

Measures of central tendency are numbers that locate or approximate the “center” of a set of data—that is, a “typical” value that describes the set of data. Mean and median are the most common measures of central tendency.

The mean is the arithmetic average of a data set. Add all the values in a set and divide this sum by the number of values in the set. The median is the middle number in a set of data arranged numerically. An outlier is a number that is much smaller or larger than most of the others in the data set. The range of a data set is the difference between the highest and lowest values of the data set.

For additional information, see the Math Notes boxes in Lessons 1.1.3 and 1.1.4 of the *Core Connections, Course 2* text.

The mean is calculated by finding the sum of the data set and dividing it by the number of elements in the set.

Example 1

Find the mean of this set of data: 34, 31, 37, 44, 38, 34, 42, 34, 43, and 41.

- $34 + 31 + 37 + 44 + 38 + 34 + 42 + 34 + 43 + 41 = 378$
- $\frac{378}{10} = 37.8$

The mean of this set of data is 37.8.

Example 2

Find the mean of this set of data: 92, 82, 80, 92, 78, 75, 95, and 77.

- $92 + 82 + 80 + 92 + 78 + 75 + 95 + 77 = 671$
- $\frac{671}{8} = 83.875$

The mean of this set of data is 83.875.

Problems

Find the mean of each set of data.

1. 29, 28, 34, 30, 33, 26, and 34.
2. 25, 34, 35, 27, 31, and 30.
3. 80, 89, 79, 84, 95, 79, 78, 89, 76, 82, 76, 92, 89, 81, and 123.
4. 116, 104, 101, 111, 100, 107, 113, 118, 113, 101, 108, 109, 105, 103, and 91.

The median is the middle number in a set of data *arranged in numerical order*. If there is an even number of values, the median is the mean (average) of the two middle numbers.

Example 3

Find the median of this set of data: 34, 31, 37, 44, 38, 34, 43, and 41.

- Arrange the data in order: 31, 34, 34, 37, 38, 41, 43, 44.
- Find the middle value(s): 37 and 38.
- Since there are two middle values, find their mean: $37 + 38 = 75$, $\frac{75}{2} = 37.5$. Therefore, the median of this data set is 37.5.

Example 4

Find the median of this set of data: 92, 82, 80, 92, 78, 75, 95, 77, and 77.

- Arrange the data in order: 75, 77, 77, 78, 80, 82, 92, 92, 95.
- Find the middle value(s): 80. Therefore, the median of this data set is 80.

Problems

Find median of each set of data.

5. 29, 28, 34, 30, 33, 26, and 34.

6. 25, 34, 27, 25, 31, and 30.

7. 80, 89, 79, 84, 95, 79, 78, 89, 76, 82, 76, 92, 89, 81, and 123.

8. 116, 104, 101, 111, 100, 107, 113, 118, 113, 101, 108, 109, 105, 103, and 91.

The range of a set of data is the difference between the highest value and the lowest value.

Example 5

Find the range of this set of data: 114, 109, 131, 96, 140, and 128.

- The highest value is 140.
- The lowest value is 96.
- $140 - 96 = 44$
- The range of this set of data is 44.

Example 6

Find the range of this set of data: 37, 44, 36, 29, 78, 15, 57, 54, 63, 27, and 48.

- The highest value is 78.
- The lowest value is 27.
- $78 - 27 = 51$
- The range of this set of data is 51.

Problems

Find the range of each set of data in problems 5 through 8.

Outliers are numbers in a data set that are either much higher or much lower than the other numbers in the set.

Example 7

Find the outlier of this set of data: 88, 90, 96, 93, 87, 12, 85, and 94.

- The outlier is 12.

Example 8

Find the outlier of this set of data: 67, 54, 49, 76, 64, 59, 60, 72, 123, 44, and 66.

- The outlier is 123.

Problems

Identify the outlier in each set of data.

9. 70, 77, 75, 68, 98, 70, 72, and 71.

10. 14, 22, 17, 61, 20, 16, and 15.

11. 1376, 1645, 1783, 1455, 3754, 1790, 1384, 1643, 1492, and 1776.

12. 62, 65, 93, 51, 55, 14, 79, 85, 55, 72, 78, 83, 91, and 76.

The axis (or axes) of a graph must be marked with equal-sized spaces called intervals. Marking the uniform intervals on the axes is called scaling the axes. The difference between consecutive markings tells the size (scale) of each interval. Note that each axis of a two-dimensional graph may use a different scale.

Sometimes the axis or set of axes is not provided. A student must count the number of usable spaces on the graph paper. How many spaces are usable depends in part on how large the graph will be and how much space will be needed for labeling beside each axis.

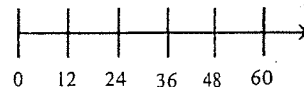
Follow these steps to scale each axis of a graph.

1. Find the difference between the smallest and largest numbers (the range) you need to put on an axis.
2. Count the number of intervals (spaces) you have on your axis.
3. Divide the range by the number of intervals to find the interval size.
4. Label the marks on the axis using the interval size.

Sometimes dividing the range by the number of intervals produces an interval size that makes it difficult to interpret the location of points on the graph. The student may then exercise judgment and round the interval size up (always up, if rounded at all) to a number that is convenient to use. Interval sizes like 1, 2, 5, 10, 20, 25, 50, 100, etc., work well. For more information, see the Math Notes box in Lesson 1.2.2 of *the Core Connections, Course 2* text.

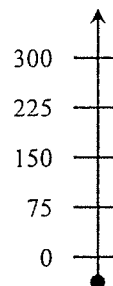
Example 1

1. The difference between 0 and 60 is 60.
2. The number line is divided into 5 equal intervals.
3. 60 divided by 5 is 12.
4. The marks are labeled with multiples of the interval size 12.



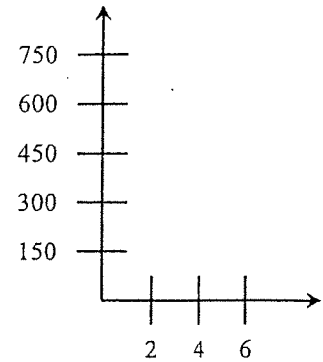
Example 2

1. The difference between 300 and 0 is 300.
2. There are 4 intervals.
3. $300 \div 4 = 75$
4. The axis is labeled with multiples of 75.



Example 3

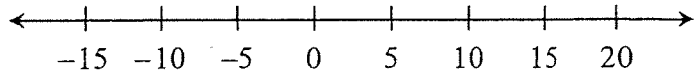
1. The difference on the vertical axis is $750 - 0 = 750$. (The origin is $(0, 0)$.) On the horizontal axis the range is $6 - 0 = 6$.
2. There are 5 spaces vertically and 3 spaces horizontally.
3. The vertical interval size is $750 \div 5 = 150$. The horizontal interval is $6 \div 3 = 2$.
4. The axes are labeled appropriately.



Example 4

Sometimes the axes extend in the negative direction.

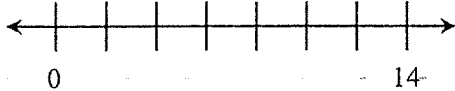
1. The range is $20 - (-15) = 35$.
2. There are 7 intervals along the line.
3. $35 \div 7 = 5$
4. Label the axes with multiples of five.



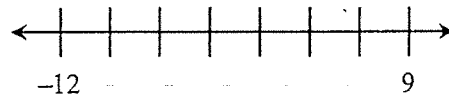
Problems

Scale each axis:

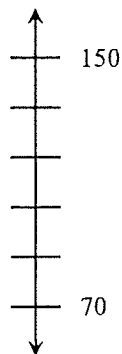
1.



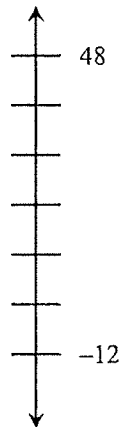
2.



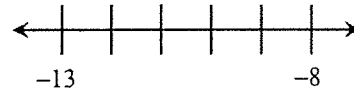
3.



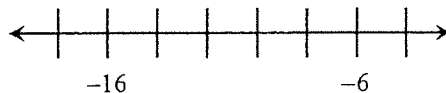
4.



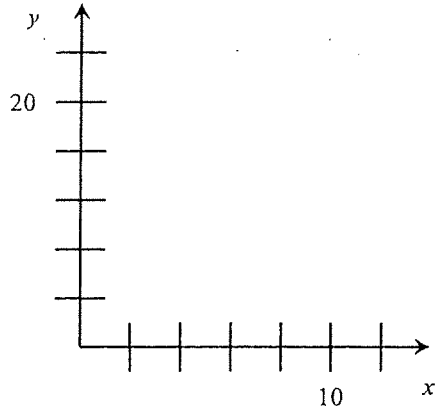
5.



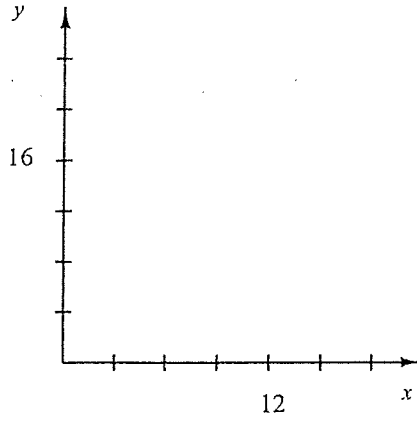
6.



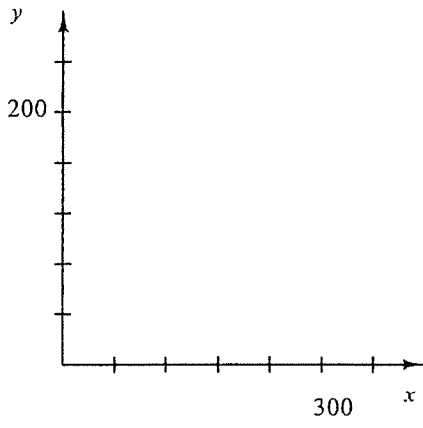
7.



8.



9.



10. Use fractions.

