TEACHER GUIDE

LINE PLOTS WITH FRACTIONAL MEASUREMENTS

GRADES 3–5

COMMON MISCONCEPTIONS

• Students struggle to interpret “most” and “least” in the context of a line plot.

Consider a line plot that displays the shoe sizes of a class of 5th graders. On this line plot, you can ask two big questions related to “most”. First, which category has the “most” responses (which shoe size had the most Xs). Next, you can ask what is the largest measure recorded, or the “most” large shoe size. Discuss with students the importance of reading the question and thinking about what the question asks; the largest shoe size is very different from which shoe size category has the greatest number of responses.

• Students may have difficulty performing operations on fractions with different denominators.

If a set of data has pieces measured to the nearest \( \frac{1}{4} \) inch, there is a good chance some data points measure \( \frac{1}{2} \) rather than \( \frac{2}{4} \). The same situation may occur if data points are measured to the nearest 1/8. Explain that the line plots with fractional amounts can show reduced equivalent fractions as measure markers, but to solve problems involving addition or subtraction, we need common denominators.

• Students misunderstand the meaning of an X on the line plot.

Students do not realize that every X on a line plot records one vote or observation of that specific value. A question like “what is the total height of all of the plants measured?” should signal students to add up the values associated with each X. You will know if students do not understand the meaning of the X if students add up all of the fractions listed on the scale rather than adding up the total of all data points. Students need practice in problem solving with line plots, such as problems that involve adding and subtracting fractions, in addition to simply constructing the line plots.

CONSTRUCT A LINE PLOT WITH FRACTION MEASUREMENTS

When introducing line plots with fractional measurements, review with the class that the first step in making a line plot is to determine the least value and the greatest value in the data. Students may need assistance in remembering how to compare fractions or mixed numbers to determine this range. Have students decide what the endpoints of the number line should be. Highlight how students can choose different ranges. Any range that includes all of the data points is correct, but encourage students to choose the closest possible range to eliminate unnecessary whitespace and effort.

The next step is to consider what the scale should be. When plotting, have a class discussion about how to break down intervals between whole numbers. The data values in a given problem should determine this.
Next have students proceed through the data set to record each observation by placing an X above the number line above the specific measure. Note: Data sets that underpin line plots can be presented in a variety of formats, including tables, lists, or tallies. Giving students a list rather than a table allows them to see that the data set does not need to be organized before it can be graphed.

SOLVE PROBLEMS USING LINE PLOTS

There are a wide variety of problems students can solve using data on a line plot. Students could use addition, subtraction, or multiplication to find the answers. Assist students, as needed, to identify key words and phrases in the questions to find clues to how to solve the problems.

- **How many** students were surveyed in all? (addition)
- **How many more** students ran 2 kilometers than 1 kilometer? (subtraction)
- **How much** faster did the fastest runner run **than** the slowest runner? (subtraction)
- **How far** did the students who ran 2 kilometers run in all? (multiplication)

MIXED NUMBERS

Once students are comfortable using fractions on line plots, progress to the next level of complexity by having students construct a line plot that includes mixed numbers.

Students may initially forget to consider the whole number parts of the mixed numbers when determining the range of the data and when plotting points on the line plot.

When solving problems, students may also forget the processes they need to follow to complete operations with mixed numbers. Check in with students to see their comfort level with mixed numbers before progressing to problem solving with line plots that contain mixed numbers.

TEACHER TIPS

Grade 4 students learn elements of fraction equivalence and arithmetic, including multiplying a fraction by a whole number and adding and subtracting fractions with unlike denominators. This lesson is designed to allow students to apply these skills to solve problems that arise from line plots with fractions.

As with any new type of graph, students should have opportunities to construct line plots and choose endpoints and scales based on the given data set. Some data can be student-generated. Students like to learn about themselves, and the easiest questions to begin with are those that can be answered by each class member contributing one piece of data. That said, students do not have to generate the data every time they work on making line plots; that would be too time-consuming.

In addition to asking questions that have students solving problems using addition, subtraction, and multiplication (whole number times a fraction) of fractions, you should also pose open-ended questions such as “what else does this line plot tell us?” This allows students to practice reasoning about data.

Encourage open discussions about different approaches to problem solving. For example, one strategy to find the difference between the tallest and shortest friend when the data are written as mixed numbers is to subtract the whole number parts, then subtract the fraction parts (by finding like denominators), and then combine the answers. Other students may choose to count up from 51\(\frac{1}{2}\) to 51\(\frac{3}{4}\). Others may choose to find a common denominator for the fractions, convert the mixed numbers to fractions greater than one, subtract, and then convert the fraction back to a mixed number.