

## Lesson 29: Measuring Data Sets

To measure a data set, you can use the mean, median, and mode. Each of these measures summarizes a data set with a single number.

### Mean

The **mean** is the sum of the numbers in a data set divided by how many numbers there are in the set. The mean is often called the “**average**.”

$$\text{mean} = \frac{\text{sum of the numbers}}{\text{how many numbers}}$$

#### Example

A train has five cars with 45, 51, 48, 39, and 42 passengers in them. What is the mean number of passengers per train car?

First, add the five numbers.

$$45 + 51 + 48 + 39 + 42 = 225$$

Now substitute the numbers into the formula, and find the mean.

$$\begin{aligned}\text{mean} &= \frac{\text{sum of the numbers}}{\text{how many numbers}} \\ &= \frac{225}{5} \\ &= 45\end{aligned}$$

The mean number of passengers per train car is 45.

## Median

The **median** is the **middle** number in a data set arranged from least to greatest (or greatest to least).

### Example

The following list shows the number of customers who ordered macaroni at Dina's Diner each day last week.

11, 15, 8, 18, 10, 15, 12

What is the median number of customers who ordered macaroni?

Arrange the numbers in order from least to greatest. Find the middle number.

8, 10, 11, **12**, 15, 15, 18

The median number of customers who ordered macaroni is 12.

## Mode

The **mode** is the number that appears **most often** in a data set. There can be one or more modes in a data set. If all the numbers appear the same number of times, there will be no mode at all.

### Example

Stephen played ten games of baseball and had the following numbers of at-bats.

4, 5, 3, 6, 3, 4, 4, 1, 5, 4

What is the mode number of at-bats?

Find the number that appears most often.

**4**, 5, 3, 6, 3, **4**, **4**, 1, 5, **4**

The mode number of at-bats is 4.



**TIP:** To find the median of a data set with an even number of numbers in a data set, find the two middle numbers. Add the two middle numbers, then divide by 2 to find the median.

To measure a data set, you can also use the range, interquartile range, and the mean absolute deviation. Each of these measures describes how a data set varies with a single number.

## Range

The **range** is the difference between the least number and the greatest number in a data set.

### Example

Cody's Crab Shack had the following number of customers last week. What is the range of the number of customers in Cody's Crab Shack?

47, 38, 55, 68, 40, 33, 55

Subtract the smallest number in the data set, 33, from the greatest number, 68.

$$68 - 33 = 35$$

The range number of customers in Cody's Crab Shack is 35.

## Interquartile Range

The **interquartile range** is the difference between the first and third **quartiles** of a data set. To find the **first quartile**, find the median of the lower half of a data set. To find the **third quartile**, find the median of the upper half of a data set.

### Example

What is the interquartile range of the following data set?

5, 15, 25, 9, 25, 12, 25, 30, 20, 21

First, put the numbers in numerical order.

5, 9, 12, 15, 20, 21, 25, 25, 25, 30

The median of the data set is  $\frac{20 + 21}{2} = 20.5$ .

The lower half of the data set is 5, 9, 12, 15, and 20. The median of this lower half is 12. The first quartile is 12.

The upper half of the data set is 21, 25, 25, 25, and 30. The median of this upper half is 25. The third quartile is 25.

The interquartile range is the difference between the first and third quartiles:  $25 - 12 = 13$ . The interquartile range of the data set is 13.

## Mean Absolute Deviation

The **mean absolute deviation** is the average amount by which the measurements in a data set vary from the mean. To find the mean absolute deviation, first find the absolute value of the difference between each data point and the mean. Then find the average of those deviation amounts.

### Example

Charlene gets the following scores during the first five holes of a golf tournament. Find the mean absolute deviation of her scores.

4, 5, 2, 8, 6

First, calculate the mean of the data set.

$$\begin{aligned} \text{mean of the data set} &= \frac{\text{sum of the numbers}}{\text{how many numbers}} \\ &= \frac{4 + 5 + 2 + 8 + 6}{5} \\ &= \frac{25}{5} \\ &= 5 \end{aligned}$$


The mean score of the data set is 5. Now find the absolute value of the difference between each data point and the mean.

$$\begin{aligned} \text{hole 1: } &|5 - 4| = 1 \\ \text{hole 2: } &|5 - 5| = 0 \\ \text{hole 3: } &|5 - 2| = 3 \\ \text{hole 4: } &|5 - 8| = 3 \\ \text{hole 5: } &|5 - 6| = 1 \end{aligned}$$

Finally, find the average of these numbers.

$$\begin{aligned} \text{mean of the deviation points} &= \frac{\text{sum of the numbers}}{\text{how many numbers}} \\ &= \frac{1 + 0 + 3 + 3 + 1}{5} \\ &= \frac{8}{5} \\ &= 1.6 \end{aligned}$$

The mean absolute deviation of the data set is 1.6.

 **TIP:** The greater the mean absolute deviation, the less the mean accurately represents the data set. A small mean absolute deviation means that the data points are close to the mean.