

9.3 Measures of Center

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

$$\begin{array}{r} 92 \quad 98, 85, 80, 86, 103, 89, 100, 95 \\ 80, 85, 86, 89, 95, 95, 100, 103 \end{array}$$

find the mean of 89 & 95

Mode = 95
Median = 92
$$\begin{array}{r} 1 \\ 89 \\ + 95 \\ \hline 184 \end{array}$$

$$\begin{array}{r} 2 \\ 184 \\ - 184 \\ \hline 0 \end{array}$$

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, 140, 145, 160, 160, 175, 205

Median = 140

Mode = 160

Bowling Scores					
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

$$\begin{array}{r} 8 \\ 2 \overline{) 179} \\ \underline{-16} \\ 19 \\ \underline{-16} \\ 3 \end{array}$$

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

75, 80, 90, 100, 102, 110

Median = 95

Mode = No Mode

Median = 89

Mode = 95

80, 85, 86, 89, 95, 95, 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
4			
5			

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 + his 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?

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

$$\text{Mean} = 48.5$$

$$\text{Median} = \frac{31+45}{2} = \frac{82}{2} = 41$$

$$\text{Mode} = 20$$

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.

$$1, 34, 46, 48, 34, 194, 67, 55$$

$$51.5$$

$$\text{Mean} = 61.25$$

$$\text{Median} = \frac{49+55}{2} = \frac{103}{2} = 51.5$$

$$\text{Mode} = \text{no mode}$$

$$3.1 \quad 67.25$$

$$3.4 \quad 8$$

$$588.00$$

$$4.6 \quad 481$$

$$4.8 \quad 38$$

$$5.5 \quad 50$$

$$6.7 \quad 20$$

$$4.93 \quad 150$$

$$+ 194 \quad 660$$

$$538 \quad - 10$$

$$- 40 \quad 40$$

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

$$2. 96, 150, 102, 87, 150, 75$$

$$75, 87, 96, 102, 150, 150$$

$$\text{Mean} = 110$$

$$\text{Median} = \frac{96+102}{2} = 99$$

$$\text{Mode} = 150$$

$$2. 75 \quad 110$$

$$87 \quad 660$$

$$396 \quad - 660$$

$$102 \quad - 660$$

$$150 \quad - 660$$

$$+ 150 \quad - 660$$

$$660 \quad - 660$$

$$- 10 \quad 0$$

$$- 40 \quad 0$$

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

with outlier

$$\text{Mean} = 48.5$$

$$\text{Median} = 41$$

$$\text{Mode} = 20$$

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 does the outlier affect the most?

The outlier is 45.

with outlier

8 10 10 15 20 45

$$\text{Mean} = \frac{108}{6} = 18$$

$$\text{Median} = \frac{10+15}{2} = \frac{25}{2} = 12.5$$

$$\text{Mode} = 10$$

45 48 65 122

without outlier

$$\text{Mean} = \frac{388-122}{7} = \frac{266}{7} = 38$$

$$\text{Median} = 37$$

$$\text{Mode} = 20$$

The mean is affected
most by the outlier.

without outlier

8 10 10 15 20

$$\text{Mean} = \frac{63}{5} = 12.6$$

$$\text{Median} = 10$$

$$\text{Mode} = 10$$

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?

Original Prices

$$\text{Mean} = 35.77$$

$$\text{Median} = 31.83$$

$$\text{Mode} = 53.42$$

Prices with Shipping Charges

$$\text{Mean} = 53.42$$

$$\text{Median} = 36.81$$

$$\text{Mode} = 58.40$$

Video Game Prices

\$53.42 \$35.69

\$18.99 \$25.13

\$27.97 \$53.42

Video Game Prices	Video Game Prices with Shipping Charge
\$53.42	\$35.69
\$18.99	\$25.13
\$27.97	\$53.42

ON YOUR OWN

What 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.