

## Mean, Median, And Mode

**Title:** Mean, Median, and mode

**Objectives:** Analyze and better understand the meaning of the measures of central tendency: mean, median and mode

**Materials:**

Teacher notes and script (*this page and next*)

Student Study guide (*1 copy per student*)

Student worksheet (*1 copy per student*)

**Previous Knowledge Needed:**

Basic math operations; basic statistics (calculating the mean, median, and mode)

**Important Concepts/Methods:**

The example done with the students downplay the calculations of finding the mean, median, and mode. It is meant to be a quick review to jog students' memories.

The second part of the example analyzes a set of data with and without an outlier. This will help students understand how the measures of central tendency are affected. The questions they answer after the problems will help them better understand the meaning of each, and be better at analyzing data and/or problems involving measures of central tendency.

**Script:**

(*Short review of how to calculate the mean, median, and mode*)

Does anyone remember how to find the mean for a set of data?

(*Fill in the definitions for mean, median, and mode using student responses, adjusting/correcting if necessary. Students fill in their worksheets with the definitions.*)

Mean: another name for the average; find the sum, then divide by the number of values in the data set.

Median: the middle value when the data are arranged in order from least to greatest.

Mode: the most frequently occurring value.

Let's do the following example together:

The following is a list of student test scores, out of 100. Find the mean, median, and mode.

45 89 82 76 98 90 85 82 68 92

Mean: the mean is the average, so we add up all of the numbers and divide by the number of values.

$$45 + 89 + 82 + 76 + 98 + 90 + 85 + 82 + 68 + 92 = 807$$

$$807 \div 10 = 80.7$$

Don't have the students work the calculations; we're just quickly reviewing the process.

are 10 values.

Median: we first have to put the values in order from least to greatest:

45 72 76 82 82 84 89 90 92 98

The middle is between 82 and 84, so we find the average of these (or, what number is exactly in between 82 and 84? The median is 83.

Mode: there are two tests with the score of 82, so the mode is 82. What if all of the test scores were different? We would say that there is no mode.

Script

## Mean, Median, And Mode

Now we're going to look at the test scores **WITHOUT** considering the score of 45. This is very low compared to all of the other scores. Let's see how this low score affects the mean, median, and mode.

Mean (without the 45):  $72 + 76 + 82 + 82 + 84 + 89 + 90 + 92 + 98 = 765$   
 $765 \div 9 = 85$

Median (without the 45): 72 76 82 82 84 89 90 92 98

Mode (without the 45): the mode does not change; the most frequently occurring score is still 82.

Let's compare:

	All ten test scores	Without the low score of 45
Mean:	80.7	85
Median:	83	84
Mode:	82	82

*(Answer the following questions in your own words or use what is written below.)*

Which measure was affected the most by the absence of the 45?

The mean is affected the most.

Why is the mean the measure that is affected the most?

The mean is calculated by adding up all of the values and then dividing. Each test score is used in calculating the mean.

Why is the median NOT affected much?

The median is about POSITION, not the actual test scores. Take a look:

$X + X + X + X + 84 + X + X + X + X$  The X's represent test scores. They could be *any* value and the middle/median would still be 84.

When is the mode affected?

Here is another set of test scores: 42 42 85 86 94 96 97. If we remove the low scores of 42, there will no longer be a mode.

*(Now students should try problems #1 and #2 on their worksheets. Answers are given below:)*

### Problem #1

1. Jaguars (the mean is 77)
2. Wolves (the median is 80)
3. The mean score (the mean score is 68.2 and the median score is 65)

### Problem #2

1. Mary (her mode is 1)
2. They all went the same amount (the medians are all 2)
3. 1<sup>st</sup> John and Brian (their mean is 2.42)  
2<sup>nd</sup> Kelly (her mean is 2.17)  
3<sup>rd</sup> Mary (her mean is 1.92)
4. July (the mean is 3.25)
5. January (the median is 1)

### **Student Problems:**

Problem #1 and #2 in the Student Worksheet

**Problem #1**

There are three different basketball teams and each has played five games. Each team's score from each of its games is in the first table below. Each team's statistics are calculated for you in the second table.

	Game 1	Game 2	Game 3	Game 4	Game 5
Jaguars	67	87	54	99	78
Wolves	85	90	44	80	46
Lions	32	101	65	88	55

Statistics	Mean	Median
Jaguars	77	78
Wolves	69	80
Lions	68.2	65

1. Suppose you want to join one of the three basketball teams. You want to join the one that is doing the best so far. If you rank each team by their mean scores, which team would you join?
2. Instead of using mean scores, you use the median score of each team to make your decision. Which team do you join?
3. Pretend you are the coach of the Lions and you were being interviewed about your team for the local newspaper. Would it be better for you to report your mean scores or your median score?

## Problem #2

You and your friends are comparing the number of times you have been to the movies in the past year. The following table illustrates how many times each person went to the movie theatre in each month. The second table shows the statistics for each friend. The third table shows the statistics for each month.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
John	1	3	2	5	2	3	1	4	2	3	2	1
Mary	1	2	1	1	1	3	3	2	2	4	1	2
Brian	1	3	2	2	1	4	5	3	2	2	1	3
Kelly	2	2	1	1	3	2	4	1	3	2	3	2

Statistics	Mean	Median	Mode
John	2.42	2	2
Mary	1.92	2	1
Brian	2.42	2	2
Kelly	2.17	2	2

Statistics	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Mean	1.25	2.5	1.5	2.25	1.75	3	3.25	2.5	2.25	2.75	1.75	2
Median	1	2.5	1.5	1.5	1.5	3	3.5	2.5	2	2.5	1.5	2

1. By comparing modes, which person went to the movies the least per month?
2. By comparing medians, which person went to the movies the most per month?
3. Rank the friends in order of most movies seen to least movies seen by comparing their means.
4. Which month, by comparing the means of movies seen in each month, is the most popular movie-watching month?
5. By comparing medians, which month is the least popular month?

**Problem #1**

There are three different basketball teams and each has played five games. Each team's score from each of its games is in the first table below. Each team's statistics are calculated for you in the second table.

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Statistics	Mean	Median
Jaguars	77	78
Wolves	69	80
Lions	68.2	65

1. Suppose you want to join one of the three basketball teams. You want to join the one that is doing the best so far. If you rank each team by their mean scores, which team would you join?

Jaguars, mean is 77

2. Instead of using mean scores, you use the median score of each team to make your decision. Which team do you join?

Wolves, median 80

3. Pretend you are the coach of the Lions and you were being interviewed about your team for the local newspaper. Would it be better for you to report your mean scores or your median score?

mean score

## Problem #2

You and your friends are comparing the number of times you have been to the movies in the past year. The following table illustrates how many times each person went to the movie theatre in each month. The second table shows the statistics for each friend. The third table shows the statistics for each month.

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Mary	1	2	1	1	1	3	3	2	2	4	1	2
Brian	1	3	2	2	1	4	5	3	2	2	1	3
Kelly	2	2	1	1	3	2	4	1	3	2	3	2

Statistics	Mean	Median	Mode
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Statistics	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Mean	1.25	2.5	1.5	2.25	1.75	3	3.25	2.5	2.25	2.75	1.75	2
Median	1	2.5	1.5	1.5	1.5	3	3.5	2.5	2	2.5	1.5	2

1. By comparing modes, which person went to the movies the least per month?

Mary, her mode is 1

2. By comparing medians, which person went to the movies the most per month?

They all went the same

3. Rank the friends in order of most movies seen to least movies seen by comparing their means.

1st John + Brian 2nd Kelly 3rd Mary

4. Which month, by comparing the means of movies seen in each month, is the most popular movie-watching month?

July

5. By comparing medians, which month is the least popular month?

January

Student Study Guide

Mean	Median	Mode
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Example: Test scores- 45 89 82 76 98 90 85 82 68 92

*Students: fill in the values as your teacher gives them to you.*

Mean

Median

Mode

Remove the low score of 45 and recalculate the mean, median, and mode: 89 82 76 98 90 85 82 68 92

*Students: fill in the values as your teacher gives them to you.*

Mean

Median

Mode

Comparison

All ten test scores

Nine test scores (without the 45)

Mean: \_\_\_\_\_

\_\_\_\_\_

Median: \_\_\_\_\_

\_\_\_\_\_

Mode: \_\_\_\_\_

\_\_\_\_\_

Which measure was affected the most by the absence of the 45?

Why is the mean the measure that is affected?

Why is the median NOT affected much?

When is the mode affected?

<p><b>Mean</b></p> <p>Another name for average; find the sum, then divide by the number of values in the data set.</p> <p>.</p>	<p><b>Median</b></p> <p>The middle value when the data are arranged in order from least to greatest</p>	<p><b>Mode</b></p> <p>The most frequently occurring value</p>
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Example: Test scores- 45 89 82 76 98 90 85 82 68 92

Students: fill in the values as your teacher gives them to you.

$45 + 89 + 82 + 76 + 98 + 90 + 85 + 82 + 68 + 92 = 807$   
Mean  $807 \div 10 = 80.7$

$45 \ 72 \ 76 \ 82 \ 82 \ 84 \ 89 \ 90 \ 92 \ 98$   
Median  $83$

$90 \ 92 \ 98$   
Mode  $82$

Remove the low score of 45 and recalculate the mean, median, and mode: 89 82 76 98 90 85 82 68 92

Students: fill in the values as your teacher gives them to you.

$72 + 76 + 82 + 82 + 84 + 89 + 90 + 92 + 98 = 765$   
Mean  $765 \div 9 = 85$

$84$   
Median  $84$

$82$   
Mode  $82$

Comparison

All ten test scores

Nine test scores (without the 45)

Mean:	<u>80.7</u>	<u>85</u>
Median:	<u>83</u>	<u>84</u>
Mode:	<u>82</u>	<u>82</u>

Which measure was affected the most by the absence of the 45?

mean

Why is the mean the measure that is affected?

mean is calculated by adding all and dividing. All the scores are used for calculating

Why is the median NOT affected much?

It is about position, not value.

When is the mode affected?

when a number that is the mode is removed.