P-values in Significance Tests

Over a long period of time in which the posted speed limit was 60 mph, the average speed along a certain stretch of highway was found to be 63 mph with a standard deviation of 4 mph. After the speed limit dropped to 55 mph, the average speed of cars in a sample of size 100 is recorded. If the sample mean is less than 63 mph, does this indicate a genuine reduction in mean speed, or could it simply be sampling variability?

We want to test the following hypotheses: (Write them using notation and in words)

H_0 (null hypothesis):

Ha (alternative hypothesis):

1. Assume the null hypothesis is true. Sketch the density curve of the sampling distribution of the sample mean. Label the values of the mean and the numbers 1, 2, and 3 standard deviations above and below the mean in your sketch. Be careful about the value of the standard deviation you use.

2. The mean of the sample of 100 cars is 61.4 mph. Find the probability that a sample of 100 cars would have a mean of 61.4 or something even more extreme if the mean of all the cars on this stretch of highway is still really 63 mph. Shade the relevant part of your sketch in #1.

3. Based on your answer to #2, describe the strength of the evidence against H_0.

4. Based on your answer to #2, is the sample mean of 61.4 statistically significant?