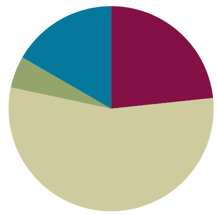
Lesson 8

Objective: Represent measurement data with line plots.

Related Topics: More Lesson Plans for the Common Core Math

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.
S: 8, 16, 24, 32, 40, 48, 56, 64, 72, 80.
T: (Write 4 × 8 = ___.) What's the value of 4 eights? Count by eights if you're 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's 24 ÷ 8? Count by eights if you're unsure.
S: 3.

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

T: Count by nines.
S: 9, 18, 27, 36, 45, 54, 63, 72, 81, 90.
T: (Write 2 × 9 = ___.) What's the value of 2 nines? Count by nines if you're unsure.
S: 18.

T: Say the multiplication sentence.

S: 9 × 2 = 18.

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

T: (Write 27 ÷ 9 = ___.) What's 27 ÷ 9? Count by nines if you're unsure.

S: 3.

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

Multiply by 7 (7 minutes)

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

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 G3–M6–lesson 6 for the directions for administration of a *Multiply By* pattern sheet.

T: (Write 5 × 7 = ___.) Let's skip-count by sevens to find the answer. I'll raise a finger for each seven. (Count with fingers to 5 as students count.)

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. (Count with fingers to 3 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)

Notes: This fluency reviews G3–M6–Lesson 6.

T: Count by halves as I write. Please don't 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.

$\frac{1}{2}$	$\cancel{\frac{2}{2}}$	$\frac{3}{2}$	$\cancel{\frac{4}{2}}$	$\frac{5}{2}$	$\cancel{\frac{6}{2}}$	$\frac{7}{2}$	$\cancel{\frac{8}{2}}$	$\frac{9}{2}$	$\cancel{\frac{10}{2}}$	$\frac{11}{2}$	$\cancel{\frac{12}{2}}$
	1		2		3		4		5		6

$\frac{1}{4}$	$\frac{2}{4}$	$\frac{3}{4}$	$\cancel{\frac{4}{4}}$	$\frac{5}{4}$	$\frac{6}{4}$	$\frac{7}{4}$	$\cancel{\frac{8}{4}}$	$\frac{9}{4}$	$\frac{10}{4}$	$\frac{11}{4}$	$\cancel{\frac{12}{4}}$
			1				2				3

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

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

T: Let's 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.)

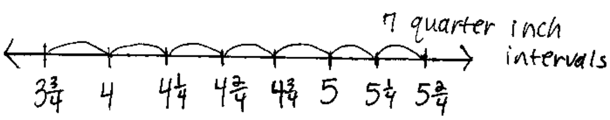
Repeat the process for fourths.

NOTES ON MULTIPLE MEANS OF REPRESENTATION:

Clarify the term *interval* 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 will need 8 quarter inch intervals to plot the lengths of the worms on a line plot. Is she right? Why or why not?

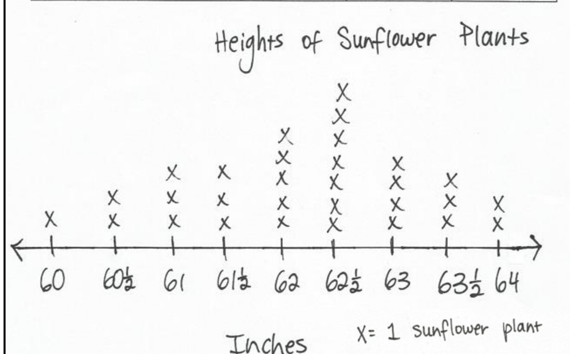


No, Kathleen is not right because they will need 7 quarter inch intervals, not 8.

Note: This problem reviews G3–M6–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.

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 ✓	$62\frac{1}{2}$ ✓	62 ✓	$62\frac{1}{2}$ ✓
$62\frac{1}{2}$ ✓	$63\frac{1}{2}$ ✓	$61\frac{1}{2}$ ✓	62 ✓	60 ✓
64 ✓	62 ✓	$60\frac{1}{2}$ ✓	$63\frac{1}{2}$ ✓	61 ✓
63 ✓	$62\frac{1}{2}$ ✓	62 ✓	64 ✓	$62\frac{1}{2}$ ✓
$62\frac{1}{2}$ ✓	$61\frac{1}{2}$ ✓	63 ✓	$62\frac{1}{2}$ ✓	$63\frac{1}{2}$ ✓
61 ✓	$61\frac{1}{2}$ ✓	62 ✓	63 ✓	$60\frac{1}{2}$ ✓



Concept Development (33 minutes)

Materials: (S) Heights of Sunflower Plants chart, personal white board, straightedge

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

Students start with the Heights of Sunflower Plants chart in their boards.

T: What data is shown in the chart?

S: The heights of sunflower plants.

T: How does the data in this chart compare to the 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. Discuss the steps you'll take to create the line plot with a partner.

S: (Discuss.)

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

S: 60 inches, because it's the smallest measurement.

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

S: 64 inches, because it's the biggest measurement.

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

S: Half inches because that's what a lot of the measurements are. → I'll use half inches because it's a common unit in the chart. → Half inches because it's 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 Height of Sunflower Plants data. Make a poster or speak the following:

- Find and record the smallest and largest measures as endpoints.
- Choose the scale. Ask, "What interval will I use: whole numbers, halves, or quarters?"
- Count in intervals (e.g., fourths) between the endpoints 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 and 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's 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 it?

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: Most of the sunflower plants measure between 62 and 63 inches.) Is this statement true?

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

MP.7

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

S: They're 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.

T: (Cover up the bottom three rows of data in the chart.) Erase the X's 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's 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 height of most of the sunflowers? Discuss with your partner.

S: When we used less data it changed the most frequent measurements. → When the most frequent measurement changed, that changed what we said about the height of most of the sunflowers. → 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 doesn't 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.

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)

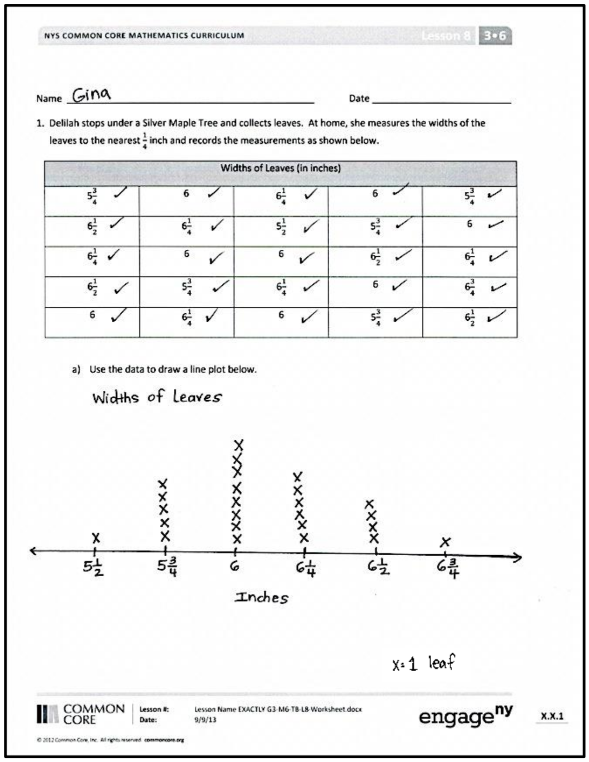
Lesson Objective: Represent measurement data with line plots.

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.

You may choose to use any combination of the questions below to lead the discussion.

- Review the process of creating the line plot in Problem 1(a).
- Invite students to share their thinking for Problem 1(d).
- What can we say about most of the leaves from Delilah's tree?
- If the only measurement data we had was the top two rows of the chart in Problem 1, 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 sunflowers and that of the bean plants from yesterday. Why would the bean plants grow so irregularly where the sunflower plants did not? Do you think some of the bean plants were exposed to different amounts of light?
- 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 at my uncle's house" or "the tree in the school yard," etc.)


NYS COMMON CORE MATHEMATICS CURRICULUM Lesson 8 3•6

Name Gina Date

1. 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 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 draw a line plot below.

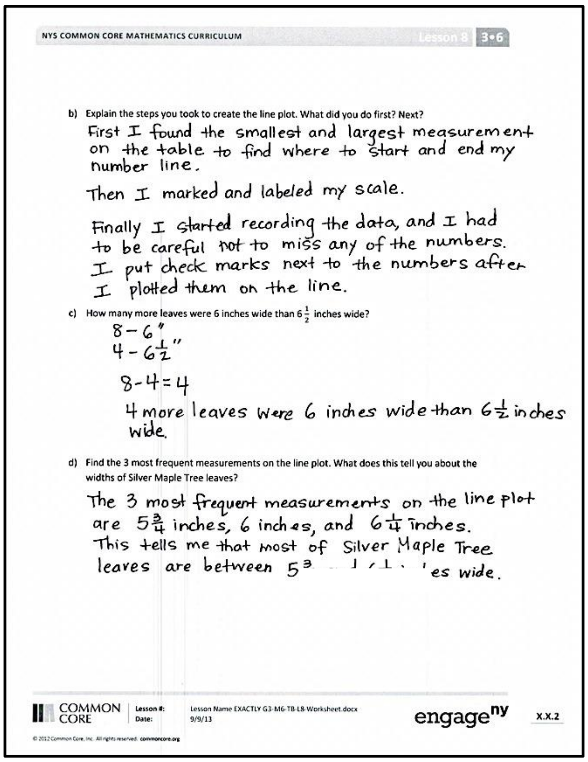
Widths of Leaves

$5\frac{1}{2}$ $5\frac{3}{4}$ 6 $6\frac{1}{4}$ $6\frac{1}{2}$ $6\frac{3}{4}$

Inches

x = 1 leaf

COMMON CORE Lesson #: Date: Lesson Name EXACTLY G3-M6-TB-L8-Worksheet.docx 9/9/13 engage ny X.X.1


NYS COMMON CORE MATHEMATICS CURRICULUM Lesson 8 3•6

b) Explain the steps you took to create the line plot. What did you do first? Next?

First I found the smallest and largest measurement on the table to find where to start and end my number line.

Then I marked and labeled my scale.

Finally I started recording the data, and I had to be careful not to miss any of the numbers. I put check marks next to the numbers after I plotted them on the line.

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

8 – 6"

4 – $6\frac{1}{2}$"

8 – 4 = 4

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

d) Find the 3 most frequent measurements on the line plot. What does this tell you about the widths of Silver Maple Tree leaves?

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 Silver Maple Tree leaves are between $5\frac{3}{4}$ [illegible]es wide.

COMMON CORE Lesson #: Date: Lesson Name EXACTLY G3-M6-TB-L8-Worksheet.docx 9/9/13 engage ny X.X.2

Exit Ticket (3 minutes)

After the Student Debrief, instruct students to complete the Exit Ticket. A review of their work will help you assess the students' understanding of the concepts that were presented in the lesson today and plan more effectively for future lessons. You may read the questions 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 = _______

Name ____ Date ______________________

1. 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 draw a line plot below.

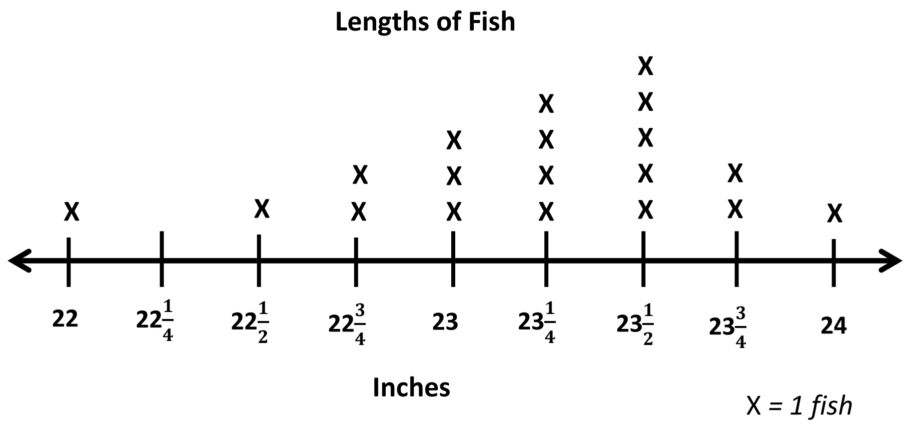
b. Explain the steps you took to create the line plot.

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 the fish children caught in the fishing derby.



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 ______________________

1. Mrs. Leah's class uses what they have 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 draw 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	$60\frac{1}{2}$