Measures of Central Tendency: Mean, Median, and Mode Examples

1. **Lesson Initiator** – What is the purpose of finding an "**average**?"

   Answers will vary. A sample answer would be that an average is a value representative of a group of values.

2. In analyzing, statistical data, it is often useful to have numbers describe the complete set of data. "**Measures of central tendency**" are used because they represent centralized or middle values of the data. These measures of central tendency are called the "**mean**," "**median**," and "**mode**."

3. The "**mean**" is a number that represents an "**average**" of a set of data. It is found by adding the elements in the set and then dividing that sum by the number of elements in the set.

Definition of Mean	The "**mean**" of a set of data is the sum of the elements in the set divided by the number of elements in the set.

4. **Example** – The high temperatures for a 7-day week during December in Chicago were 29^o, 31^o, 28^o, 32^o, 29^o, 27^o, and 55^o. Find the **mean** high temperature for the week.

Mean = $\dfrac{29+31+28+32+29+27+55}{7}$

The mean is the sum of 7 numbers divided by 7.

Mean = $\dfrac{231}{7}$

Mean = 33

The mean, or average, high temperature for the week was 33^o.

5. **Thought Provoker** – In the example above, is 33^o a good representation of the data?

The mean temperature, 33^o, is greater than all of the daily temperatures except one, 55^o. Thus, 33^o is not a very good representation of the average of the set of data. Extremely high or low values, such as 55^o, affect the mean.

Point out to students that because the 33^o temperature is not a good representation of the set of data, possibly the mean is not always the best average. This opens the door to introducing the "median" and "mode" as averages that sometimes are better representations.

6. **Example –** A football team had offensive drives of 43, 42, 45, 44, 45, and 48 yards. Find the mean offensive drive for the team.

Mean = $\frac{43+42+45+44+45+48}{6}$

The mean is the sum of 6 numbers divided by 6.

Mean = $\frac{267}{6}$ ➔ **44.5**

The mean, or average, offensive drive is 44.5 yards.

7. **Example** – The heights of players on Central High School's basketball team are 72", 74", 70", 78", 75", and 70". Find the mean height.

Mean = $\frac{72+74+70+78+75+70}{6}$

Mean = $\frac{439}{6} = 73\frac{1}{6}$

The mean, or average, height is $73\frac{1}{6}$**".**

8. Another measure of central tendency is the "**median**." The same number of values are above the median as below the median.

Definition of Median	The "**median**" is the middle number of a set of data when the numbers are arranged in numerical order.

9. **Example** – The high temperatures for a 7-day week during December in Chicago were 29^o, 31^o, 28^o, 32^o, 29^o, 27^o, and 55^o. Find the **median** high temperature for the week.

Arrange the numbers in order from least to greatest.

27^o 28^o 29^o 29^o 31^o 32^o 55^o

Emphasize that the data must be arranged in numerical order, either greatest to least value or from least value to greatest value.

Since there are an odd number of temperatures, 7, the middle one is the fourth value, which is 29^o. The median temperature for the 7-day period is 29^o.

10. In the above example, is the **mean** or **median** a better measure of central tendency?

The median is a better representation. The extremely high temperature does not affect it.

11. **Thought Provoker** – If a set of data contains an even number of elements, how do you determine the **median**?

If a set of data contains an even number of elements, the median is the value halfway between the two middle elements. In other words, when there are an even number of elements in a set of data, the median is found by determining the mean of the two middle elements.

12. **Example** – The batting averages for 10 members of a baseball team are 0.234, 0.256, 0.321, 0.333, 0.290. 0.240, 0.198, 0.222, 0.300, and 0.276. Find the median batting average.

Arrange the batting averages in order.

0.198, 0.22, 0.234, 0.240, 0.256, 0.276, 0.290, 0.300, 0.321, 0.333
Since there are an even number of batting averages, the median is halfway between the two middle elements, 0.256 and 0.276.

$$\frac{0.256 + 0.276}{2} = 0.266$$

Find the mean of the two middle elements.

The median batting average is 0.266.
There are five averages above the median and five below the median.

13. The tuition costs for ten private schools in Florida are $7568, $8650, $9225, $5880, $6720, $8840, $7820, $ 8260, $ 8432, and $8990. Find the median tuition costs.

Arrange the tuition costs in order.

5880 6720 7568 7820 8260 8432 8650 8840 8990 9225

Since there is an even number of elements, the median is halfway between the two middle tuition costs, 8260 and 8432.

Median = $\frac{8260 + 8432}{2} = 8346$

The median tuition cost is $8346.
There are five costs above the median and five below the median.

14. Another measure of **central tendency** is called the **mode**.

Definition of Mode	The **mode** is the number that occurs most often in a set of data.

15. **Thought Provoker** – If no number occurs more than the other numbers, what is the mode?

If no number occurs more often than the other numbers, then a set of data has no mode.

16. **Thought Provoker** – What if a set of data has multiple occurrences of certain numbers, what is the mode?

A set of data may have more than one mode. For example, in {2, 3, 3, 4, 6, 6}, 3 and 6 are both modes for the set of data.

For a set in which there are two modes, it is sometimes said to be bimodal, a set of three modes, trimodal, and so on.

17. **Example** – The stem and leaf plot represents the scores on the Chapter 5 test in Mrs. Jone's geometry class. Find the median and mode scores.

Geometry Test Scores

Stem	Leaf
5	6 8 9
6	1 6 9
7	4 5 77 99
8	2 4 6 7 7 8 8 9
9	1 3 3 4 4 5 5 5 7
10	0 0

There are 31 scores shown. The median will be the middle score, or the 16th value. You can count the leaves from the bottom up to the 16th score or from the top down.

The median score is 87.

The mode is the score that appears most often. Note that for stem 9, there are three leaves with a value of 5.

The mode is 95.

18. **Example** – The stem and leaf plot shown represents the scores on an algebra test. Find the median and mode.

Algebra Test Scores

Stem	Leaf
3	2 4
4	0 2
5	1 1 3 7
6	2 3 4 4 6 8
7	1 3 5 6 7 9
8	2 5 6 8 8
9	3 6

There are 27 scores shown. The median will be the middle score, or the 14th value. You can count the leaves from the bottom up to the 14th score or from the top down.

The median score is 68.

The mode is the score that appears most often. Note that there are three modes, 51, 64, and 88. Each occurs three times.

Name:_____
Date:_____
Class:_____

Measures of Central Tendency: Mean, Median, and Mode Worksheet

Find the mean, median, and mode for each set of data

1. 4, 6, 9, 12, 5
2. 7, 13, 4, 7
3. 10, 3, 8, 15
4. 9, 9, 9, 9, 8
5. 300, 24, 40, 50, 60
6. 23, 23, 12, 12

Find the median and mode of the data represented in each stem and leaf plot.

7.

Stem	Leaf
7	3 5
8	2 2 4
9	0 4 7 9
10	5 8
11	4 6

8.

Stem	Leaf
5	3 3
6	5 8
7	3 7 7
8	4 8 8 9

9.

Stem	Leaf
9	3 5
10	2 5 8
11	5 8 9 9
12	47 8 9

Solve:

10. The price list for computers shown in a magazine advertisement was $899, $1295, $1075, $1597, and $1800. Find the median price.

11. The prices of six different models of printers in a computer store a re $299, $349, $495, $329, $198, and $375. Find the median price.

12. In a basketball game between Kennedy High School and Lincoln High School, the Lincoln players' individual points were 23, 4, 6, 11, 4, 7, 8, 12, 3, and 5. Find the mean, median, and mode of the individual points.

13. Olivia swims the 50-yard freestyle for the Mud Dogs swim team. Her times in the last six meets were 26.89 seconds, 26.27 seconds, 25.18 seconds, 25.63 seconds, 27.16 seconds, and 27.18 seconds. Find the mean and median of her swimming times.

14. The prices of slacks in five different stores are $29.95, $31.50, $25.45, $33. 49, and $28.49. Find the mean price of slacks.

15. Shane bowled 6 games, and his scores were 147, 134, 132, 157, 123, and 140. Find his mean and median bowling scores.

16. One of the events in the Winter Olympics is the Men's 500-meter Speed Skating. The times for this event are show to the right. Find the mean, median, and mode times.

Year	**Time**	**Year**	**Time**
1928	43.4	1964	40.1
1932	43.4	1968	40.3
1936	43.4	1972	39.44
1948	43.1	1976	39.17
1952	43.2	1980	38.03
1956	40.2	1984	38.19
1960	40.2	1988	36.45

Measures of Central Tendency: Mean, Median, and Mode Worksheet Key

Find the mean, median, and mode for each set of data

1. 4, 6, 9, 12, 5 ➔ **mean = 7.2; median = 6; mode = no mode**
2. 7, 13, 4, 7 ➔ **mean = 7.75; median = 7; mode = 7**
3. 10, 3, 8, 15 ➔ **mean = 9; median = 9; mode = no mode**
4. 9, 9, 9, 9, 8 ➔ **mean = 8.8; median = 9; mode = 9**
5. 300, 24, 40, 50, 60 ➔ **mean = 96.8; median = 50; mode = no mode**
6. 23, 23, 12, 12 ➔ **mean = 17.5; median = 17.5; mode = 12, 23**

Find the median and mode of the data represented in each stem and leaf plot.

7.

Stem	Leaf
7	3 5
8	2 2 4
9	0 4 7 9
10	5 8
11	4 6

There are 13 items in the table. The 7th term, 94, is the median.

82 occurs twice, therefore 82 is the mode.

8.

Stem	Leaf
5	3 3
6	5 8
7	3 7 7
8	4 8 8 9

There are 10 items in the table. The median is halfway between the 5th and 6th terms $\frac{77+77}{2}$, therefore 77 is the median.

77 and 88 occur twice, therefore 77 and 88 are the modes.

9.

Stem	Leaf
9	3 5
10	2 5 8
11	5 8 9 9
12	4 7 8 9

There are 12 items in the table. The median is halfway between the 6th and 7th terms $\frac{115+118}{2}$, therefore 116.5 is the median.

119 occurs twice, therefore 119 is the mode.

Solve:

10. The price list for computers shown in a magazine advertisement was $899, $1295, $1075, $1597, and $1800. Find the median price.

Place in numerical order.

899, 1075, 1295, 1597, 1800

$1295 is the median price.

11. The prices of six different models of printers in a computer store a re $299, $349, $495, $329, $198, and $375. Find the median price.

Place in numerical order.

198 299, 329 349, 375 495

The median is halfway between the 3rd and 4th terms

Median = $\frac{329+349}{2}$ **= 339**

12. In a basketball game between Kennedy High School and Lincoln High School, the Lincoln players' individual points were 23, 4, 6, 11, 4, 7, 8, 12, 3, and 5. Find the mean, median, and mode of the individual points.

Mean = sum of all terms divided by ten = $\frac{83}{10} = 8.3$

Median (place in numerical order) 3, 4, 4, 5, 6, 7, 8, 11, 12, 23

The median is halfway between the 5th and 6th terms $\frac{6+7}{2} = 6.5$

The is 4, it occurs twice.

13. Olivia swims the 50-yard freestyle for the Mud Dogs swim team. Her times in the last six meets were 26.89 seconds, 26.27 seconds, 25.18 seconds, 25.63 seconds, 27.16 seconds, and 27.18 seconds. Find the mean and median of her swimming times.

Mean = sum of all terms divided by six = $\frac{158.31}{6} = 26.385$ **s**

Median (place in numerical order) 25.18, 25.63, 26.27, 26.89, 27.16, 27.18

The median is halfway between the 3rd and 4th terms $\frac{26.27 + 26.89}{2} = 26.58$ **s**

14. The prices of slacks in five different stores are $29.95, $31.50, $25.45, $33.49, and $28.49. Find the mean price of slacks.

Mean = sum of all terms divided by five $\frac{148.88}{2} = 29.776 \cong 29.78$

Mean = $29.78

15. Shane bowled 6 games, and his scores were 147, 134, 132, 157, 123, and 140. Find his mean and median bowling scores.

Mean = sum of all terms divided by six $\frac{833}{6} = 138\frac{5}{6}$

Median (place in numerical order) 123, 132, 134, 140, 147, 157

Median is halfway between the 3rd and 4th terms $\frac{134 + 140}{2} = 137$

16. One of the events in the Winter Olympics is the Men's 500-meter Speed Skating. The times for this event are show to the right. Find the mean, median, and mode times.

Year	Time	Year	Time
1928	43.4	1964	40.1
1932	43.4	1968	40.3
1936	43.4	1972	39.44
1948	43.1	1976	39.17
1952	43.2	1980	38.03
1956	40.2	1984	38.19
1960	40.2	1988	36.45

Mean = sum of all terms divided by fourteen $\frac{568.54}{14}$ **= 40.61**

Median (place in numerical order) 36.45, 38.03, 38.19, 39.17, 39.44, 40.1, 40.2, 40.2, 40.3, 43.1, 43.2, 43.4, 43.4, 43.4

The median is halfway between the 7th and 8th terms $\frac{40.2 + 40.2}{2}$ **= 40.2**

The mode is 43.4, it occurs three times.

Student Name: _____

Date: _____

Measures of Central Tendency: Mean, Median, and Mode Checklist

1. On questions 1 thru 6, did the student find the mean correctly?

    a. All six (30 points)
    b. Five of the six (25 points)
    c. Four of the six (20 points)
    d. Three of the six (15 points)
    e. Two of the six (10 points)
    f. One of the six (5 points)

2. On questions 1 thru 6, did the student find the median correctly?

    a. All six (30 points)
    b. Five of the six (25 points)
    c. Four of the six (20 points)
    d. Three of the six (15 points)
    e. Two of the six (10 points)
    f. One of the six (5 points)

3. On questions 1 thru 6, did the student find the mode correctly?

    a. All six (30 points)
    b. Five of the six (25 points)
    c. Four of the six (20 points)
    d. Three of the six (15 points)
    e. Two of the six (10 points)
    f. One of the six (5 points)

4. On questions 7 thru 9, did the student find the median correctly based on the stem and leaf plot?

    a. All three (15 points)
    b. Two of the three (10 points)
    c. One of the three (5 points)

5. On questions 7 thru 9, did the student find the mode correctly based on the stem and leaf plot?

    a. All three (15 points)
    b. Two of the three (10 points)
    c. One of the three (5 points)

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6. On questions 10 and 11, did the student find the median correctly?

    a. Both (10 points)
    b. One of the two (5 points)

7. On question 12, did the student find the mean, median, and mode correctly?

    a. All three (15 points)
    b. Two of the three (10 points)
    c. One of the three (5 points)

8. On question 13, did the student find the mean and median correctly?

    a. Both (10 points)
    b. One of the two (five points)

9. On question 14, did the student find the mean price correctly?

    a. Yes (5 points)

10. On question 15, did the student find the mean and median scores correctly?

    a. Both (10 points)
    b. One of the two (five points)

11. On question 16, did the student find the mean, median, and mode correctly?

    a. All three (15 points)
    b. Two of the three (10 points)
    c. One of the three (5 points)

Total Number of Points _____

A 166 points and above

B 148 points and above

C 129 points and above

D 111 points and above

F 110 points and below