

Grade 6 · Mean, Median, Range, IQR and Mean Absolute Deviation · Lesson

Common Core 6.SP.A.3, 6.SP.B.5c, 6.SP.B.5d · mathovore.fr

The mean and the median are measures of center, and the range, interquartile range, and mean absolute deviation are measures of variability. The mean is the sum divided by the count, and the median is the middle value. When a data set has an outlier, the median and the IQR describe it better.

Grade 6 Common Core: 6.SP.A.3 · 6.SP.B.5c · 6.SP.B.5d

Key facts:

- Mean: sum of the values divided by the number of values.
- Median: the middle value of the ordered data.
- Range is maximum minus minimum; $IQR = Q_3 - Q_1$.
- MAD is the mean of the distances of the values from the mean.
- An outlier changes the mean much more than the median.

What are the mean and the median?

The mean is the fair-share value: add all the values and divide by how many there are. The median is the middle value of the ordered data. With an even number of values, the median is the mean of the two middle values. For the scores 6, 8, 9, 10, and 12, the mean is $\frac{6+8+9+10+12}{5} = \frac{45}{5} = 9$, and the median is also 9.

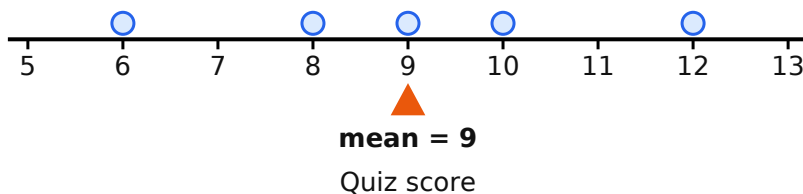


Figure 1. The mean is the balance point of the dots.

How do you measure variability?

Variability tells how spread out the data are. Three measures are used in this chapter.

Measures of variability

Measure	How to find it
Range	maximum minus minimum
Interquartile range (IQR)	$Q_3 - Q_1$, the spread of the middle half
Mean absolute deviation (MAD)	the mean of the distances of the values from the mean

To find the quartiles, order the data and find the median. The first quartile Q_1 is the median of the lower half. The third quartile Q_3 is the median of the upper half. For 10 values, each half has 5 values.

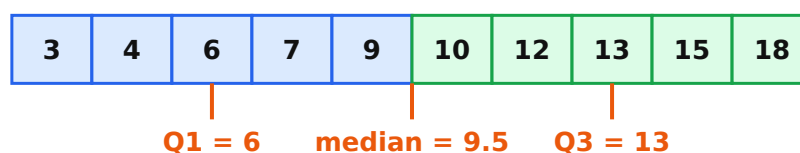


Figure 2. Ordered data split into a lower half (blue) and an upper half (green).

Here $IQR = 13 - 6 = 7$ and the range is $18 - 3 = 15$.

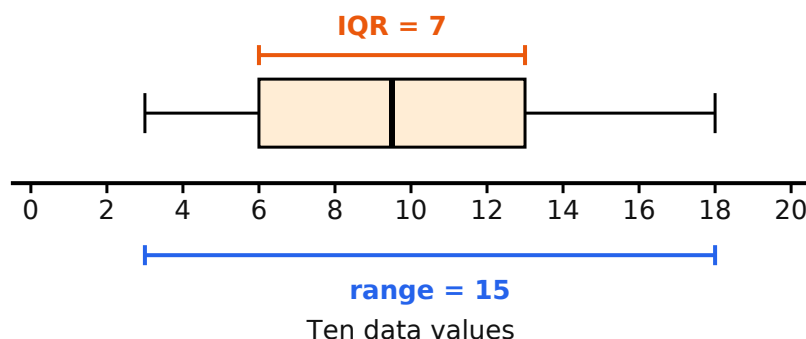


Figure 3. The IQR is the length of the box; the range is the length of the whole plot.

How do you find the MAD?

1. Find the mean.
2. Find the distance from each value to the mean.
3. Add the distances.
4. Divide by the number of values.

Example. For 6, 8, 9, 10, and 12 the mean is 9.

Value	6	8	9	10	12
Distance from 9	3	1	0	1	3

The distances add to 8, so $MAD = \frac{8}{5} = 1.6$.

How do outliers change the answer?

Seven students' weekly allowances are \$8, \$10, \$10, \$12, \$12, \$14, and \$46. The mean is \$16, higher than six of the seven values, but the median is \$12.

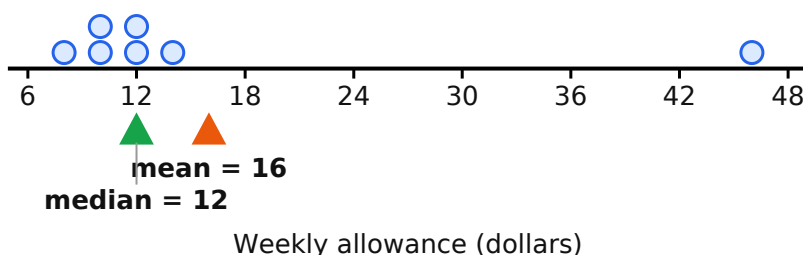


Figure 4. The value 46 pulls the mean up, but the median stays near the cluster.

When the data are skewed or have an outlier, use the median and the IQR. When the data are roughly symmetric, the mean and the MAD describe them well.

Mean, Median, Range, IQR and Mean Absolute Deviation: frequently asked questions

What is the difference between the mean and the median?

The mean is the sum of the values divided by how many there are. The median is the middle value when the data are in order. The mean is affected by outliers, but the median is not.

How do you find the interquartile range?

Order the data, find the median of the lower half Q_1 and the median of the upper half Q_3 , then subtract: $IQR = Q_3 - Q_1$. It measures the spread of the middle half of the data.

What is the mean absolute deviation?

It is the mean of the distances between each value and the mean of the data. A small MAD means the values are close to the mean, and a large MAD means they are spread out.

When should you use the median instead of the mean?

Use the median when the data are skewed or have an outlier, because a few extreme values pull the mean away from the cluster. Pair it with the IQR.

How do you find a missing value when the mean is known?

Multiply the mean by the number of values to get the total. Subtract the sum of the known values to find the missing one.