4th Grade Mathematics

Instructional Week 22

Linear measurement and data analysis

Paced Standards:

4.M.1: Measure length to the nearest quarter-inch, eighth-inch, and millimeter. ✓

4.DA.1: Formulate questions that can be addressed with data. Use observations, surveys, and experiments to collect, represent, and interpret the data using tables (including frequency tables), line plots, and bar graphs. ✓

4.DA.2: Make a line plot to display a data set of measurements in fractions of a unit (1/2, 1/4, 1/8). Solve problems involving addition and subtraction of fractions by using data displayed in line plots. ✓

Connections to other 4th Grade Standards:

4.NS.3: Express whole numbers as fractions and recognize fractions that are equivalent to whole numbers. Name and write mixed numbers using objects or pictures. Name and write mixed numbers as improper fractions using objects or pictures.

4.NS.4: Explain why a fraction, a/b, is equivalent to a fraction, (n × a)/(n × b), by using visual fraction models, with attention to how the number and size of the parts differ even though the two fractions themselves are the same size. Use this principle to recognize and generate equivalent fractions. [In grade 4, limit denominators of fractions to 2, 3, 4, 5, 6, 8, 10, 25, 100.]

4.NS.5: Compare two fractions with different numerators and different denominators (e.g., by creating common denominators or numerators, or by comparing to a benchmark, such as 0, 1/2, and 1). Recognize comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with symbols >, =, or <, and justify the conclusions (e.g., by using a visual fraction model).

4.NS.6: Write tenths and hundredths in decimal and fraction notations. Use words, models, standard form and expanded form to represent decimal numbers to hundredths. Know the fraction and decimal equivalents for halves and fourths (e.g., 1/2 = 0.5 = 0.50, 7/4 = 1 3/4 = 1.75).

4.AT.5: Solve real-world problems involving addition and subtraction of fractions referring to the same whole and having common denominators (e.g., by using visual fraction models and equations to represent the problem).

Prerequisite/Foundational Standards:

3.M.2: Choose and use appropriate units and tools to estimate and measure length, weight, and temperature. Estimate and measure length to a quarter-inch, weight in pounds, and temperature in degrees Celsius and Fahrenheit.

3.DA.2: Generate measurement data by measuring lengths with rulers to the nearest quarter of an inch. Display the data by making a line plot, where the horizontal scale is marked off in appropriate units, such as whole numbers, halves, or quarters.

3.NS.3: Understand a fraction, 1/b, as the quantity formed by 1 part when a whole is partitioned into b equal parts; understand a fraction, a/b, as the quantity formed by a parts of size 1/b. [In grade 3, limit denominators of fractions to 2, 3, 4, 6, 8.]

3.NS.4: Represent a fraction, 1/b, on a number line by defining the interval from 0 to 1 as the whole, and partitioning it into b equal parts. Recognize that each part has size 1/b and that the endpoint of the part based at 0 locates the number 1/b on the number line.

3.NS.5: Represent a fraction, a/b, on a number line by marking off lengths 1/b from 0. Recognize that the resulting interval has size a/b, and that its endpoint locates the number a/b on the number line.

2.NS.3: Plot and compare whole numbers up to 1,000 on a number line.

2.M.2: Estimate and measure the length of an object by selecting and using appropriate tools, such as rulers, yardsticks, meter sticks, and measuring tapes to the nearest inch, foot, yard, centimeter and meter.

4th Grade ISTEP+ Toolkit

4.M.1

Standard: 4.M.1: Measure length to the nearest quarter-inch, eighth-inch, and millimeter.

Teacher Background Information:

There are four important principles of iterating units of length, whether they are nonstandard or standard (Dietiker, Gonulates, Figueras, & Smith, 2010, p. 2):

- All units must have equal length—if not, you cannot accumulate units by counting.
- All units must be placed on the path being measured—otherwise, a different quantity is being measured.
- The units must be without gaps—if not, part of the quantity is not being measured.
- The units must not overlap—otherwise, part of the quantity is measured more than once.

Students have measured to the nearest half-inch and centimeter in prior years.
Review of these concepts might be necessary in order to fill in student's learning gaps.

http://www.learner.org/courses/learningmath/measurement/session3/index.html Annenberg Learner: Metric System mini unit

Fractional Parts of Units. Students are sometimes perplexed when measurements do not result in a whole number. As early as first grade, students are exploring halves; this is an excellent context for students to apply their developing concepts of fractions. Students can relate the idea of unit to the whole, and partition to see half units. The use of fractional units helps students understand subdivision marks on a ruler.

Process Standards to Emphasize with Instruction of 4.M.1:

4.PS.2: Reason abstractly and quantitatively.
4.PS.3: Construct viable arguments and critique the reasoning of others.
4.PS.4: Model with mathematics.
4:PS.5: Use appropriate tools strategically.
4.PS.6: Attend to precision.

4.DA.1

Standard: 4.DA.1: Formulate questions that can be addressed with data. Use observations, surveys, and experiments to collect, represent, and interpret the data using tables (including frequency tables), line plots, and bar graphs.

Teacher Background Information:

- Data collection should be for a purpose, to answer a question, just as in the real world. Then the analysis of data actually adds information about some aspect of our world, just as political pollsters, advertising agencies, market researchers, census takers, wild-life managers, medical researchers, and hosts of others gather data to answer questions and make informed decisions.
  When students formulate the questions, the data they gather become more meaningful. How they organize the data and the techniques for analyzing them have a purpose. They may start by just hand raising, a tally, or a ballot using both limited response (narrow range of possible answers) and then unlimited response options. Often the need to gather data will come from the class naturally in the course of discussion or from questions arising in other content areas. Science, of course, is full of measurements and, thus, abounds in data analysis possibilities. Social studies is also full of opportunities to pose questions requiring data collection.

- Students want to learn about themselves (what does the "typical" student look like or have an interest in?), their families and pets, measures such as arm span or time to get to school, their likes and dislikes, and so on. The easiest questions to begin with are those that can be answered by each class member contributing one piece of data. Here are a few ideas:
  - *Favorites:* TV shows, games, movies, ice cream, video games, sports teams, music (When there are lots of possibilities, start by restricting the number of choices.)
  - *Numbers:* number of pets, siblings; hours watching TV or hours of sleep; bedtime; time spent on the computer
  - *Measures:* height, arm span, area of foot, long-jump distance, shadow length, seconds to run around the track, minutes spent traveling to school

Process Standards to Emphasize with Instruction of 4.DA.1:

4.PS.1: Make sense of problems and persevere in solving them.
4.PS.2: Reason abstractly and quantitatively.
4.PS.3: Construct viable arguments and critique the reasoning of others.
4.PS.4: Model with mathematics.
4.PS.5: Use appropriate tools strategically.

4.DA.2

Standard: 4.DA.2: Make a line plot to display a data set of measurements in fractions of a unit (1/2, 1/4, 1/8). Solve problems involving addition and subtraction of fractions by using data displayed in line plots.

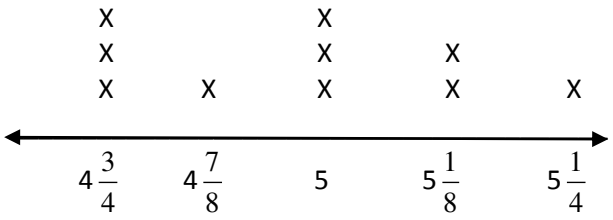
Teacher Background Information:

This standard provides a context for students to work with fractions by measuring objects to an eighth of an inch. Students are making a line plot of this data and then adding and subtracting fractions based on data in the line plot.

Line plots are counts of things along a numeric scale. To make a line plot, a number line is drawn and an X is made above the corresponding value on the line for every corresponding data element. One advantage of a line plot is that every piece of data is shown on the graph. It is also a very easy type of graph for students to make. It is essentially a bar graph with a potential bar for every possible value.

Example:

- Ten students in Room 31 measured their pencils at the end of the day. They recorded their results on the line plot below.



Possible questions:

- What is the difference in length from the longest to the shortest pencil?
- If you were to line up all the pencils, what would the total length be?
- If the 5 1/8" pencils are placed end to end, what would be their total length?

Process Standards to Emphasize with Instruction of 4.DA.2:

4.PS.2: Reason abstractly and quantitatively.
4.PS.4: Model with mathematics.
4.PS.5: Use appropriate tools strategically.
4.PS.6: Attend to precision.
4.PS.7: Look for and make use of structure.

Instructional Week 22
4th Grade Mathematics Assessment

Name: _____

1. Zoe and Brenda were asked to measure the length of a worm for science class. Brenda and Zoe recorded their measurements in their science journals.

Zoe's science journal:	Brenda's science journal:
The worm is $4\frac{1}{4}$ inches long.	The worm is $4\frac{2}{10}$ inches long.

1a. Which student recorded the length of the worm correctly in their science journal?

Answer _____

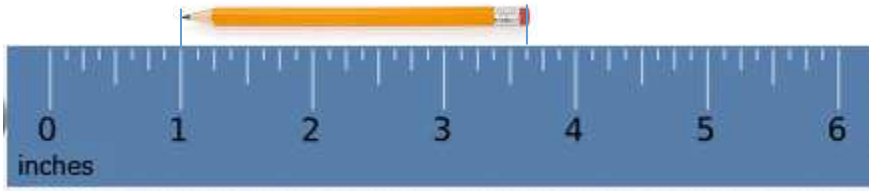
1b. On the lines below, explain how the student who measured correctly determined her answer.

_____

_____

_____

2. Debra used the ruler to measure a pencil. What is the length of the pencil to the nearest eighth-inch?



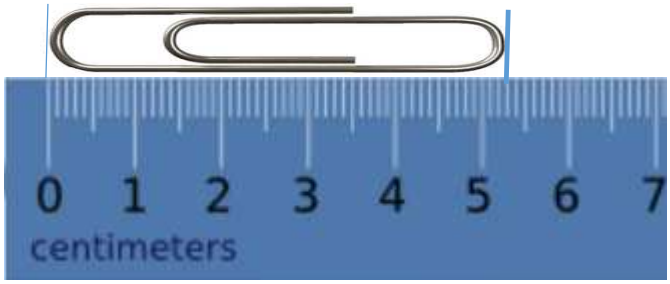
A) 1 inch

B) $3\frac{5}{8}$ inches

C) $3\frac{1}{2}$ inches

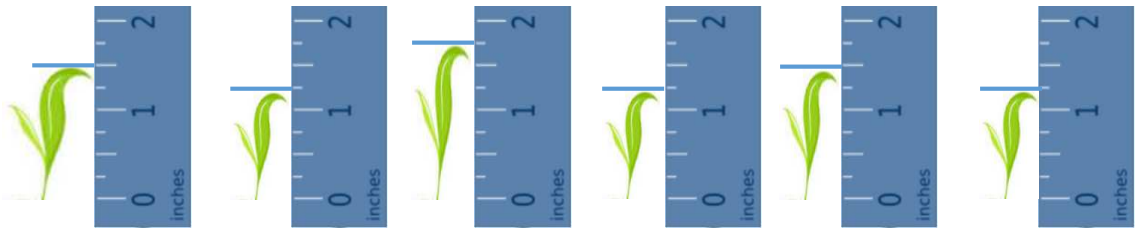
D) $2\frac{5}{8}$ inches

3. What is the length of the paperclip to the nearest millimeter?



A) 5 millimeters
B) 5.3 millimeters
C) 53 millimeters
D) 63 millimeters

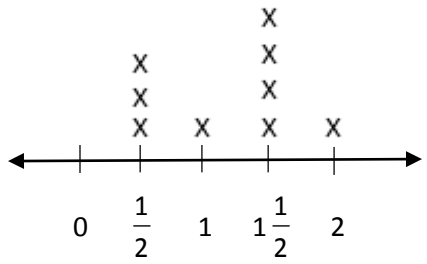
4. Louis measured the heights of different seedlings.



Complete the line plot below showing the heights of the seedlings.

Seedling Heights (inches)

5. Carlos measured the lengths of several Lego pieces, in inches, and created a line plot to represent his data.



Lego Lengths (inches)

Part A

Complete the frequency table below to show how many Legos Carlos has of each length.

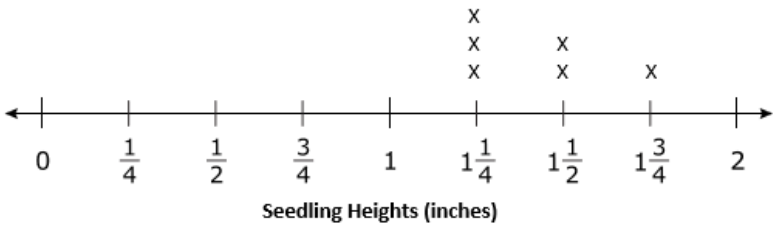
Lego Length (inches)	**Tally marks**	**Frequency**
0		
$\frac{1}{2}$		
1		
$1\frac{1}{2}$		
2		

Part B

How much longer is the combined length of Carlos' $1\frac{1}{2}$ -inch Legos compared to the length of his 2-inch Lego?

Show all work

***Answer*_____**

<table>
<tr><th colspan="3">Instructional Week 22
4th Grade Assessment Answer Key</th></tr>
<tr><th>Question</th><th>Correct Answer</th><th>Standard(s)</th></tr>
<tr><td>1a</td><td>Zoe</td><td>4.M.1</td></tr>
<tr><td>1b</td><td>Zoe started at 0 and knew that the worm was longer than 4 inches. She counted the spaces between 4 and 5 to determine that each space is one-eighth. The worm ends at $4\frac{2}{8}$, which is the same as $4\frac{1}{4}$.</td><td>4.M.1</td></tr>
<tr><td>2</td><td>D</td><td>4.M.1</td></tr>
<tr><td>3</td><td>C</td><td>4.M.1</td></tr>
<tr><td>4</td><td> 

Seedling Heights (inches)</td><td>4.DA.2</td></tr>
<tr><td>5a</td><td><table>
<tr><th>Lego Length (inches)</th><th>Tally marks</th><th>Frequency</th></tr>
<tr><td>0</td><td></td><td>0</td></tr>
<tr><td>$\frac{1}{2}$</td><td>|||</td><td>3</td></tr>
<tr><td>1</td><td>|</td><td>1</td></tr>
<tr><td>$1\frac{1}{2}$</td><td>||||</td><td>4</td></tr>
<tr><td>2</td><td>|</td><td>1</td></tr>
</table></td><td>4.DA.1</td></tr>
<tr><td>5b</td><td>4 inches</td><td>4.DA.1</td></tr>
</table>

Content Rubric	
2	A score of two indicates a thorough understanding of the mathematical concepts embodied in the task. The response • shows content related work executed correctly and completely.
1	A score of one indicates a partial understanding of the mathematical concepts embodied in the task. The response • contains errors in the content related work
0	A score of zero indicates limited or no understanding of the mathematical concepts embodied in the task.