

Means, Modes and Medians Worksheet **Answers**

1. Collect data using LEGO setup. Run several trials to make sure that the data you are getting is not constant (that the sensor doesn't measure the distance to the floor and is pointed directly at the platform).
2. Once the data is collected, choose an arbitrary consecutive sample population of 5 data points and record it in the spreadsheet in Part A below. Determine the mean, median, and mode of the sample data.
3. Choose a consecutive sample population of 10 data points around the same points used for Part A and record it in the spreadsheet in a Part B below. Determine the mean, median, and mode of the sample data.

Part A

1. Record below the 5 sample data points you've chosen

37	37	39	41	43
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2. Calculate the mean of the set of numbers above. Clearly indicate the formulas you are using.

$$Mean_A = \frac{x_1+x_2+x_3+x_4+x_5}{5} = \frac{37+37+39+41+43}{5} = 39.4.$$

The mean of this set of data is 39.4.

3. Calculate the median of the set of numbers above

Data appears to be ordered in ascending order, i.e., 37, 37, 39, 41, 43.

Since there is an odd number of data entries collected, then the median is the "middle number".

Hence, the median is 39.

4. Calculate the mode of the set of numbers above. How many modes does your data have?

The mode is 37. There is only one mode in the set.

Part B

1. Record below the 10 sample data points you've chosen

42	41	33	34	41	39	43	40	43	40
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2. Calculate the mean of the set of numbers above. Clearly indicate the formulas you are using.

$$Mean_B = \frac{x_1+x_2+x_3+x_4+x_5+x_6+x_7+x_8+x_9+x_{10}}{10} = \frac{42+41+33+34+41+39+43+40+43+40}{10} = 39.6.$$

3. Calculate the median of the set of numbers above.

Order the data: 33, 34, 39, 40, 40, 41, 41, 42, 43, 43.

Since there is an even number of data, the median is the average of the 5th and 6th numbers from left to right. In other words, the median = $\frac{40+41}{2} = 40.5$.

4. Calculate the mode of the set of numbers above. How many modes does your data have?

The data has multiple modes and, therefore, is multimodal. The modes are 40, 41, and 43.

5. Calculate the percent difference between the means obtained in Part A and B. Show work.

$$\text{Percent difference} = \left| \frac{\text{mean}_A - \text{mean}_B}{\frac{\text{mean}_A + \text{mean}_B}{2}} \right| \times 100\% = \left| \frac{39.4 - 39.6}{(39.4 + 39.6)/2} \right| \times 100\% = 0.506329\%$$

The percent difference between the sample mean of 5 data points and the sample mean of 10 data points is less than 1%.

6. Calculate the percent error between measured mean value obtained in Part A and Part B. Assume that the average value obtained in Part B is our “Theoretical” average, and the average calculated in Part A is our “Experimental” average.

Since the mean value in part B was assumed to be more accurate approximation of the true mean of the data set, we treat it as “Theoretical” mean value. Hence, the mean value from part A is treated as “Experimental” value.

$$\begin{aligned} \text{Percent error} &= \frac{|\text{Experimental} - \text{Theoretical}|}{\text{Theoretical}} \times 100\% = \frac{|\text{Mean}_A - \text{Mean}_B|}{\text{Mean}_B} \times 100\% = \\ &= \frac{|39.4 - 39.6|}{39.6} \times 100\% = 0.505051\% \end{aligned}$$