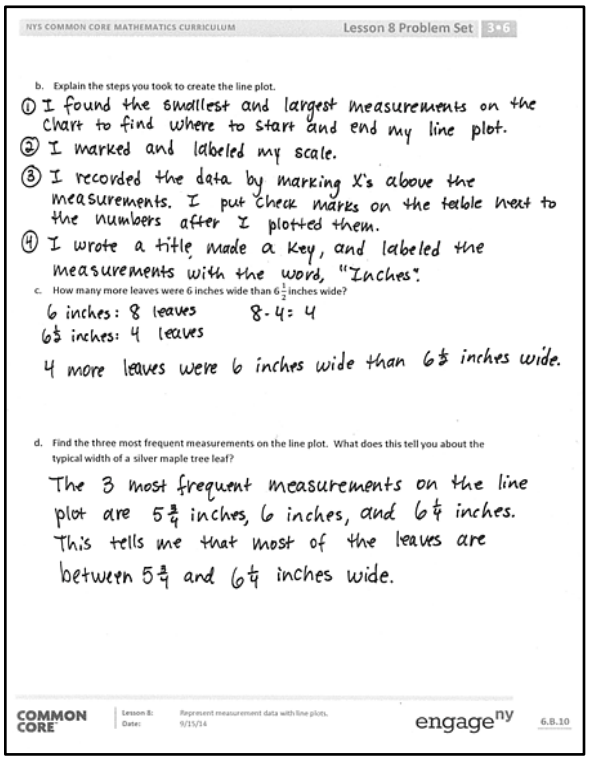
Delilah stops under a silver maple tree and collects leaves. At home, she measures the widths of the leaves to the nearest $\frac{1}{4}$ inch and records the measurements as shown below.

Widths of Silver Maple Tree Leaves (in inches)				
$5\frac{3}{4}$ ✓	6 ✓	$6\frac{1}{4}$ ✓	6 ✓	$5\frac{3}{4}$ ✓
$6\frac{1}{2}$ ✓	$6\frac{1}{4}$ ✓	$5\frac{1}{2}$ ✓	$5\frac{3}{4}$ ✓	6 ✓
$6\frac{1}{4}$ ✓	6 ✓	6 ✓	$6\frac{1}{2}$ ✓	$6\frac{1}{4}$ ✓
$6\frac{1}{2}$ ✓	$5\frac{3}{4}$ ✓	$6\frac{1}{4}$ ✓	6 ✓	$6\frac{3}{4}$ ✓
6 ✓	$6\frac{1}{4}$ ✓	6 ✓	$5\frac{3}{4}$ ✓	$6\frac{1}{2}$ ✓

a. Use the data to create a line plot below.

Widths of Silver Maple Tree Leaves

COMMON CORE Lesson 8: Represent measurement data with line plots. Date: 9/15/14 engage^ny 6.B.9



NYS COMMON CORE MATHEMATICS CURRICULUM Lesson 8 Problem Set 3•6

b. Explain the steps you took to create the line plot.

① I found the smallest and largest measurements on the chart to find where to start and end my line plot.
② I marked and labeled my scale.
③ I recorded the data by marking X's above the measurements. I put check marks on the table next to the numbers after I plotted them.
④ I wrote a title, made a key, and labeled the measurements with the word, "Inches".

c. How many more leaves were 6 inches wide than $6\frac{1}{2}$ inches wide?

6 inches: 8 leaves 8 - 4 = 4
$6\frac{1}{2}$ inches: 4 leaves

4 more leaves were 6 inches wide than $6\frac{1}{2}$ inches wide.

d. Find the three most frequent measurements on the line plot. What does this tell you about the typical width of a silver maple tree leaf?

The 3 most frequent measurements on the line plot are $5\frac{3}{4}$ inches, 6 inches, and $6\frac{1}{4}$ inches. This tells me that most of the leaves are between $5\frac{3}{4}$ and $6\frac{1}{4}$ inches wide.

COMMON CORE Lesson 8: Represent measurement data with line plots. Date: 9/15/14 engage^ny 6.B.10

- If the only **measurement data** we had was the top two rows of the chart, how might that change your understanding of the width of most of Delilah's leaves?
- Why does having a large amount of data help us have a clearer understanding of what the data means?
- Compare the shape of this data to that of the bean plants from yesterday. Why might the bean plants have grown so irregularly whereas the sunflower plants did not? Might their environments have been different?
- Looking at the size of most of the leaves from Delilah's tree, do you know any trees in your neighborhood that might be the same kind? Do you know any that are certainly not the same kind? (Students might talk about trees they see in the park or in their neighborhood, such as "the tree in the schoolyard," etc.)

Exit Ticket (3 minutes)

After the Student Debrief, instruct students to complete the Exit Ticket. A review of their work will help with assessing students' understanding of the concepts that were presented in today's lesson and planning more effectively for future lessons. The questions may be read aloud to the students.

Multiply.

7 x 1 = _____	7 x 2 = _____	7 x 3 = _____	7 x 4 = _____
7 x 5 = _____	7 x 1 = _____	7 x 2 = _____	7 x 1 = _____
7 x 3 = _____	7 x 1 = _____	7 x 4 = _____	7 x 1 = _____
7 x 5 = _____	7 x 1 = _____	7 x 2 = _____	7 x 3 = _____
7 x 2 = _____	7 x 4 = _____	7 x 2 = _____	7 x 5 = _____
7 x 2 = _____	7 x 1 = _____	7 x 2 = _____	7 x 3 = _____
7 x 1 = _____	7 x 3 = _____	7 x 2 = _____	7 x 3 = _____
7 x 4 = _____	7 x 3 = _____	7 x 5 = _____	7 x 3 = _____
7 x 4 = _____	7 x 1 = _____	7 x 4 = _____	7 x 2 = _____
7 x 4 = _____	7 x 3 = _____	7 x 4 = _____	7 x 5 = _____
7 x 4 = _____	7 x 5 = _____	7 x 1 = _____	7 x 5 = _____
7 x 2 = _____	7 x 5 = _____	7 x 3 = _____	7 x 5 = _____
7 x 4 = _____	7 x 2 = _____	7 x 4 = _____	7 x 3 = _____
7 x 5 = _____	7 x 3 = _____	7 x 2 = _____	7 x 4 = _____
7 x 3 = _____	7 x 5 = _____	7 x 2 = _____	7 x 4 = _____

multiply by 7 (1–5)

Name _____ Date _____

Delilah stops under a silver maple tree and collects leaves. At home, she measures the widths of the leaves to the nearest $\frac{1}{4}$ inch and records the measurements as shown below.

Widths of Silver Maple Tree Leaves (in Inches)				
$5\frac{3}{4}$	6	$6\frac{1}{4}$	6	$5\frac{3}{4}$
$6\frac{1}{2}$	$6\frac{1}{4}$	$5\frac{1}{2}$	$5\frac{3}{4}$	6
$6\frac{1}{4}$	6	6	$6\frac{1}{2}$	$6\frac{1}{4}$
$6\frac{1}{2}$	$5\frac{3}{4}$	$6\frac{1}{4}$	6	$6\frac{3}{4}$
6	$6\frac{1}{4}$	6	$5\frac{3}{4}$	$6\frac{1}{2}$

a. Use the data to create a line plot below.

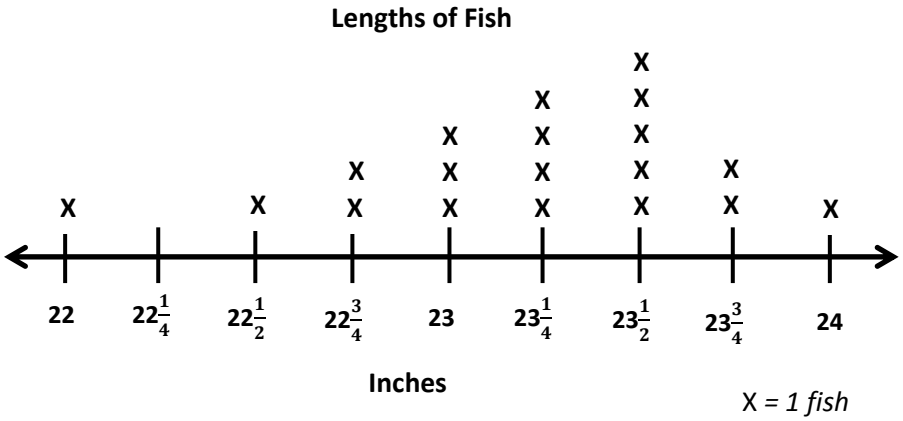
b. Explain the steps you took to create the line plot.

c. How many more leaves were 6 inches wide than $6\frac{1}{2}$ inches wide?

d. Find the three most frequent measurements on the line plot. What does this tell you about the typical width of a silver maple tree leaf?

Name _____ Date _____

The line plot below shows the lengths of fish the fishing boat caught.



a. Find the three most frequent measurements on the line plot.

b. Find the difference between the lengths of the longest and shortest fish.

c. How many more fish were $23\frac{1}{4}$ inches long than 24 inches long?

Name _____ Date _____

Mrs. Leah's class uses what they learned about simple machines to build marshmallow launchers. They record the distances their marshmallows travel in the chart below.

Distance Traveled (in Inches)				
$48\frac{3}{4}$	49	$49\frac{1}{4}$	50	$49\frac{3}{4}$
$49\frac{1}{2}$	$48\frac{1}{4}$	$49\frac{1}{2}$	$48\frac{3}{4}$	49
$49\frac{1}{4}$	$49\frac{3}{4}$	48	$49\frac{1}{4}$	$48\frac{1}{4}$
49	$48\frac{3}{4}$	49	49	$48\frac{3}{4}$

a. Use the data to create a line plot below.

b. Explain the steps you took to create the line plot.

c. How many more marshmallows traveled $48\frac{3}{4}$ inches than $48\frac{1}{4}$ inches?

d. Find the three most frequent measurements on the line plot. What does this tell you about the distance that most of the marshmallows traveled?

Mrs. Schaut measures the heights of the sunflower plants in her garden. The measurements are shown in the chart below.

Heights of Sunflower Plants (in Inches)				
61	63	62	61	$62\frac{1}{2}$
$61\frac{1}{2}$	$61\frac{1}{2}$	$61\frac{1}{2}$	62	60
64	62	$60\frac{1}{2}$	$63\frac{1}{2}$	61
63	$62\frac{1}{2}$	$62\frac{1}{2}$	64	$62\frac{1}{2}$
$62\frac{1}{2}$	$63\frac{1}{2}$	63	$62\frac{1}{2}$	$63\frac{1}{2}$
62	$62\frac{1}{2}$	62	63	$60\frac{1}{2}$

heights of sunflower plants chart