AP Statistics
Unit 05 – Distributions
Day 03 – Homework #3 (Sample Means)

Name_____
Period_____

1. A grinding machine in an auto parts plant prepares axles with a target diameter μ = 40.125 millimeters (mm). The machine has some variability, so the standard deviation of the diameter is σ = 0.002 mm. The machine operator inspects a random sample of 4 axles each hour for quality control purposes and records the sample mean diameter $\bar{x}$.

a. Assuming that the process is working properly, what is the mean of the sampling distribution of $\bar{x}$? Explain.

b. Assuming that the process is working properly, what is the standard deviation of the sampling distribution of $\bar{x}$? Explain.

c. How many axles would you need to sample if you wanted the standard deviation of the sampling distribution of $\bar{x}$ to be 0.0005 mm? Justify your answer.

2. Mrs. De Marre's iPod has about 10,000 songs. The distribution of the play times for these songs is heavily skewed to the right with a mean of 225 seconds and a standard deviation of 60 seconds. Supposed we choose an SRS of 100 songs from this population and calculate the mean playtime $\bar{x}$ of these songs.

a. What are the mean and standard deviation of the sampling distribution of x? Explain.

b. How many songs would you need to sample if you wanted the standard deviation of the sampling distribution of $\bar{x}$ to be 30 seconds? Justify your answer.

3. A bottling company uses a filling machine to fill plastic bottles with cola. The bottles are supposed to contain 300 milliliters (ml). In fact, the contents vary according to a Normal distribution with mean μ = 298 ml and standard deviation σ = 3 ml.

a. What is the probability that a randomly selected bottle contains less than 295 ml? Show your work.

b. What is the probability that the mean contents of six randomly selected bottles are less than 295 ml? Show your work.

4. A company's cereal boxes advertise 9.65 ounces of cereal. In fact, the amount of cereal in randomly selected boxes follows a Normal distribution with mean μ = 9.70 ounces and standard deviation σ = 0.03 ounces.

a. What is the probability that a randomly selected box of cereal contains less than 9.65 ounces of cereal? Show your work.

b. Now take an SRS of 5 boxes. What is the probability that the mean amount of cereal $\bar{x}$ in these boxes is 9.65 ounces or less? Show your work.

5. A car company has found that the lifetime of its batteries varies from car to car according to a Normal distribution with mean μ = 48 months and standard deviation σ = 8.2 months. The company installs a new brand of battery on an SRS of 8 cars.

a. If the new brand has the same lifetime distribution as the previous type of battery, describe the sampling distribution of the mean lifetime $\bar{x}$.

b. The average life of the batteries on these 8 cares turns out to be $\bar{x}$ = 42.2 months. Find the probability that the sample mean lifetime is 42.2 months or less if the lifetime distribution is unchanged. What conclusion would you draw?