Unit Topic: Sample Distributions **Grade level: AP Stats**
Length of lesson: 5 days

Stage 1 – Desired Results
Content Standard(s): • HSS.ID.A.4 Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve. • HSS.CP.A.2 Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent. • HSS.CP.A.3 Understand the conditional probability of A given B as P(A and B)/P(B), and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B. • HSS.CP.A.4 Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results. • HSS.CP.A.5 Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer. • HSS.CP.B.6 Find the conditional probability of A given B as the fraction of B's outcomes that also belong to A, and interpret the answer in terms of the model. • HSS.CP.B.7 Apply the Addition Rule, P(A or B) = P(A) + P(B) - P(A and B), and interpret the answer in terms of the model. • HSS.CP.B.8 (+) Apply the general Multiplication Rule in a uniform probability model, P(A and B) = P(A)P(B|A) = P(B)P(A|B), and interpret the answer in terms of the model. • HSS.CP.B.9 (+) Use permutations and combinations to compute probabilities of compound events and solve problems. • HSS-MD.A.1 - Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space; graph the corresponding probability distribution using the same graphical displays as for data distributions. • HSS-MD.A.2 - Calculate the expected value of a random variable; interpret it as the mean of the probability distribution. • HSS-MD.A.3 - Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value. • HSS-MD.A.4 - Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected

value.
- HSS-MD.B.5 - Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values.
- HSS-MD.B.6 - Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).
- HSS-MD.B.7 - Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).

Understanding (s)/goals

Students will understand:

- Given that variation may be random or not, conclusions are uncertain.
- The normal distribution may be used to model variation.
- Probabilistic reasoning allows us to anticipate patterns in data.

Essential Question(s):

- How likely is it to get a value this large just by chance?
- How can we anticipate patterns in the values of a statistic from one sample to another?

Student objectives (outcomes):

Students will be able to:

- Distinguish between a parameter and a statistic.
- Create a sampling distribution using all possible samples from a small population.
- Use the sampling distribution of a statistic to evaluate a claim about a parameter.
- Distinguish among the distribution of a population, the distribution of a sample, and the sampling distribution of a statistic.
- Determine if a statistic is an unbiased estimator of a population parameter.
- Describe the relationship between sample size and the variability of a statistic.
- Calculate the mean and standard deviation of the sampling distribution of a sample proportion $\hat{p}$ and interpret the standard deviation.
- Determine if the sampling distribution $\hat{p}$ of is approximately Normal.
- If appropriate, use a Normal distribution to calculate probabilities involving $\hat{p}$ or $\hat{p}_1 - \hat{p}_2$.
- Calculate the mean and the standard deviation of the sampling distribution of a difference in sample proportions and interpret the standard deviation.
- Determine if the sampling distribution of $\hat{p}_1 - \hat{p}_2$ is approximately Normal.
- If appropriate, use a Normal distribution to calculate probabilities involving $\hat{p}$ or $\hat{p}_1 - \hat{p}_2$.
- Calculate the mean and standard deviation of the sampling distribution of a sample mean $\overline{x}$ and interpret the standard deviation.
- Explain how the shape of the sampling distribution of $\overline{x}$ is affected by the shape of the population distribution and the sample size.
- If appropriate, use a Normal distribution to calculate probabilities involving $\overline{x}$ or $\overline{x}_1 - \overline{x}_2$.
- Calculate the mean and the standard deviation of the sampling distribution of a difference in sample means $\overline{x}_1 - \overline{x}_2$ and interpret the standard deviation.
- Determine if the sampling distribution of $\overline{x}_1 - \overline{x}_2$ is approximately Normal.
- If appropriate, use a Normal distribution to calculate probabilities involving $\overline{x}$ or

$\overline{x}_1 - \overline{x}_2$

Stage 2 – Assessment Evidence	
Performance Task(s):	**Other Evidence:** •
Stage 3 – Learning Plan	
Learning Activities:	