Using Mean, Median, and Mode

Whether you use mean, median, or mode depends both
• on the **type of data** and
• on the **shape of distribution**.

**Example.** This distribution of science quiz scores is heavily skewed (asymmetrical), and its “peak” is at 6. Which of the three measures of center would best describe this distribution?

Let’s calculate the mean, median, and mode.

**Mode:** We can see from the graph that the mode is 6.

**Median:** There are 24 students. The students’ actual scores are 1, 2, 3, 3, 4, 4, 4, 5, 5, 5, 5, 5, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6.

The median is the average of the 12th and 13th scores, which is 5.

The **mean** is \[
\frac{1 + 2 + 3 + 3 + 4 + 4 + 4 + 7 \times 5 + 10 \times 6}{24} = 4.79167 \approx 4.79.
\]

Notice that the mean is less than 5, but the two highest bars on the graph are at 5 and 6. In this case, the mean does not describe the peak of the distribution very well because it actually falls outside the peak! Both the median and the mode do describe it well.

1. a. Find the mean, median, and mode of this data set: 3, 4, 4, 5, 5, 5, 5, 6, 8, 25.

   mean _______ median _______ mode _______

b. Which of the three, mean, median, or mode, best describes the center of this data?

   Clearly, either the _______ or the _______, but not the _______!

   The _______ is off from the central peak of the distribution.

   The reason for this is that the data item “25” throws it off. This 25 is very different from the other data items in the set, and could even be a typing error! Such an item is called an **outlier**.

2. The graph shows the response to a certain question in a survey. It was measured as a yes/no question. Which of the below are possible to determine? (Mark with an “x”).

   ___ mean ___ median ___ mode

   *Hint:* Imagine what the original data that was used to create the graph looks like.

**Sample worksheet from**
https://www.mathmammoth.com
Guidelines for using mean, median, and mode

- The **mode** can be used with any type of data.
- The **median** can only be used if the data can be put in order.
- The **mean** can only be used if the data is numerical.

Sometimes, the median and the mean do not fall where the peak of the distribution is.

- The mean works best if the distribution is fairly close to a bell shape and does not have outliers.
- If the distribution is very skewed or has outliers, it is better to use median than mean.

3. Judith asked 55 teenagers about how much money they spent to purchase Mother's Day gifts.

   a. The distribution is skewed. Based on that, which of the numbers $11 and $9 is the mean?
      Which is the median?

   b. Would mean or median better describe this data? Why?

   c. Approximately what percentage of these teenagers spent $10 or less on a Mother's Day gift?

4. For (a) and (b) below, name what is being studied (check the title of the graph). Describe how the data was measured and in what units. For example, perhaps the data consists of numbers, in dollars. Or perhaps the respondents chose “yes” or “no.” (Hint: Think what kind of data was used to create the graph.)

   **Note:** You do not have to find the mean, even when it is possible.

   a. What is being measured or studied? ______________________

      How is it measured?

      Which are possible? (Mark with an “x”).
      ____ mean   ____ median   ____ mode

      The mode is: _____________     The median is: _____________

   b. What is being measured or studied? ______________________

      How is it measured?

      Which are possible? (Mark with an “x”).
      ____ mean   ____ median   ____ mode

      The mode is: _____________     The median is: _____________
For the following data sets:

- Create a dot plot or a bar graph.
- Name your graph.
- Describe the shape of the distribution.
- Indicate how many observations there are.
- Choose measure(s) of center that describe the peak of the distribution, and calculate them.

5. a. The length of words on three pages in a children’s storybook:

7 5 6 8 3 6 2 4 2 2 3 3 4 3 5 5 4
5 4 3 2 5 2 1 4 4 7 5 4 8 3 3 3 3 3 5
5 3 4 2 3 1 6 2 5 4 4 3 4 3 2 8

Here is the same data sorted:

1 1 2 2 2 2 2 3 3 3 3 3 3 3 3 4 4 4 4 4 4 4 4 5 5 5 5 5 6 6 6 7 8 8 8

b. A restaurant asked its customers some questions about their food and service. One question was, “How would you rate the meal you ate today?” There were five possible answers: “excellent,” “good,” “normal,” “not so good,” and “poor.” The customers’ responses are listed below:

normal poor excellent good good excellent good
normal normal good excellent good good
not so good not so good excellent good good good

Puzzle Corner

Can you find a quick, mental math method for calculating the mean for this data set? 102, 94, 99, 105, 96, 107, 101, 104 (the weights of a litter of kittens at birth, in grams)

Sample worksheet from https://www.mathmammoth.com