

Statistics and
Probability
Lesson 3:

Additional Data
and Outliers

Essential Question: How do outliers affect measures of center?

VOCABULARY

_____ - a value that is far from a majority of values in a data set (also called a **striking deviation**)

Find the outlier in this set of data: 6, 3, 2, 5, 8, 1, 52, 0 → Outlier: _____

EXAMPLE 1: ADDITIONAL DATA

A. The table below shows how many medals the United States won during the Winter Olympics. Find the mean, median, and mode of this data. Round to the nearest tenth.

U.S. Winter Olympic Medals Won								
Year	2014	2010	2006	2002	1998	1994	1992	1988
Medals	28	37	25	34	13	13	11	6

Mean: _____ ÷ _____ = _____ Median: _____ Mode: _____

B. The United States won 8 medals at Sarajevo in 1984 and 12 medals at Lake Placid in 1980. Add this data to the table and find the mean, median, and mode. How does this additional data change the measures of center?

U.S. Winter Olympic Medals Won										
Year	2014	2010	2006	2002	1998	1994	1992	1988	1984	1980
Medals	28	37	25	34	13	13	11	6		

Mean: _____ ÷ _____ = _____ Median: _____ Mode: _____

The mean _____ by _____.

The median _____ by _____.

The mode _____.

EXAMPLE 2: HOW DO OUTLIERS AFFECT DATA

In 2001, 64-year-old Sherman Bull became the oldest American to reach the top of Mount Everest. Other climbers to reach the summit that day were 33, 31, 31, 32, 33, and 28 years old. Find the mean, median, and mode **with and without** Bull's age, and explain the changes.

Outlier: _____

	With the Outlier	Without the Outlier
Mean	_____ ÷ _____ = _____	_____ ÷ _____ = _____
Median		
Mode		

NOTE: In 2014, Bill Burke reached the summit of Mt. Everest at the age of 72.

The mean _____ by _____. The median _____ by _____.

The mode _____.

The _____ is affected the most by an outlier.

ADDITIONAL DATA AND OUTLIERS: GUIDED PRACTICE

Daily High Temperature (°F)	
Monday	88
Tuesday	94
Wednesday	94
Thursday	92
Friday	87
Saturday	55

Find the mean, median, and mode with and without the outlier

Outlier = _____

	With the Outlier	Without the Outlier
Mean	_____ ÷ _____ = _____	_____ ÷ _____ = _____
Median		
Mode		

ADDITIONAL DATA AND OUTLIERS: INDEPENDENT PRACTICE

1. The table below shows how many wins the Philadelphia Phillies had from 2010 to 2016. Find the mean, median, and mode. The Phillies went to the World Series in 2008 (92 wins) and 2009 (93 wins). Add this data to the table and find the mean, median, and mode. Round to the nearest tenth.

Wins by the Philadelphia Phillies									
Year	2016	2015	2014	2013	2012	2011	2010	2009	2008
Wins	71	63	73	73	81	102	97		

2010 to 2016

Mean: _____ ÷ _____ = _____ Median: _____ Mode: _____

Including 2008 and 2009

Mean: _____ ÷ _____ = _____ Median: _____ Mode: _____

The mean _____ by _____.

The median _____ by _____.

The mode _____.

2. Julio Franco (42) of the New York Mets became the oldest player to hit a homerun on September 30, 2006. Four other Mets hit homeruns that day: David Wright (24), Endy Chavez (28), Ramon Castro (30), and Shawn Green (33). Find the mean, median, and mode with and without the outlier.

Outlier: _____

	With the Outlier	Without the Outlier
Mean	_____ ÷ _____ = _____	_____ ÷ _____ = _____
Median		
Mode		

The mean _____ by _____. The median _____ by _____.

The mode _____.

Essential Question: How do outliers affect measures of center?

VOCABULARY

outlier - a value that is far from a majority of values in a data set (also called a **striking deviation**)

Find the outlier in this set of data: 6, 3, 2, 5, 8, 1, 52, 0 → Outlier: 52

EXAMPLE 1: ADDITIONAL DATA

A. The table below shows how many medals the United States won during the Winter Olympics. Find the mean, median, and mode of this data. Round to the nearest tenth.

U.S. Winter Olympic Medals Won								
Year	2014	2010	2006	2002	1998	1994	1992	1988
Medals	28	37	25	34	13	13	11	6

Mean: $\frac{167}{8} = 20.9$ Median: 19 Mode: 13

Handwritten notes: 6, 11, 13, 13, 25, 28, 34, 37. A vertical line is drawn between 13 and 25. Below the line, $13+25=38$ and $38 \div 2$ are written.

B. The United States won 8 medals at Sarajevo in 1984 and 12 medals at Lake Placid in 1980. Add this data to the table and find the mean, median, and mode. How does this additional data change the measures of center?

U.S. Winter Olympic Medals Won										
Year	2014	2010	2006	2002	1998	1994	1992	1988	1984	1980
Medals	28	37	25	34	13	13	11	6	8	12

Mean: $\frac{187}{10} = 18.7$ Median: 13 Mode: 13

Handwritten notes: 6, 8, 11, 12, 13, 13, 25, 28, 34, 37. A vertical line is drawn between 13 and 13.

The mean decreased by 2.2.

The median decreased by 6.

The mode remained the same.

EXAMPLE 2: HOW DO OUTLIERS AFFECT DATA

In 2001, 64-year-old Sherman Bull became the oldest American to reach the top of Mount Everest. Other climbers to reach the summit that day were 33, 31, 31, 32, 33, and 28 years old. Find the mean, median, and mode **with and without** Bull's age, and explain the changes.

Outlier: 64

	With the Outlier	Without the Outlier
Mean	$\frac{252}{7} = 36$	$\frac{188}{6} = 31.3$
Median	28 31 31 <u>32</u> 33 33 64 32	28 31 31 32 33 33 31.5
Mode	31 and 33	31 and 33

NOTE: In 2014, Bill Burke reached the summit of Mt. Everest at the age of 72.

The mean decreased by 4.7. The median decreased by 0.5.

The mode remained the same.

The mean is affected the most by an outlier.

How does an outlier affect data?
mean: big
median: small
mode: not at all

ADDITIONAL DATA AND OUTLIERS: GUIDED PRACTICE

Daily High Temperature (°F)	
Monday	88
Tuesday	94
Wednesday	94
Thursday	92
Friday	87
Saturday	55

Find the mean, median, and mode with and without the outlier

Outlier = 55

	With the Outlier	Without the Outlier
Mean	$\frac{510}{6} = 85$	$\frac{455}{5} = 91$
Median	55 87 88 92 94 94 90	87 88 <u>92</u> 94 94 92
Mode	94	94

ADDITIONAL DATA AND OUTLIERS: INDEPENDENT PRACTICE

1. The table below shows how many wins the Philadelphia Phillies had from 2010 to 2016. Find the mean, median, and mode. The Phillies went to the World Series in 2008 (92 wins) and 2009 (93 wins). Add this data to the table and find the mean, median, and mode. Round to the nearest tenth.

Wins by the Philadelphia Phillies									
Year	2016	2015	2014	2013	2012	2011	2010	2009	2008
Wins	71	63	73	73	81	102	97	93	92

World Series Champs!

2010 to 2016

63 71 73 (73) 81 97 102

Mean: $\underline{560} \div \underline{7} = \underline{80}$ Median: $\underline{73}$ Mode: $\underline{73}$

Including 2008 and 2009

63 71 73 73 (81) 92 93 97 102

Mean: $\underline{745} \div \underline{9} = \underline{82.8}$ Median: $\underline{81}$ Mode: $\underline{73}$

The mean increased by 2.8.

The median increased by 8.

The mode remained the same.

2. Julio Franco (42) of the New York Mets became the oldest player to hit a homerun on September 30, 2006. Four other Mets hit homeruns that day: David Wright (24), Endy Chavez (28), Ramon Castro (30), and Shawn Green (33). Find the mean, median, and mode with and without the outlier.

Outlier: 42

	With the Outlier	Without the Outlier
Mean	$\underline{157} \div \underline{5} = \underline{31.4}$	$\underline{115} \div \underline{4} = \underline{28.8}$
Median	24 28 30 33 42 <u>30</u>	24 28 30 33 <u>29</u> <u>29</u>
Mode	<u>no mode</u>	<u>no mode</u>

The mean decreased by 2.6. The median decreased by 1.

The mode remained the same.