

9.3 Measures of Center

ESSENTIAL QUESTION: How do you find the median and mode of a set of numbers?

80, 85, 86, 89, 95, 95, 100, 103
 92 98, 85, 80, 88, 103, 89, 100, 95

Mode = 95

Median = 92

Find the mean of 89 & 95

$$\begin{array}{r} 92 \\ 2 \overline{)184} \\ \underline{184} \\ 0 \end{array}$$

$$\begin{array}{r} 1 \\ 89 \\ + 95 \\ \hline 184 \end{array}$$

Find the median and mode of the data.

20, 4, 17, 8, 9, 5, 20, 13, 12

4, 5, 8, 9, 12, 13, 17, 20, 20 Median = 12
 Mode = 20

A measure of center is a measure that describes the typical value of a data set. The mean is one type of measure of center. Here are two others.

Median

Put data in order from least to greatest

For an odd number of values, the median is the middle value.

For an even number of values, the median is the mean of the 2 middle numbers.

Mode

Value(s) that occur most often.

There can be 1 mode, more than 1 mode, or no mode.

When all values occur only once, there is no mode.

EXAMPLE 1 -> Finding the Median and Mode

Find the median and mode of the bowling scores.

90, 105, 120, 125, 135, 145, 160, 160, 175, 205

Median = 140

Mode = 160

$$\begin{array}{r} 140 \\ 135 \\ + 145 \\ \hline 280 \end{array}$$

$$\begin{array}{r} 140 \\ 2 \overline{)280} \\ \underline{280} \\ 0 \end{array}$$

| | | | | |
|-----|-----|-----|-----|-----|
| 120 | 135 | 160 | 125 | 90 |
| 205 | 160 | 175 | 105 | 145 |

ON YOUR OWN

Find the median and mode of the data.

1. 20, 4, 17, 8, 12, 9, 5, 20, 13

95, 80, 85, 86, 89, 100, 95

2. 100, 75, 90, 80, 110, 102

75, 80, 90, 100, 102, 110

Median = 95

Mode = No Mode

$$\begin{array}{r} 8 \\ 2 \overline{)179} \\ \underline{16} \\ 19 \end{array}$$

Median = 89

Mode = 95

80, 85, 86, 89, 95, 95, 100, 100

EXAMPLE 2-> Finding the Mode

The list shows the favorite types of movies for students in a class. Organize the data in a frequency table. Then find the mode.

| Action | Comedy | Horror | Drama |
|--------|--------|--------|-------|
| | | | |
| 5 | 8 | 7 | 4 |

The mode is comedy

Favorite Types of Movies

| | | |
|--------|--------|--------|
| Comedy | Drama | Horror |
| Horror | Drama | Horror |
| Comedy | Comedy | Action |
| Action | Comedy | Action |
| Horror | Drama | Comedy |
| Comedy | Comedy | Horror |
| Horror | Comedy | Action |
| Horror | Action | Drama |

ON YOUR OWN

One member of the class was absent and ends up voting for horror. Does this change the mode? Explain.

Yes this will make the mode be both comedy and horror.

EXAMPLE 3-> Choosing the Best Measure of Center

Find the mean, median, and mode of the sneaker prices.

Which measure best represents the data?

48.5
8 | 388.0
326
69
-64
40
40

20
20
31
37
45
48
265
+ 122
388

20, 20, 31, 37, 45, 48, 65, 122

Mean = 48.5
Median = $\frac{37+45}{2} = \frac{82}{2} = 41$
Mode = 20

The median best represents the data because the mode is less than most of the data and the mean is greater than most of the data.



ON YOUR OWN

Find the mean, median, and mode of the data. Choose the measure that best represents the data. Explain your reasoning.

- 1, 93, 46, 48, 34, 194, 67, 55
2. 96, 150, 102, 87, 150, 75

1, 34, 46, 48, 55, 67, 93, 194
Mean = 67.25
Median = $\frac{48+55}{2} = \frac{103}{2} = 51.5$
Mode = no mode

31
34
46
48
55
67
493
+ 194
538

67.25
8 | 538.00
486
58
50
-10
40
40

The median best represents the data because it is closer to more of the data.

75, 87, 96, 102, 150, 150
Mean = 110
Median = $\frac{96+102}{2} = 99$
Mode = 150

75
87
396
102
150
+ 150
660

110
6 | 660
-60
6
-6
0
0

The median best represents the data because the mode is the greatest value and the mean is greater than most of the data.

EXAMPLE 4 -> Removing an Outlier

Identify the outlier in Example 3. Find the mean, median, and mode without the outlier. Which measure does the outlier affect the most?

20 20 31 **37** 45 48 65 **122** ← outlier

with outlier
 Mean = 48.5
 Median = 41
 mode = 20

without outlier
 Mean $\frac{388-122}{7} = \frac{266}{7} = 38$
 median = 37
 Mode = 20

The mean is affected most by the outlier.

ON YOUR OWN

The times (in minutes) it takes six students to travel to school are 8, 10, 10, 15, 20, and 45.

Identify the outlier. Find the mean, median, and mode with and without the outlier. Which measure the outlier affect the most?

The outlier is 45.

with outlier
 8, 10, 10, 15, 20, 45
 Mean = $\frac{108}{6} = 18$
 Median $\frac{10+15}{2} = \frac{25}{2} = 12.5$
 mode = 10

without outlier
 8, 10, 10, 15, 20
 Mean = $\frac{63}{5} = 12.6$
 Median = 10
 mode = 10

The mean is affected the most by the outlier

EXAMPLE 5 -> Changing the Values of a Data Set

The prices of six video games at an online store are shown in the table.

The price of each game increases by \$4.98 when a shipping charge is included. How does this increase affect the mean, median, and mode?

| Video Game Prices | |
|-------------------|---------|
| \$53.42 | \$35.69 |
| \$18.99 | \$25.13 |
| \$27.97 | \$53.42 |

Original Prices
 mean = 35.77
 median = 31.83
 mode = 53.42

Prices with shipping charges
 mean = 53.42
 median = 36.81
 mode = 58.40

Video Game Prices with shipping charge

| | |
|---------|---------|
| \$58.40 | \$40.67 |
| \$23.97 | \$30.11 |
| \$32.95 | 58.40 |

ON YOUR OWN

What is if the store decreases the price of each video game by \$3. How does this decrease affect the mean, median, and mode?

The mean, median and mode all increase by 4.98

The mean, median, and mode will all decrease by \$3.