Grade 6: Minerals at the Museum

6.SP.B.5 - Summarize numerical data sets in relation to their context, such as by:

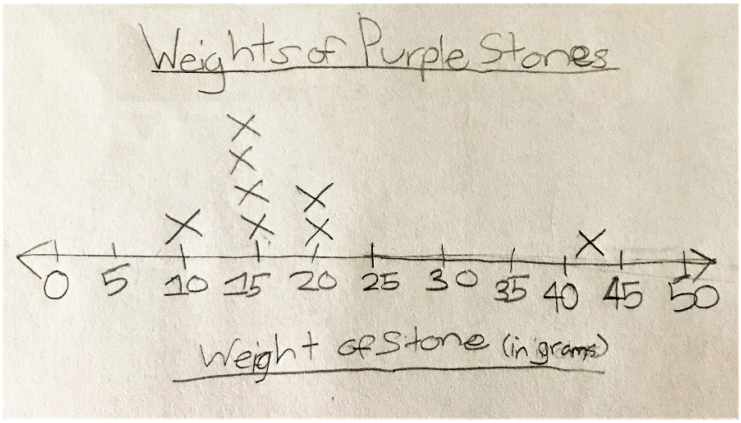
> **6.SP.B.5c -** Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered.

Alisson went on a field trip to the science museum. A museum guide helped Alisson weigh some minerals.

Alisson wrote down her measurements. She also made a line plot to show the measurements.

PURPLE STONES

Stone	Weight in grams
1	15
2	15
3	20
4	20
5	10
6	15
7	15
8	42



What was the mean value (average) of Alisson's measurements?

Answer: ☐ grams

Solution

Correct if student writes 19 in the box.

A note about the units. In this problem, Alisson "weighs" the stones in units of grams. However, grams are actually a unit of mass, not a unit of weight. If the student has learned the difference between mass and weight, you may want to clarify that, in this problem, Alisson is actually finding the stones' mass, not their weight. The problem uses the everyday language of weight in case students are not yet familiar with the scientific concept of mass or the physics distinction between mass and weight. In this solution, we'll use the terms mass and weight as if they were synonymous.

The mean, or average, value is a single number that can be used to summarize a set of measurements. To calculate the mean value, add together the 8 data values, and then divide by 8.

Total: 15 + 15 + 20 + 20 + 10 + 15 + 15 + 42 = 152 grams

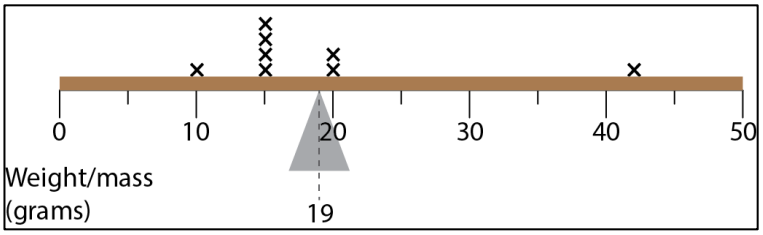
Mean value: 152 ÷ 8 = 19 grams.

On average, a stone in this collection weighs 19 grams. Note that 19 grams is greater than the smallest value (10 grams) and less than the greatest value (42 grams). The mean value lies between the extremes.

Looking at the line plot, notice that there is a main group of weights in the range from 15 to 20 grams; the mean value is located in this part of the line plot where many values are clustering together.

Even though, on average, a stone in this collection weighs 19 grams, no stone in the collection actually weighs 19 grams.

One way to interpret a mean of 19 grams is to say that if you had 8 *identical* stones, *each* weighing 19 grams, then together they would weigh the same as the 8 stones that were actually measured. On this interpretation, the mean value "equalizes" the variation in the stones' weights. An equivalent way to interpret a mean of 19 grams is to say that if the total of 152 grams were shared equally among the stones, then each stone would weigh 19 grams. So 19 grams is a fair-share weight.



Yet another way to look at the mean is that the mean tells you the "balance point" on a line plot. If you imagine the line plot as being like a teeter-totter on the playground (with each of the X's being like little kids), then locating the pivot point of the teeter-totter at exactly 19 grams brings the two sides into balance. This interpretation of the mean relies on physics principles that students may learn later in high school. (Note, in the teeter-totter analogy, all eight of the "kids" weigh the same amount.)

If it weren't for the one unusually heavy stone (42 grams), then the mean value would have been pretty close to 15 grams. (In terms of the teeter-totter idea, if we take away the X at 42 grams, then the balance point of the remaining X's would be very near 15 grams.) The presence of the unusually heavy stone "raises the average" from 15 grams all the way up to 19 grams.

The unusually high value of 42 grams is sometimes called an *outlier*. Sometimes people remove outliers from the data before they calculate a mean value; in this case, however, the value 42 was kept because there is no reason to believe that the measurement was done incorrectly. The eight stones in the collection have a mean weight of 19 grams.

Elaboration on Alignment

There appear to be eight purple stones in the image—one of which looks distinctly heavier than the others, one perhaps a bit lighter than the others. This basic state of affairs is reflected in the data values.

There are more than eight stones in the picture; the premise, as reflected in the titles of data table and the line plot, is that only the purple stones have been weighed. Nobody has to notice this to get the answer right.

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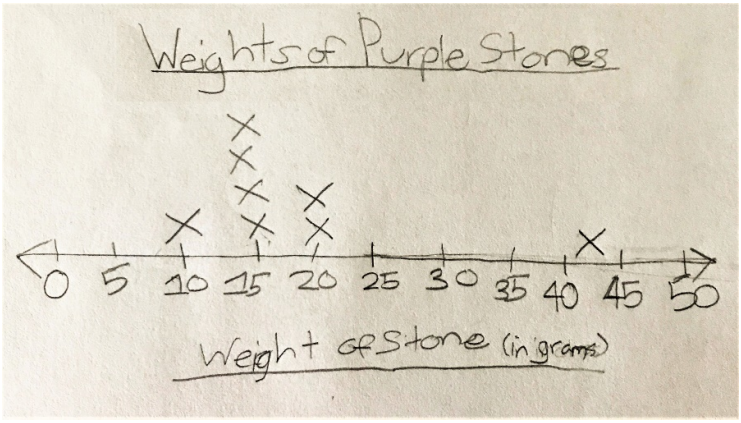

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