1. A sample of size \( n \) is chosen randomly from a population that can be described by a Normal model with mean \( \mu \), and standard deviation \( \sigma \).

What is the sampling distribution model of sample means? Describe the shape, center, and spread.

2. Place an X by any of the following statements that are NOT true according to the Central Limit Theorem:

___ An increase in sample size from \( n = 16 \) to \( n = 25 \) will produce a sampling distribution with a smaller standard deviation.

___ The mean of a sampling distribution of sample means is equal to the population mean divided by the square root of the sample size.

___ The larger the sample size, the more the sampling distribution of sample means resembles the shape of the population distribution.

___ The mean of the sampling distribution of sample means for samples of size \( n = 15 \) will be the same as the mean of the sampling distribution for samples of size \( n = 100 \).

___ The larger the sample size, the more the sampling distribution of sample means will resemble a normal distribution, regardless of the shape of the population distribution.

___ If the shape of the population distribution is itself normal, then the sampling distribution of sample means will resemble a normal distribution for any sample size.

3. The height of American adult women is distributed almost exactly as a normal distribution. The mean height of adult American women is 63.5 inches with a standard deviation of 2.5 inches. Imagine that all possible random samples of size 25 (\( n = 25 \)) are taken from the population of American adult women's heights, and then the means from each sample are graphed to form the sampling distribution of sample means.

a. Using the Central Limit Theorem, draw and label this sampling distribution. Show the mean and standard deviation on your drawing.
b. What is the probability that the mean height of a random sample of 25 women is less than 62.5 inches?

c. What is the probability that the mean height of a random sample of 25 women is more than 64 inches?

4. The amount of time it takes to complete an exam has a skewed-to-left distribution with a mean of 65 minutes and a standard deviation of 8 minutes. A sample of 64 students is selected at random. Describe and draw a picture of the sampling distribution of the sample mean ( \( \bar{x} \) ) for samples of size \( n = 64 \).

5. A brake pad manufacturer claims its brake pads will last for 38,000 miles, on average. Assume that the lifespans of the brake pads are normally distributed. Past analyses indicate that \( \sigma = 5000 \) miles. You work for a consumer protection agency and you are testing this manufacturer’s brake pads using a random sample of 30 brake pads. In your tests, the mean lifespan of the brake pads you sample is 35,700 miles.

a. Would it be unusual to have an individual brake pad last for 35,700 miles? Why, or why not?
b. Assuming the manufacturer’s claim is correct, what is the probability that the mean lifespan of the sample is as low as 35,700 miles? (That is, 35,700 miles or lower.)

c. Using your answer from (b), what do you think of the manufacturer’s claim?

d. Use your answers to parts a, b & c to structure a hypothesis test of the manufacturer’s claim that $\mu = 38,000$ for his brake pads. Give:
   (i) the null hypothesis, in words:
   (ii) the null hypothesis, in symbols: $\mu = \phantom{0}$
   (iii) the alternative hypothesis, in words:
   (iv) the alternative hypothesis, in symbols: $\mu \phantom{0} \phantom{0} \phantom{0}$
   (v) the p-value if $n=9$: 
   (vi) your conclusion if $n=9$, based on how small the p-value is:
   (vii) the p-value if $n=36$: 
   (viii) your conclusion if $n=36$, based on how small the p-value is: