

Sample Lesson Plan for Standard 5.MD.B.2: Creating Line Plots

An Introduction to Line Plots Using Whole Numbers

Grade Level Expectations

For this standard, fifth grade students are expected to create line plots and use them to graph a set of data points in fractions of $\frac{1}{2}$, $\frac{1}{4}$ and $\frac{1}{8}$ of a whole. Students then use the line plots to add, subtract, multiply and divide the fractions.

Table of Contents

This sample Lesson Plan provides an introduction to line plots using whole numbers and has been divided into six sections.

Section 1: Understanding line plots.

Section 2: Create a line plot using whole numbers.

Section 3: Create an expression and complete any calculations.

Section 4: Use the line plot for further discussion.

Section 5: An explanation of the “Continue to Practice” section.

Section 6: Student worksheets.

Section 1: Understanding line plots.

Definition

A line plot is a graph on a horizontal number line (or x-axis) that records a set of data or information taken from a science experiment, survey or group of measurements. The number line starts at the lowest whole number and ends at the highest whole number to be graphed. The line is divided into equal intervals. Each data point is marked or recorded above its appropriate place on the number line.

Line Plots in the Earlier Grades

In the second grade, students measure the length of a group of objects using whole numbers to create a set of data. They then record this data on a line plot. (Second Grade Standard 2.MD.D.9). In the third grade, students will continue to measure objects and use the data to create line plots to $\frac{1}{2}$ and $\frac{1}{4}$ intervals. (Third Grade Standard 3.MD.B.4). In the fourth grade, students will use line plots to record a given set of data in $\frac{1}{2}$, $\frac{1}{4}$ and $\frac{1}{8}$ intervals. Fourth grade line plots are then used to solve problems involving the addition and subtraction of the fractions recorded. (Fourth Grade Standard 4.MD.B.4).

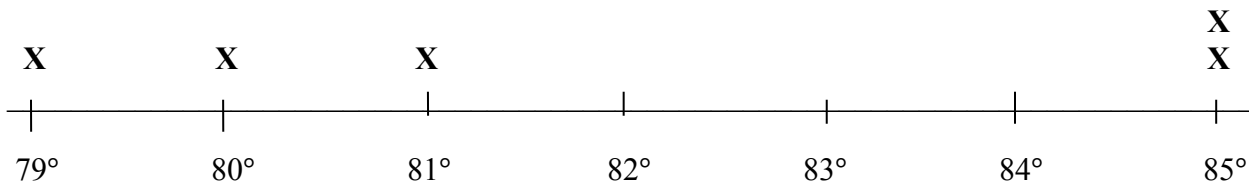
Line Plot Names

A line plot is named based on the data that it graphs. In the example below, students recorded the temperature outside at noon for five days in August and created the following set of data:

79°, 85°, 81°, 85° and 80°

This data was then recorded on a line plot named “Temperature Recorded at Noon in August.”

Example of a Line Plot



Temperature Recorded at Noon in August

Section 2: Create a line plot using whole numbers.

Example: Mrs. Howard asked 11 students how many children were in each of their families. Students gave the following answers to her survey:

1,4,1,2,5,2,2,4,7,3 and 2 children

Use the set of data to create a line plot and determine the average number of children per family.

Create a Line Plot

Step 1: Draw a straight horizontal line. Number the line in equal intervals starting at 1 (the least number of children per family) and ending at 7 (the most number of children per family). Explain that each equal interval on the line represents one whole.

Step 2: Record each data point by marking an X (or a dot) above its appropriate place on the line.

Step 3: Do not put the set of data in numerical order before marking the line plot. Once all of the points have been plotted, they will be in numerical order.

Step 4: Check off each point in the set of data as it is recorded.

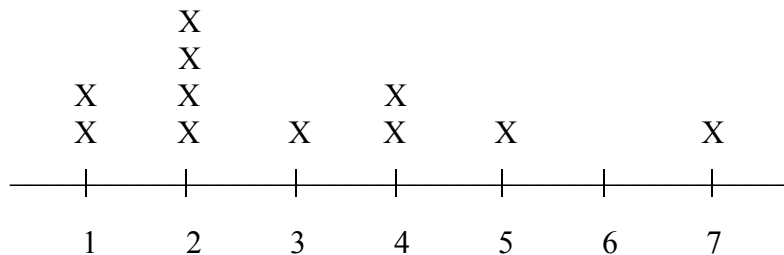
Check off Each Point as it is Recorded

1√, 4√, 1√, 2√

Step 5: Count to make sure that there are the same number of X's on the line plot as in the set of data (11).

Step 6: Name the line plot as the "Number of Children per Family."

Example of a Line Plot



Number of Children per Family

Section 3: Create an expression and complete any calculations.

Find the Total Number of Children

Explain that to find the average number of children, it is necessary to find the total number of children and then divide by 11 or the number of families surveyed.

Step 1: Use the line plot to create an expression to find the total number of children.

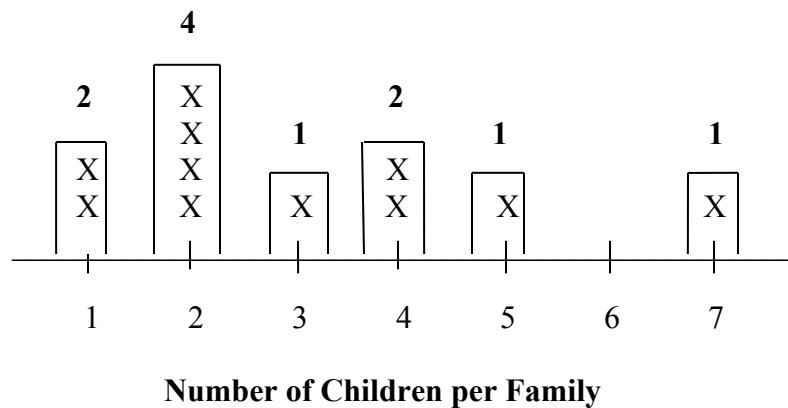
$$(2 \times 1) + (4 \times 2) + (1 \times 3) + (2 \times 4) + (1 \times 5) + (1 \times 7)$$

This expression states that two families had 1 child, four families had 2 children, one family had 3 children, two families had 4 children, one family had 5 children and one family had 7 children.

Change to the Appearance of a Bar Graph to Provide Better Understanding

If students are having difficulty understanding how the above expression was created, draw rectangles around the data points to create the appearance of a bar graph. Write the quantity of each interval (or number of X's) above each bar on the graph.

Rectangles Drawn Around the Data Points



Step 2: Solve the expression as:

$$2 + 8 + 3 + 8 + 5 + 7 = 33 \text{ children}$$

Find the Average

Divide the total number of children (33) by the number of families surveyed (11) to obtain an average of 3 children per family.

In the sixth grade, students will learn that another name for this average is the **mean**. (Sixth Grade Standard 6.SP.B.5.c).

A Note about Grouping Symbols

In the third grade, students learn to solve expressions using the order of the four operations (multiplication, division, addition and subtraction) without the use of parentheses. (Footnote to the Third Grade Standard 3.OA.D.8). However, parentheses have been used in this section to emphasize to students the grouping of the numbers.

Without parentheses, the expression would be written as follows and would result in the same solution:

$$2 \times 1 + 4 \times 2 + 1 \times 3 + 2 \times 4 + 1 \times 5 + 1 \times 7$$

Solve this expression as:

$$2 + 8 + 3 + 8 + 5 + 7 = 33 \text{ children}$$

Discuss the Use of Parentheses

Have a discussion with students about the use of the parentheses. Ask: “When I create an expression to find the total number of children, is it necessary to use the parentheses?”

Students can answer. “The answer will be the same either with or without the parentheses. When multiplication and addition both appear in the same expression, the solution is found by performing any multiplication first. Because the parentheses do not change this order of the operations, the answer will be the same.”

Section 4: Use the line plot for further discussion.

Ask students informal questions about the data on the line plot.

(1) How many families have less than three children?

Students will answer that 6 families have less than three children.

(2) How many families have more than four children?

Students will answer that 2 families have more than four children.

(3) How many more children does the largest family have than the smallest family?

Students will answer that the difference between the number of children in the largest and smallest family is $7 - 1 = 6$.

In the sixth grade, students will learn that this difference between the largest and the smallest number in a set of data is called the **range**.

Explore the Relationship Between Addition and Subtraction

Students can also find the difference between the largest family and the smallest family, or the range of “R”, by creating an unknown addition equation and counting up.

$$1 + R = 7$$

$$1 + 6 = 7$$

$$R = 6 \text{ children}$$

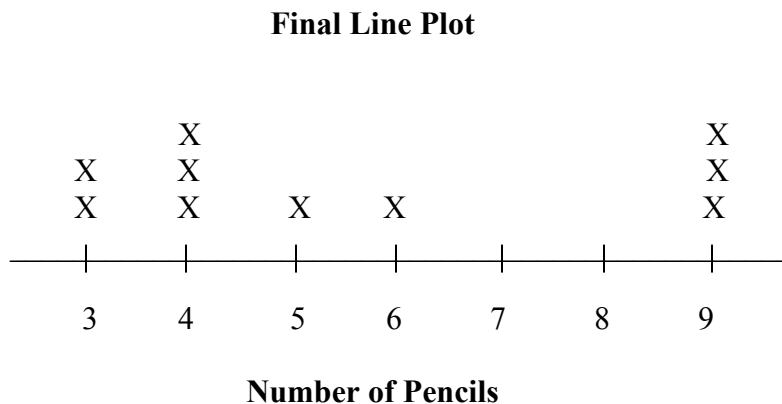
Section 5: An explanation of the “Continue to Practice” section.

Instructors can create additional practice problems by filling in the blank templates in the “Continued to Practice” section found at the end of each Lesson Plan. For example, 10 students could be surveyed to find out the number of pencils that they each have in their desks. Students might give the following answers that can then be used to create an additional line plot:

3, 9, 4, 9, 3, 4, 9, 5, 4 and 6 pencils.

Create a Line Plot

Since the smallest number in the set of data is 3 and the largest number in the set of data is 9, the final line plot would look as follows:



Find the Total Number of Pencils

Step 1. Students can use the line plot to create an expression to find the total number of pencils.

$$(2 \times 3) + (3 \times 4) + (1 \times 5) + (1 \times 6) + (3 \times 9)$$

Step 2: Solve the expression as:

$$6 + 12 + 5 + 6 + 27 = 56 \text{ pencils}$$

Use the Templates to Differentiate Instruction

These templates can also be used as a resource to differentiate instruction within a classroom. By creating additional practice problems of varying levels of complexity, an instructor can respond to the needs of individual learners but still remain within the confines of the Common Core.

Student Worksheets for Standard 5.MD.B.2

Creating Line Plots

An Introduction to Line Plots Using Whole Numbers

Section 6

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An Introduction to Line Plots Using Whole Numbers

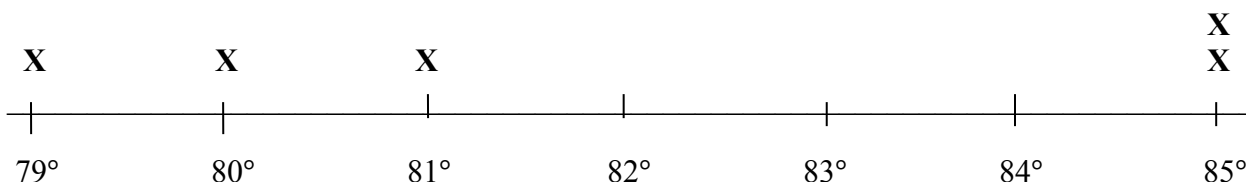
Set of Data: A group of numbers used to represent information. If the temperature outside at noon was recorded for five days in August, the set of data might look as follows:

79°, 85°, 81°, 85° and 80°

Line Plot: A line plot is a graph on a horizontal number line. It is used to record a set of data taken from a science experiment, survey or group of measurements. The line is divided into equal intervals and each data point is marked with an “x” or a “dot” above its place on the number line.

Line Plot Name: A line plot is named based on the data that it graphs. Here the line plot has been named “Temperature Recorded at Noon in August.”

Example of a Line Plot



Temperature Recorded at Noon in August

Mean: A type of average. The mean is found by adding numbers together and dividing the total by the number of numbers added together.

The Mean Temperature in August

$$79^{\circ} + 80^{\circ} + 81^{\circ} + (2 \times 85^{\circ}) = 410^{\circ}$$

$$410^{\circ} \div 5 = 82^{\circ}$$

Range: The difference between the largest and smallest number in a set of data. In the example above, the range is $85^{\circ} - 79^{\circ} = 6^{\circ}$.

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An Introduction to Line Plots Using Whole Numbers

Example: Mrs. Howard asked 11 students how many children were in each of their families. Students gave the following answers to her survey:

1,4,1,2,5,2,2,4,7,3 and 2 children

Mrs. Howard wanted to graph the data and find out the average number of children per family.

1. Create a line plot in the space below and use it to graph the set of data that Mrs. Howard collected. Name the line plot.

Line Plot

2. Use the line plot to create an expression to find the total number of children.

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3. What does this expression state? _____

4. Solve the expression to find the total number of children.

5. Find the average number of children per family.

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An Introduction to Line Plots Using Whole Numbers

6. Use the line plot to determine how many families have less than three children. _____

7. Use the line plot to determine how many families have more than four children. _____

8. How many more children does the largest family have than the smallest family? _____

9. What is the name for the difference between the largest number and the smallest number in a set of data?

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An Introduction to Line Plots Using Whole Numbers: Continue to Practice

Example: A teacher asked _____ students in the class how many children were in each of their families. The students gave the following answers to her survey:

_____ children.

1. What is the largest number in the set of data? _____
2. What is the smallest number in the set of data? _____
3. Create a line plot in the space below and use it to graph the set of data that the teacher collected. Name the line plot.

Line Plot

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An Introduction to Line Plots Using Whole Numbers: Continue to Practice

4. Use the line plot to create an expression to find the total number of children.

5. Solve the expression to find the total number of children.

6. How many more children does the largest family have than the smallest family? _____

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An Introduction to Line Plots Using Whole Numbers: Continue to Practice

Example: A teacher asked _____ students in the class how many pencils were in each of their desks. The students gave the following answers to her survey:

_____ pencils.

1. What is the largest number in the set of data? _____
2. What is the smallest number in the set of data? _____
3. Create a line plot in the space below and use it to graph the set of data that the teacher collected. Name the line plot.

Line Plot

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4. Use the line plot to create an expression to find the total number of pencils.

5. Solve the expression to find the total number of pencils.

6. What is the range of the pencils that the students have in their desks? _____

About the Next 5.MD.B.2 Lesson Plans

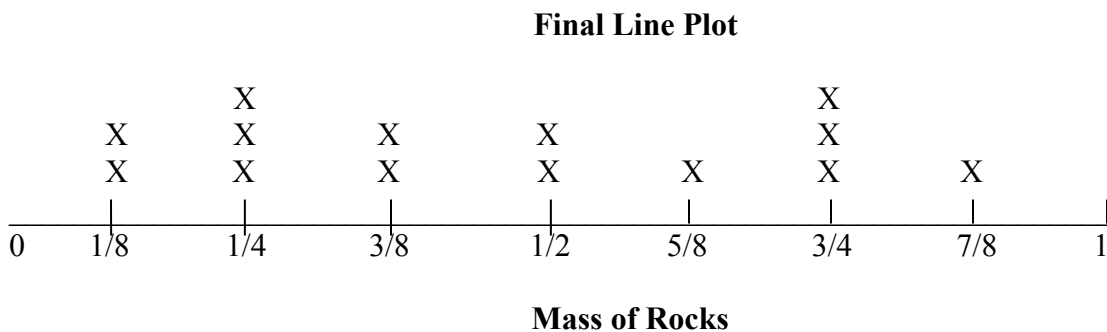
In the subsequent sections of my 5.MD.B.2 lesson plans, fifth grade students will gradually master the skills of partitioning number lines and creating line plots to fractions of $\frac{1}{2}$, $\frac{1}{4}$ and $\frac{1}{8}$ of a whole. Students will also work with mixed numbers, decimal fractions and create a science experiment to reinforce the concepts learned. Students will add, subtract, multiply and divide the fractions and mixed numbers. The following is an example of a more complex fraction problem and solution:

An Example with Fractions

Example: Dr. Smith used a scale to weigh a set of 14 rocks. He recorded the following mass (or weight) of the rocks:

$\frac{1}{2}$, $\frac{1}{4}$, $\frac{3}{4}$, $\frac{3}{4}$, $\frac{1}{2}$, $\frac{3}{8}$, $\frac{7}{8}$, $\frac{1}{4}$, $\frac{1}{8}$, $\frac{1}{4}$, $\frac{5}{8}$, $\frac{3}{4}$, $\frac{1}{8}$ and $\frac{3}{8}$ pounds.

Plot the mass of the set of rocks on a line plot. Use the line plot to find the combined mass of the rocks that are less than $\frac{1}{2}$ of a pound each.



Find the Combined Mass of the Rocks Under $\frac{1}{2}$ Pound

Because $\frac{1}{4}$ is equivalent to $\frac{2}{8}$, students can find the combined mass of the rocks under $\frac{1}{2}$ of a pound by creating the following expression:

$$(2 \times \frac{1}{8}) + (3 \times \frac{2}{8}) + (2 \times \frac{3}{8})$$

This expression can be solved as: $\frac{2}{8} + \frac{6}{8} + \frac{6}{8} = \frac{8}{8} + \frac{6}{8} = 1 + \frac{6}{8}$ pounds.

The combined mass of the rocks that are less than $\frac{1}{2}$ of a pound each is $1 \frac{6}{8}$ pounds.