

Resource Mean, Mode, and Median

The language of sets

The **sum** of a set of numbers is the result obtained by adding the values in the set.

The **size** of a set of numbers is *the number of numbers* in the set and is often designated as "***n***."

Example: The set A represents the amounts Joey spent when she used her debit card yesterday. How many transactions did Joey have, and what is the total amount she spent?

$$A = \{38, 14, 12, 26\}$$

The size of the set is $n = 4$, so Joey had 4 transactions.

How did you find n ? Simply count the number of data values!

The sum of the set is $38 + 14 + 12 + 26 = 90$, so Joey spent \$90.

How did you determine this? You may have used your calculator. However, you could challenge yourself to work mentally. Sometimes regrouping the numbers makes them easier to work with. Look again at the set A . Do you see a way to rearrange the set to make pairs of numbers you could add together more easily in your head? (Check the bottom of this page if you are stuck.)

You can regroup the numbers in your head as follows:

$$38 + 14 + 12 + 26 =$$

$$(38 + 12) + (14 + 26) =$$

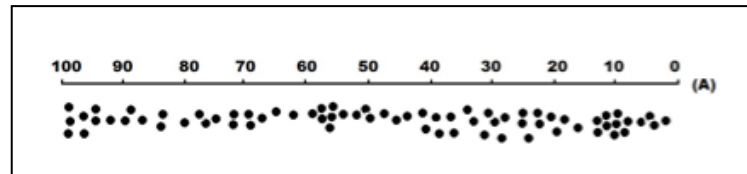
$$50 + 40 =$$

$$90$$

Averages

People often talk about “averages,” and you probably have an idea of what is meant by that. Now you will look at more formal mathematical ways of defining averages. In mathematics, you call an average a measure of center because an average is a way of measuring or *quantifying* the center of a set of data. There are different measures of center because there are different ways to define the center.

Think about a long line of people waiting to buy tickets for a concert. (Figure A shows a line about 100 feet long, and each dot represents a person in the line.) In some sections of the line, people are grouped together very closely, while in other sections of the line, people are spread out.

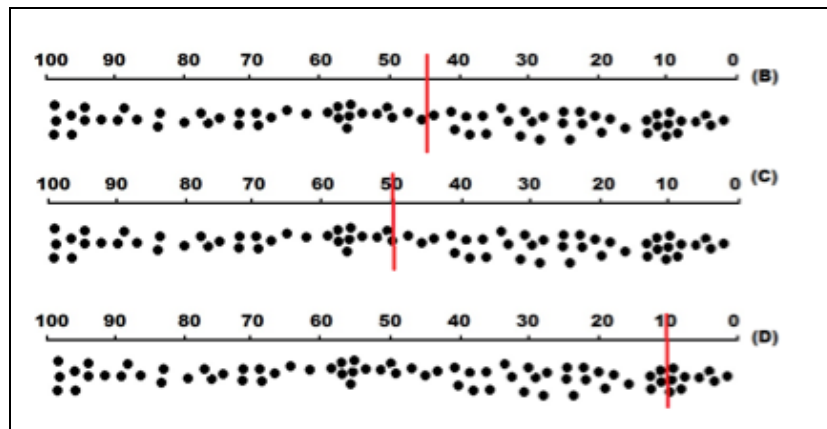


How would you describe the location of the center of the line in Figure A?

Would you define the center of the line by finding the point at which half the people in the line are on one side and half are on the other (see Figure B)?

Is the center based on the length of the line even though there would be more people on one side of the center than on the other (see Figure C)?

Would you place the center among the largest groups of people (see Figure D)?



The answer would depend on what you needed the center for. When working with data, you need different measures for different purposes.

Different measures of center are described on the next page.

Mean (arithmetic average)

Find the average of numeric values by finding the sum of the values and dividing the sum by the number of values. The mean is what most people are describing when they say “average.”

Example:

$$\begin{aligned}\text{Mean} &= \frac{\text{sum}}{n} \\ &= \frac{X1+X2+X3+X4+X5}{n} \\ &= \frac{32 + 12 + 8 + 42 + 100}{5} \\ &= \frac{194}{5} \\ &= 38.8\end{aligned}$$

Table 1: Manny's Purchases

	W	X
1	Shirt	32
2	Hat	12
3	Lunch	8
4	Gas	42
5	Gift Card	100

So, there are three ways to talk about this value:

- 1) The set is “centered” at 38.8.
- 2) The mean of the numbers is 38.8.
- 3) Manny spent an average of \$38.80 per purchase.

Mode

Determine the mode by identifying the number(s) that occur(s) most frequently. There may be more than one mode in a collection of values.

Example 1:

Find the mode of 18, 23, 45, 18, 36.

The number 18 occurs twice, more than any other number, so the mode is 18.

Example 2:

Find the mode of the quiz grades. 70, 75, 75, 75, 80, 80, 85, 85, 85, 90, 95, 95

The number 75 occurs three times, as does 85. This is more than any other number, so there are two modes, 75 and 85.

Median

Find the median of a set of numbers by first arranging the data in order of size, then:

- 1) If there are an odd number of values, the median is the middle number.
- 2) If there are an even number of values, the median is the mean of the two middle numbers.

Example (*data set with odd number of values*)

To find the median of Manny's purchases, write the numbers in order:

8, 12, 32, 42, 100

There are 5 values (an odd number), so the median is the number in the middle.

8, 12, 32, 42, 100

The median is 32.

Example (*data set with even number of values*)

To find the median of a different set of values (such as exam scores), first write the numbers in order: 12, 14, 26, 38

With an even number of values, there is no one middle number. Find the median by finding the mean of the two middle numbers:

$$\text{Median} = \frac{14 + 26}{2} = \frac{40}{2} = 20$$

If you need some review on measures of central tendency, you can view free videos on the Khan Academy website.

- <https://www.khanacademy.org/math/ap-statistics/summarizing-quantitative-data-ap/measuring-center-quantitative/v/statistics-intro-mean-median-and-mode>