7-2 Mean, Median, Mode, and Range

Warm Up

Problem of the Day

Lesson Presentation

Warm Up

Order the numbers from least to greatest.

1. 7, 4, 15, 9, 5, 2 2, 4, 5, 7, 9, 15

2. 70, 21, 36, 54, 22 21, 22, 36, 54, 70

Divide.

3. 820 ÷ 4 205

4. 650 ÷ 10 65

5. 1,125 ÷ 25 45

6. 2,275 ÷7 325

Problem of the Day

Complete the expression using the numbers 3, 4, and 5 so that it equals 19.

$$\frac{4}{\ } + \frac{5}{\ } \times \frac{3}{\ }$$

or

$$\frac{4}{\ } + \frac{3}{\ } \times \frac{5}{\ }$$

7-2 Mean, Median, Mode, and Range

Learn to find the mean, median, mode, and range of a data set.

Vocabulary

mean

median

mode

range

outlier

7-2 Mean, Median, Mode, and Range

The **mean** is the sum of the data values divided by the number of data items.

Helpful Hint

The mean is sometimes called the average.

The **median** is the middle value of an odd number of data items arranged in order. For an even number of data items, the median is the average of the two middle values.

The **mode** is the value or values that occur most often. When all the data values occur the same number of times, there is no mode.

The **range** of a set of data is the difference between the greatest and least values. It is used to show the spread of the data in a data set.

Additional Example 1: Finding the Mean, Median, Mode, and Range of Data

Find the mean, median, mode, and range of the data set.

4, 7, 8, 2, 1, 2, 4, 2

mean:

$\underbrace{4 + 7 + 8 + 2 + 1 + 2 + 4 + 2}_{8 \text{ items}} = \underbrace{30}_{\text{sum}}$

Add the values.

$30 \div 8 = 3.75$

Divide the sum by the number of items.

The mean is 3.75.

Additional Example 1 Continued

Find the mean, median, mode, and range of the data set.

4, 7, 8, 2, 1, 2, 4, 2

median:

1, 2, 2, 2, 4, 4, 7, 8

Arrange the values in order.

2 + 4 = 6

6 ÷ 2 = 3

There are two middle values, so find the mean of these two values.

The median is 3.

Additional Example 1 Continued

Find the mean, median, mode, and range of the data set.

4, 7, 8, 2, 1, 2, 4, 2

mode:

1, 2, 2, 2, 4, 4, 7, 8

The value 2 occurs three times.

The mode is 2.

Additional Example 1 Continued

Find the mean, median, mode, and range of the data set.

4, 7, 8, 2, 1, 2, 4, 2

range:

1, 2, 2, 2, 4, 4, 7, 8

Subtract the least value from the greatest value.

8 – 1 = 7

The range is 7.

Check It Out: Example 1

Find the mean, median, mode, and range of the data set.

6, 4, 3, 5, 2, 5, 1, 8

mean:

$6 + 4 + 3 + 5 + 2 + 5 + 1 + 8 =$ 34

$6 + 4 + 3 + 5 + 2 + 5 + 1 + 8 =$: 8 items

34 : sum

Add the values.

$34 \div 8 = 4.25$

Divide the sum by the number of items.

The mean is 4.25.

Check It Out: Example 1 Continued

Find the mean, median, mode, and range of the data set.

6, 4, 3, 5, 2, 5, 1, 8

median:

1, 2, 3, 4, 5, 5, 6, 8

Arrange the values in order.

4 + 5 = 9

9 ÷ 2 = 4.5

There are two middle values, so find the mean of these two values.

The median is 4.5.

Check It Out: Example 1 Continued

Find the mean, median, mode, and range of the data set.

6, 4, 3, 5, 2, 5, 1, 8

mode:

1, 2, 3, 4, 5, 5, 6, 8

The value 5 occurs two times.

The mode is 5.

Check It Out: Example 1 Continued

Find the mean, median, mode, and range of the data set.

6, 4, 3, 5, 2, 5, 1, 8

range:

1, 2, 3, 4, 5, 5, 6, 8

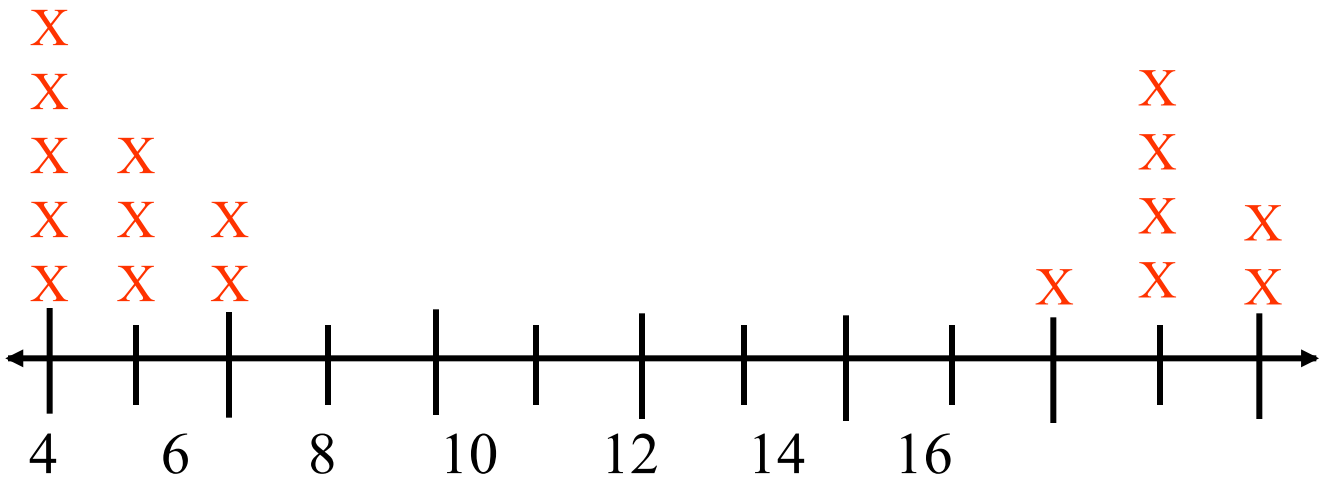
Subtract the least value from the greatest value.

8 – 1 = 7

The range is 7.

Additional Example 2: Choosing the Best Measure to Describe a Set of Data

The line plot shows the number of miles each of the 17 members of the cross-country team ran in a week. Which measure of central tendency best describes this data? Justify your answer.



Additional Example 2 Continued

The line plot shows the number of miles each of the 17 members of the cross-country team ran in a week. Which measure of central tendency best describes this data? Justify your answer.

mean:

$$\frac{4+4+4+4+4+5+5+5+6+6+14+15+15+15+15+16+16}{17}$$

$$= \frac{153}{17} = 9$$

The mean is 9. The mean best describes the data set because the data is clustered fairly evenly about two areas.

Additional Example 2 Continued

The line plot shows the number of miles each of the 17 members of the cross-country team ran in a week. Which measure of central tendency best describes this data? Justify your answer.

median:

4, 4, 4, 4, 4, 5, 5, 5, 6, 6, 14, 15, 15, 15, 15, 16, 16

The median is 6. The median does not best describe the data set because many values are not clustered around the data value 6.

Additional Example 2 Continued

The line plot shows the number of miles each of the 17 members of the cross-country team ran in a week. Which measure of central tendency best describes this data? Justify your answer.

mode:

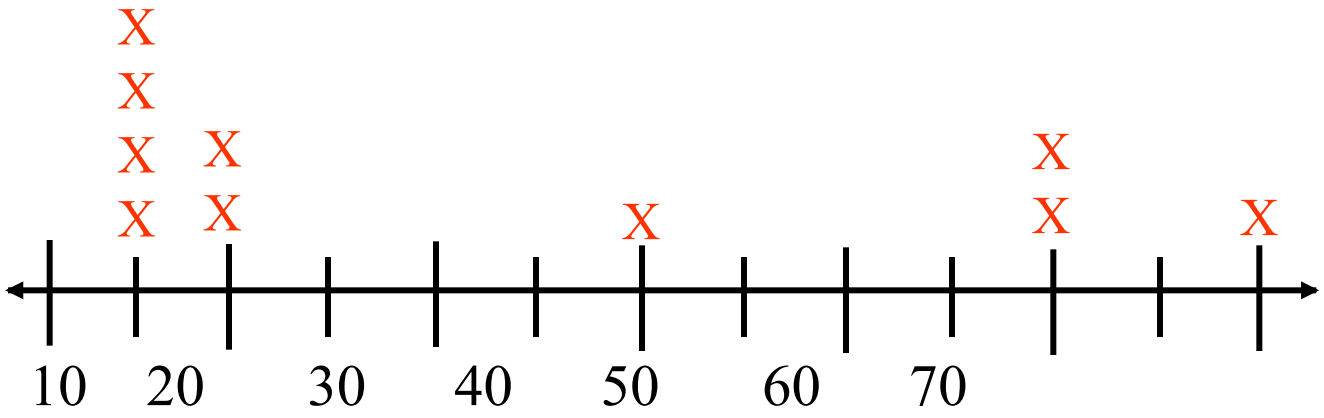
The greatest number of X's occur above the number 4 on the line plot.

The mode is 4.

The mode focuses on one data value and does not describe the data set.

Check It Out: Example 2

The line plot shows the number of dollars each of the 10 members of the cheerleading team raised in a week. Which measure of central tendency best describes this data? Justify your answer.



Check It Out: Example 2 Continued

The line plot shows the number of dollars each of the 10 members of the cheerleading team raised in a week. Which measure of central tendency best describes this data? Justify your answer.

mean:

$$\frac{15 + 15 + 15 + 15 + 20 + 20 + 40 + 60 + 60 + 70}{10}$$

$$= \frac{330}{10} = 33$$

The mean is 33. Most of the cheerleaders raised less than $33, so the mean does not describe the data set best.

Check It Out: Example 2 Continued

The line plot shows the number of dollars each of the 10 members of the cheerleading team raised in a week. Which measure of central tendency best describes this data? Justify your answer.

median:

15, 15, 15, 15, 20, 20, 40, 60, 60, 70

The median is 20. The median best describes the data set because it is closest to the amount most cheerleaders raised.

Check It Out: Example 2 Continued

The line plot shows the number of dollars each of the 10 members of the cheerleading team raised in a week. Which measure of central tendency best describes this data? Justify your answer.

mode:

The greatest number of X's occur above the number 15 on the line plot.

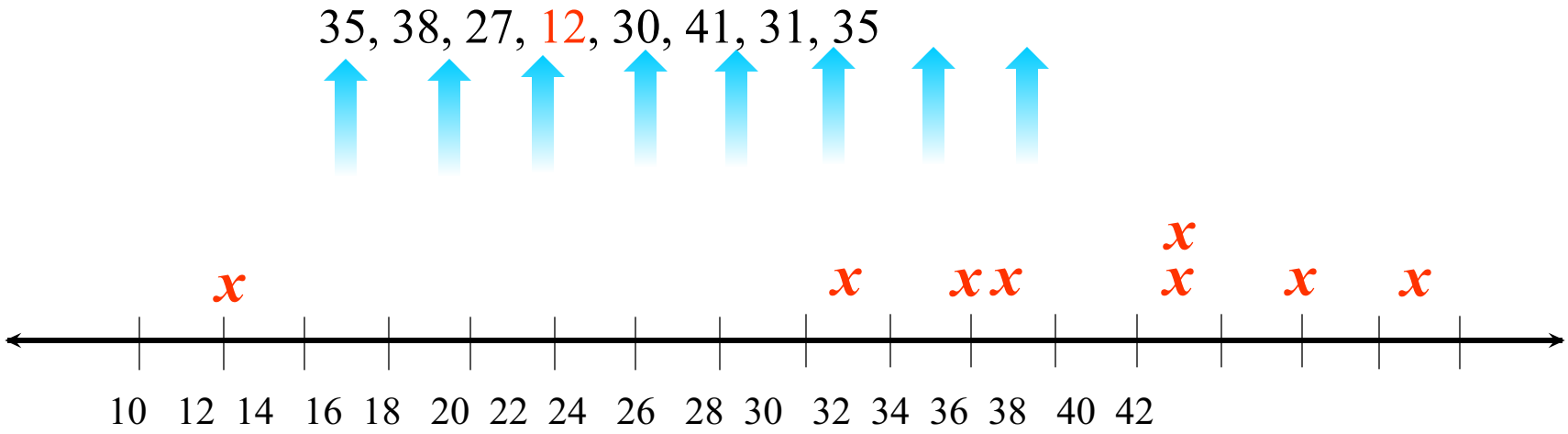
The mode is 15.

The mode focuses on one data value and does not describe the data set.

Measure	Most Useful When
mean	The data are spread fairly evenly
median	The data set has an outlier
mode	The data involve a subject in which many data points of one value are important, such as election results.

7-2 Mean, Median, Mode, and Range

In the data set below, the value 12 is much less than the other values in the set. An extreme value such as this is called an outlier.



Additional Example 3: Exploring the Effects of Outliers on Measures of Central Tendency

The data shows Sara's scores for the last 5 math tests: 88, 90, 55, 94, and 89. Identify the outlier in the data set. Then determine how the outlier affects the mean, median, and mode of the data. Then tell which measure of central tendency best describes the data with the outlier.

55, 88, 89, 90, 94

outlier → 55

Additional Example 3 Continued

With the Outlier

55, 88, 89, 90, 94

outlier → 55

mean:	median:	mode:
55+88+89+90+94 = 416 416 ÷ 5 = 83.2 The mean is 83.2.	55, 88, 89, 90, 94 The median is 89.	There is no mode.

Additional Example 3 Continued

Without the Outlier

~~55~~, 88, 89, 90, 94

mean:	median:	mode:
88+89+90+94 = 361 361 ÷ 4 = 90.25 The mean is 90.25.	88, 89, 90, 94 $\frac{89+90}{2}$ = 89.5 The median is 89.5.	There is no mode.

Caution!

Since all the data values occur the same number of times, the set has no mode.

Additional Example 3 Continued

	Without the Outlier	With the Outlier
mean	90.25	83.2
median	89.5	89
mode	no mode	no mode

Adding the outlier decreased the mean by 7.05 and the median by 0.5.

The mode did not change.

The median best describes the data with the outlier.

Check It Out: Example 3

Identify the outlier in the data set. Then determine how the outlier affects the mean, median, and mode of the data. The tell which measure of central tendency best describes the data with the outlier.

63, 58, 57, 61, 42

42, 57, 58, 61, 63

outlier → 42

Check It Out: Example 3 Continued

With the Outlier

42, 57, 58, 61, 63

outlier → 42

mean:	median:	mode:
42+57+58+61+63 = 281 281 ÷ 5 = 56.2 The mean is 56.2.	42, 57, 58, 61, 63 The median is 58.	There is no mode.

Check It Out: Example 3 Continued

Without the Outlier

42, 57, 58, 61, 63

mean:	median:	mode:
57+58+61+63 = 239 239 ÷ 4 = 59.75 The mean is 59.75.	57, 58, 61, 63 $\frac{58+61}{2}$ = 59.5 The median is 59.5.	There is no mode.

Check It Out: Example 3 Continued

	Without the Outlier	With the Outlier
mean	59.75	56.2
median	59.5	58
mode	no mode	no mode

Adding the outlier decreased the mean by 3.55 and decreased the median by 1.5.

The mode did not change.

The median best describes the data with the outlier.

Lesson Quiz: Part I

1. Find the mean, median, mode, and range of the data set. 8, 10, 46, 37, 20, 8, and 11

mean: 20; median: 11; mode: 8; range: 38

Lesson Quiz: Part II

2. Identify the outlier in the data set, and determine how the outlier affects the mean, median, and mode of the data. Then tell which measure of central tendency best describes the data with and without the outlier. Justify your answer. 85, 91, 83, 78, 79, 64, 81, 97

The outlier is 64. Without the outlier the mean is 85, the median is 83, and there is no mode. With the outlier the mean is 82, the median is 82, and there is no mode. Including the outlier decreases the mean by 3 and the median by 1, there is no mode. Because they have the same value and there is no outlier, the median and mean describes the data with the outlier. The median best describes the data without the outlier because it is closer to more of the other data values than the mean.