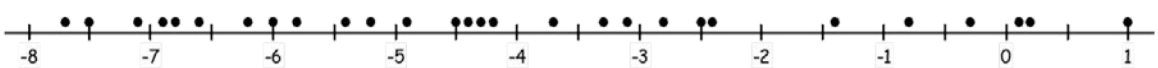
Why Worry About Sampling Variability?

How is a *meaningful* difference in sample means different from a *non-meaningful* difference in sample means? You may use what you saw in the dot plots of this lesson to help you answer this question.

Below are three dot plots. Each dot plot represents the differences in sample means for random samples selected from two populations (Bag A and Bag B). For each distribution, the differences were found by subtracting the sample means of Bag B from the sample means of Bag A (sample mean A − sample mean B).

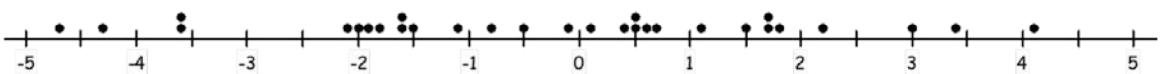
1. Does the graph below indicate that the population mean of Bag A is larger than the population mean of Bag B? Why or why not?



Sample Mean A − Sample Mean B

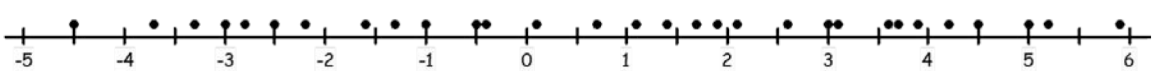
2. Use the graph above to estimate the difference in the population means (Mean A − Mean B).

3. Does the graph below indicate that the population mean of Bag A is larger than the population mean of Bag B? Why or why not?



Sample Mean A − Sample Mean B

4. Does the graph below indicate that the population mean of Bag A is larger than the population mean of Bag B? Why or why not?



Sample Mean A − Sample Mean B

5. In the above graph, how many differences are greater than 0? How many differences are less than 0? What might this tell you?

6. In Problem 4, the population mean for Bag A is really larger than the population mean for Bag B. Why is it possible to still get so many negative differences in the graph?

How is a *meaningful* difference in sample means different from a *non-meaningful* difference in sample means? You may use what you saw in the dot plots of this lesson to help you answer this question.

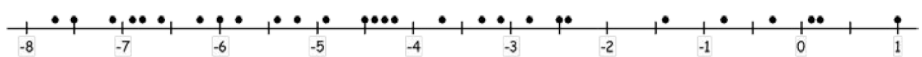
A meaningful difference in sample means is one that is not likely to have occurred by just chance if there is no difference in the population means. A meaningful difference in sample means would be one that is very far from 0 (or not likely to happen if the population means are equal). A non-meaningful difference in sample means would be one that is relatively close to 0, which indicates the population means are equal.

Note that how big this difference needs to be in order to be declared "meaningful" depends on the context, the sample size, and the variability in the populations.

Below are three dot plots. Each dot plot represents the differences in sample means for random samples selected from two populations (Bag A and Bag B). For each distribution, the differences were found by subtracting the sample means of Bag B from the sample means of Bag A (sample mean A − sample mean B).

1. **Does the graph below indicate that the population mean of Bag A is larger than the population mean of Bag B? Why or why not?**

   No, since most of the differences are negative, it appears that the population mean of Bag A is smaller than the population mean of Bag B.



Sample Mean A − Sample Mean B

2. **Use the graph above to estimate the difference in the population means ($\text{Mean A} - \text{Mean B}$).**

   About -4. This is about the middle of the graph.

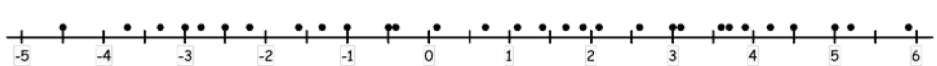
3. **Does the graph below indicate that the population mean of Bag A is larger than the population mean of Bag B? Why or why not?**

   No, the dots are all centered around 0, meaning that the population means of Bag A and Bag B might be equal.

Sample Mean A − Sample Mean B

4. **Does the graph below indicate that the population mean of Bag A is larger than the population mean of Bag B? Why or why not?**

   Yes, the dots are near 1.5. There is a small difference in the population means, but it is so small that it is difficult to detect. (Note to teachers: Some students may answer "No, the dots appear centered around 0." Problem 6 should cause students to rethink this answer.)



Sample Mean A − Sample Mean B

5. **In the above graph, how many differences are greater than 0? How many differences are less than 0? What might this tell you?**

   There are 18 dots greater than 0 and 12 dots less than 0. It tells me that there are more positive differences, which may mean that the population mean for Bag A is bigger than the population mean for Bag B.

6. **In Problem 4, the population mean for Bag A is really larger than the population mean for Bag B. Why is it possible to still get so many negative differences in the graph?**

   It is possible to get so many negative values because the population mean of Bag A may only be a little bigger than the population mean of Bag B.