Application of the Central Limit Theorem

A manufacturer of auto batteries claims the distribution of the lengths of life of its best battery has a mean of 54 months with a standard deviation of 6 months. A consumer group decides to check the manufacturer's claim by purchasing a sample of 49 of the batteries and subjecting them to tests that estimate that estimate the life of the batteries.

According to the CLT, if the manufacturer's claim is true, the sampling distribution of the mean lifetime of a sample of 49 batteries will have a mean of

$\mu_{\bar{x}} =$ _______ = ________.

Again, by the CLT, the standard deviation (standard error of the mean) of the sampling distribution is given by

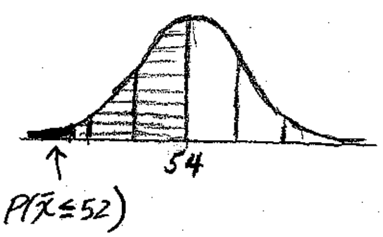
$\sigma_{\bar{x}} =$ _______ = _______ ≈ ________

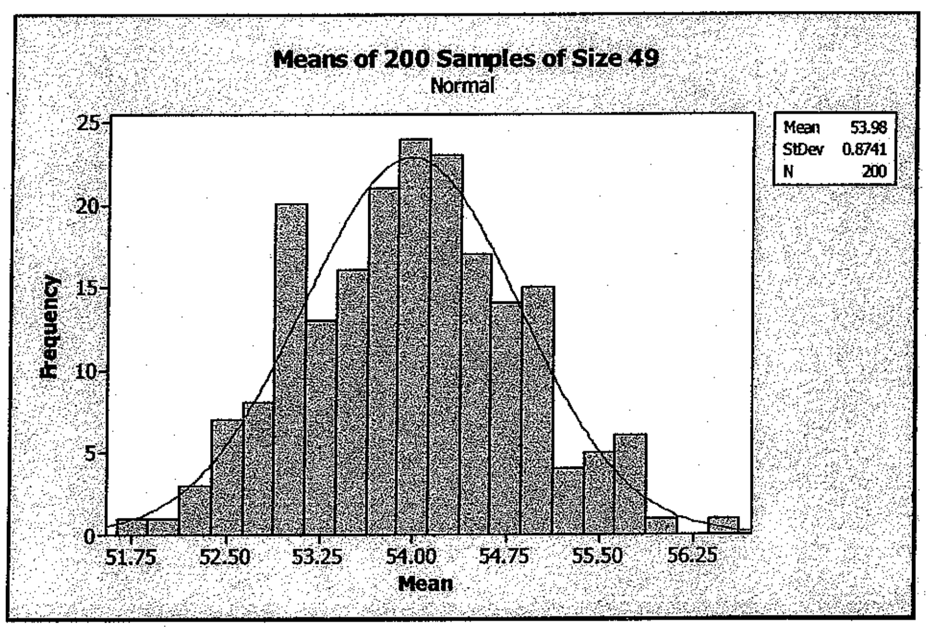
If we assume the manufacturer's claim is true, what is the probability that the consumer group's sample has a mean life of 52 or fewer months?

The histogram below shows the result of simulating the drawing and testing 200 samples of size 49 from a population with mean 54 and standard deviation of 6. Can we use the result of the simulation to estimate the probability that the consumer group's sample has a mean life of 52 or fewer months?

From the histogram,
$P(\bar{x} \leq 52) \approx$ _________.

A sketch of the situation we are considering.





Since the sampling distribution is approximately normal we can calculate $P(x \leq 52)$ by computing the standard normal z value:

$z = \frac{\bar{x}-\mu_{\bar{x}}}{\sigma_{\bar{x}}} = \frac{\bar{x}-\mu}{\sigma_{\bar{x}}} =$ ________ ≈ __________. $P(\bar{x} \leq 52) = P(z \leq$ ________) ≈ _______.

So, if the manufacturer's claim is true, the probability the consumer group will observe a sample mean of 52 or less is only _________.