Southern York County School District Instructional Plan

Name:	Dates: Summer Assignment
Course/Subject: AP Statistics	Unit 1

Stage 1 – Desired Results

PA State Standard(s) Addressed:

- **2.5.11.A: Select and use appropriate mathematical concepts and techniques from different areas of mathematics and apply them to solving non-routine and multi-step problems.**
- **2.5.11.D: Conclude a solution process with a summary of results and evaluate the degree to which the results obtained represent an acceptable response to the initial problem and why the reasoning is valid.**
- **2.6.11A: Design and conduct an experiment using random sampling. Describe the data as an example of a distribution using statistical measures of center and spread. Organize and represent the results with graphs. (Use standard deviation, variance and t-tests.)**
- **2.6.11.B: Use appropriate technology to organize and analyze data taken from the local community.**

Understanding(s): ***Students will understand that…***	Essential Question(s):
1. Variables are divided into two groups, categorical and quantitative 2. There are different ways to evaluate a set of data – pie charts, bar graphs for categorical and dotplots, stemplots and histograms for quantitative 3. Data can also be evaluated numerically – counts, percents, proportions, mean, median, mode, range, standard deviation, interquartile range	▪ How can variables be used? ▪ How can data be described graphically? ▪ How can data be described numerically?
Learning Objectives: ***Students will know…*** ▪ Categorical vs. Quantitative variables ▪ Both graphical displays and numerical summaries – how to read, create and evaluate	***Students will be able to…*** ▪ Describe a set of data ▪ Calculate the numerical summaries of a set of data, by hand and through the use of their calculator. This includes mean, median, mode, st. dev, Q1, Q3, IQR, outliers, and range. ▪ Create and evaluate all types of numerical and graphical summaries.

Name:	Dates: September
Course/Subject: AP Statistics	Unit 2

Stage 1 – Desired Results

PA State Standard(s) Addressed:

- **2.5.11.A: Select and use appropriate mathematical concepts and techniques from different areas of mathematics and apply them to solving non-routine and multi-step**

problems.

- **2.5.11.D: Conclude a solution process with a summary of results and evaluate the degree to which the results obtained represent an acceptable response to the initial problem and why the reasoning is valid.**
- **2.6.11.I: Describe the normal curve and use its properties to answer questions about sets of data that are assumed to be normally distributed.**
- **2.6.11.B: Use appropriate technology to organize and analyze data taken from the local community.**

Understanding(s): ***Students will understand that…*** 1. A density curve is a curve that is always on the horizontal axis and has total area under it of 1. 2. Given a normal distribution both the mean and standard deviation can be approximated 3. A histogram, stemplot and/or boxplot can be used to assess normality.	**Essential Question(s):** ▪ How can the mean and median be located in a density curve? What happens if the curve is symmetric? ▪ How can a z-score be calculated and what does it mean? ▪ What is the empirical rule and how can it be used to interpret and/or compare normal distributions?
Learning Objectives: ***Students will know…*** ▪ How to locate the median and mean on a density curve. ▪ What the empirical rule is and how to apply it to a normal distribution. ▪ How to determine the proportion of observations within one, two or three standard deviations.	***Students will be able to…*** ▪ How can the mean and median be located in a density curve? What happens if the curve is symmetric? ▪ How can a z-score be calculated and what does it mean? ▪ What is the empirical rule and how can it be used to interpret and/or compare normal distributions?

Name:	**Dates: September**
Course/Subject: AP Statistics	**Unit 3**

Stage 1 – Desired Results

PA State Standard(s) Addressed:

- **2.5.11.A: Select and use appropriate mathematical concepts and techniques from different areas of mathematics and apply them to solving non-routine and multi-step problems.**
- **2.5.11.D: Conclude a solution process with a summary of results and evaluate the degree to which the results obtained represent an acceptable response to the initial problem and why the reasoning is valid.**
- **2.6.11.C: Determine the regression equation of best fit (e.g., linear, quadratic, exponential).**
- **2.6.11.D: Make predictions using interpolation, extrapolation, regression and estimation using technology to verify them.**
- **2.6.11.B: Use appropriate technology to organize and analyze data taken from the local community.**

Understanding(s): ***Students will understand that…*** 1. A scatterplot shows the relationship between two quantitative variables measured on the same individuals. 2. The correlation measures the direction and strength of the linear relationship between two quantitative variables. 3. The least squares regression line of y on s is the line that makes the sum of the squares of the vertical distances of the data points as small as possible.	**Essential Question(s):** ▪ What can a scatterplot tell about a set of data? ▪ What is correlation and what does it tell about a set of data? ▪ What is a least squares regression line and when it is appropriate to use it as a line of best fit. What information can be gained from a line of best fit?
Learning Objectives: ***Students will know…*** ▪ How to make a scatterplot ▪ What correlation is and how it is calculated ▪ How to find the least squares regression line	***Students will be able to…*** ▪ Interpret a scatterplot ▪ Calculate correlation for a small set of data by hand and large set through their calculator ▪ Calculate and construct a least squares regression line

Name:	**Dates: October**
Course/Subject: AP Statistics	**Unit 4**

Stage 1 – Desired Results

PA State Standard(s) Addressed:

- **2.5.11.A: Select and use appropriate mathematical concepts and techniques from different areas of mathematics and apply them to solving non-routine and multi-step problems.**
- **2.6.11.C: Determine the regression equation of best fit (e.g., linear, quadratic, exponential).**
- **2.6.11.D: Make predictions using interpolation, extrapolation, regression and estimation using technology to verify them.**
- **2.6.11.B: Use appropriate technology to organize and analyze data taken from the local community.**
- **2.6.11.F: Determine the degree of dependence of two quantities specified by a two-way table.**

Understanding(s): ***Students will understand that…*** 1. Not all data follows a linear pattern, some are best modeled by an exponential, logarithmic or power function 2. Correlation does not mean causation 3. Two way tables provide more information through marginal and conditional distributions	**Essential Question(s):** ▪ What model best fits a given set of data? ▪ Are there any lurking or confounding variables associated with the data? Is there a common response? ▪ What is the relationship between two categorical variables?
Learning Objectives:	

Students will know…	***Students will be able to…***
▪ How to perform a logarithmic transformation and obtain points that lie in a linear pattern. ▪ Deviations from the overall pattern of data are best examined in the residual plot ▪ Both r and the lsrl can be influenced by a few extreme observations ▪ Find the marginal and conditional distributions given a two way table	▪ Recognize the difference between exponential growth and decay and the ladder of power functions ▪ Recognize possible lurking variables between two observed variables, x and y. ▪ Describe the marginal and conditional distributions given a two way table ▪ Recognize simpson's paradox and be able to explain it

Name:	**Dates: October/November**
Course/Subject: AP Statistics	**Unit 5**

Stage 1 – Desired Results

PA State Standard(s) Addressed:

- **2.6.11.A: Design and conduct an experiment using random sampling. Describe the data as an example of a distribution using statistical measures of center and spread. Organize and represent the results with graphs. (Use standard deviation, variance and t-tests.)**
- **2.6.11.E: Determine the validity of the sampling method described in a given study.**
- **2.6.11.G: Describe questions of experimental design, control groups, treatment groups, cluster sampling and reliability.**
- **2.6.11.H: Use sampling techniques to draw inferences about large populations.**

Understanding(s): ***Students will understand that…***	**Essential Question(s):**
1. Various types of bias affect samples taken from any given population 2. A randomized comparative experiment can give good evidence for cause and effect relationships 3. Random phenomena can be investigated by means of a carefully designed simulation.	▪ What types of bias can be discovered from a sample or survey? Undercoverage? Response? Wording? Nonresponse? ▪ What process can best be used to design experiments? What are the groups? The sizes of these groups? The specific treatments? The response variable? ▪ What steps are needed to take to construct a simulation? What is the problem? What are the assumptions? What values represent which outcomes? How many times should this procedure be repeated? What are your conclusions?
Learning Objectives:	

Students will know… ▪ The effects of bias and be able to recognize it ▪ What a srs is and how to obtain one ▪ The difference between an observational study and an experiment ▪ When the use of a double-blind study is necessary	**Students will be able to…** ▪ Use a table of random digits to select a SRS ▪ Recognize possible lurking or confounding variables between two observed variables, x and y. ▪ Identify the factors, treatments, response variables and experimental units in an experiment ▪ Recognize the placebo effect ▪ Conduct simulations

Name:	**Dates: November/Beginning of December**
Course/Subject: AP Statistics	**Unit 6**

Stage 1 – Desired Results

PA State Standard(s) Addressed:

- **2.7.11.D: Use experimental and theoretical probability distributions to make judgments about the likelihood of various outcomes in uncertain situations.**
- **2.7.11.E: Solve problems involving independent simple and compound events.**
- **2.7.5.I: Find all possible combinations and arrangements involving a limited number of variables.**
- **2.7.5.J: Develop a tree diagram and list the elements.**

Understanding(s): ***Students will understand that…*** 1. Probability describes the pattern of chance outcomes and provide the basis for inference. 2. Rules and tools which help describe the behavior of statistics from random samples	**Essential Question(s):** ▪ How can the following events be determined disjoint? Complementary? Independent? ▪ What is the union or intersection? ▪ When is it reasonable to assume independence as part of a probability model?
Learning Objectives: ***Students will know…*** ▪ The probability rules and be able to apply them to determine probabilities of defined events ▪ How to construct tree diagrams to organize the use of the multiplication and addition rules to solve problems with several stages. ▪ How to find conditional probabilities for individuals chosen at random from a table of counts of possible outcomes	***Students will be able to…*** ▪ Use the multiplication principle to determine the number of outcomes (if finite). ▪ Use Venn Diagrams and tree diagrams to determine simple probabilities. ▪ For the continuous case, use geometric areas to find probabilities of events

Name:	**Dates: December**
Course/Subject: AP Statistics	**Unit 7**

Stage 1 – Desired Results

PA State Standard(s) Addressed:

- **2.7.11.D: Use experimental and theoretical probability distributions to make judgments**

about the likelihood of various outcomes in uncertain situations.

- **2.7.11.E: Solve problems involving independent simple and compound events.**
- **2.6.11.A: Design and conduct an experiment using random sampling. Describe the data as an example of a distribution using statistical measures of center and spread. Organize and represent the results with graphs. (Use standard deviation, variance and t-tests.)**

Understanding(s): ***Students will understand that…***	**Essential Question(s):**
1. There are discrete and continuous random variables 2. The mean and variance of a random variable can be calculated	▪ What are examples of random variables in real life? ▪ How can random variables be used to describe various situations?
Learning Objectives: **Students will know…** ▪ The different types of random variables ▪ How to calculate the mean and variance of a random variable ▪ The Law of Large Numbers ▪ The rules for means and rules for variances involving sums, differences, and linear combinations of random variables	**Students will be able to…** ▪ Differentiate between discrete and continuous random variables ▪ Determine probabilities of events under a density curve ▪ Construct a probability histogram for a random variable ▪ Find the expected value of a game of chance ▪ use the law of large numbers to approximate the mean of a distribution

Name:	**Dates: January**
Course/Subject: AP Statistics	**Unit 8**

Stage 1 – Desired Results

PA State Standard(s) Addressed:

- **2.7.11.D: Use experimental and theoretical probability distributions to make judgments about the likelihood of various outcomes in uncertain situations.**
- **2.7.11.E: Solve problems involving independent simple and compound events.**

Understanding(s): ***Students will understand that…***	**Essential Question(s):**
1. Binomial distributions involve a random variable which has two outcomes, a fixed number of independent trials, and the same probability of success for each of those trials 2. Geometric distributions involve a random variable, which has two outcomes, the probability of success is the same for each trial, the trials are independent, and the count of interest is the number of trials required to get one success.	▪ What are examples of random variables, which have binomial or geometric distributions in real life? ▪ How do the values our calculator simulates relate to the real-life probability of an event?
Learning Objectives:	

Students will know… ▪ How to calculate the probability distribution of a binomial and geometric random variables ▪ How to calculate cumulative distribution functions for binomial and geometric random variables.	***Students will be able to…*** ▪ Construct probability distribution tables and histograms ▪ Use a normal approximation to the binomial or geometric distribution to compute probabilities ▪ Calculate means and standard deviations of binomial random variables
Name:	**Dates: January/February**
Course/Subject: AP Statistics	**Unit 9**
Stage 1 – Desired Results	
PA State Standard(s) Addressed: ▪ **2.6.11.A: Design and conduct an experiment using random sampling. Describe the data as an example of a distribution using statistical measures of center and spread. Organize and represent the results with graphs. (Use standard deviation, variance and t-tests.)** ▪ **2.6.11.H: Use sampling techniques to draw inferences about large populations.** ▪ **2.6.11.I: Describe the normal curve and use its properties to answer questions about sets of data that are assumed to be normally distributed.** ▪ **2.7.11.B: Apply probability and statistics to perform an experiment involving a sample and generalize its results to the entire population.**	
Understanding(s): ***Students will understand that…*** 1. The variability of a statistic is controlled by the size of the sample. 2. The sample mean has approximately a normal distribution with the sample is large. (Central Limit Theorem). 3. The standard deviation of the sample distribution of “p hat” and “x bar”gets smaller at the rate sq. rt. of n as the same size n gets larger.	**Essential Question(s):** ▪ To what extent does the number of times a method is used increase the reliability of a statistical inference?
Learning Objectives: ***Students will know…*** ▪ The difference between a parameter and a statistic ▪ How to calculate the mean and standard deviation for a sampling distribution	***Students will be able to…*** ▪ Recognize the fact of sampling variability. ▪ Interpret a sampling distribution as describing the values taken by a statistic in all possible repetitions of a sample or experiment under the same conditions. ▪ Describe the bias and variability of a statistic in terms of the mean and spread of its sampling variability. ▪ Recognize when a problem involves a sample proportion or a sample mean.

Name:	**Dates: February/March**
Course/Subject: AP Statistics	**Unit 10**

Stage 1 – Desired Results

PA State Standard(s) Addressed:

- **2.6.11.H: Use sampling techniques to draw inferences about large populations.**
- **2.6.11.I: Describe the normal curve and use its properties to answer questions about sets of data that are assumed to be normally distributed.**
- **2.7.11.D: Use experimental and theoretical probability distributions to make judgments about the likelihood of various outcomes in uncertain situations.**

Understanding(s):	**Essential Question(s):**
Students will understand that… 1. Confidence intervals give correct results within a specified margin of error a set percent of the time. 2. Significance tests provide support to reject or accept the null hypothesis. 3. Two errors are possible when conducting significance tests - Type I and Type II errors. 4. The margin of error of a confidence interval changes with the sample size and the level of confidence C.	▪ To what extent can statistical reliability be determined? ▪ To what extent can the evidence for a claim about a parameter be validated?
Learning Objectives: ***Students will know…*** ▪ How to assess statistical significance. ▪ Significance testing does not measure the size or importance of an effect. ▪ The Difference between Type I And Type II errors. ▪ What is meant by a specified level of significance.	***Students will be able to…*** ▪ State the null and alternative hypotheses in a testing situation when the parameter in question is the population mean. ▪ Explain the meaning of the P-value. ▪ Calculate the one-sample z statistic and the P-value for both a one-sided and two-sided test about the mean of a normal population]. ▪ Calculate the powering a significance testing problem. ▪ Calculate a confidence interval for the mean of a normal population with a known standard deviation. ▪ Find the sample size required to achieve a specified margin of error when the confidence level is given.

Name:	**Dates: March**
Course/Subject: AP Statistics	**Unit 11**

Stage 1 – Desired Results

PA Standard(s)/Assessment Anchors Addressed:

- **2.6.11.H: Use sampling techniques to draw inferences about large populations.**
- **2.6.11.I: Describe the normal curve and use its properties to answer questions about sets of data that are assumed to be normally distributed.**

Understanding(s): ***Students will understand . . .***	**Essential Question(s):**
1. Confidence intervals give correct results within a specified margin of error a set percent of the time 2. Significance tests provide support to reject or accept the null hypothesis. 3. In the design of a study, outliers, or a small sample from a skewed distribution make t procedures risky	▪ What are the t-procedures for means? ▪ When should the following designs be used?: One Sample, Matched Pairs, Two Sample ▪ When can data analysis be utilized? Is there strong skewness? Outliers? Too small a sample? ▪ When is a t test applicable? When is a confidence interval applicable? ▪ Are there any practical conclusions for the results?
Learning Objectives: ***Students will know . . .*** ▪ The difference between various study designs ▪ How to calculate a t test and a confidence interval ▪ How to use Table C of t critical values to approximate the P-value or carry out a fixed α test.	***Students will be able to:*** ▪ Recognize when a problem requires inference about a mean or comparing two means ▪ Recognize from the design of a study whether one-sample, matched pairs or two-sample procedures are needed ▪ Carry out a t test for the hypothesis that a population has a specified value against either a one-sided or two-sided alternative. ▪ Recognize when t procedures are appropriate, in particular that they are quire robust against lack of normality but are influenced by outliers ▪ Use the two-sample t statistic with conservative degrees of freedom with the TI-83 ▪ Test the hypothesis that two populations have equal means against a one-sided or two-sided alternative.
Name:	**Dates: April**
Course/Subject: AP Statistics	**Unit 12**

Stage 1 – Desired Results

PA Standard(s)/Assessment Anchors Addressed:

- **2.6.11.H: Use sampling techniques to draw inferences about large populations.**
- **2.6.11.I: Describe the normal curve and use its properties to answer questions about sets of data that are assumed to be normally distributed.**

Understanding(s):	**Essential Question(s):**

Students will understand . . . 1. Confidence intervals give correct results within a specified margin of error a set percent of the time 2. In the design of a study, outliers, or a small sample from a skewed distribution make t procedures risky	▪ What are the z-procedures for one proportion? ▪ What are the two-sample z-procedures? ▪ When should the following designs be used?: One Sample, Matched Pairs, Two Sample ▪ When can data analysis be utilized? Is there strong skewness? Outliers? Too small a sample? ▪ Are there any practical conclusions for the results?
Learning Objectives: **Students will know . . .** ▪ The difference between various study designs ▪ How to calculate from sample counts the sample proportion or proportions that estimate the parameters of interest. ▪ How to verify that z procedures can be used in a particular setting	***Students will be able to:*** ▪ Recognize from the design of a study whether one-sample, matched pairs or two-sample procedures are needed ▪ Use the z-procedure to give a confidence interval for a population proportion p ▪ Use the z statistic to carry our a test of significance for the hypothesis Ho: P = Po about a population p against either a one-sided or two-sided alternative ▪ Use the two-sample z procedures to give a confidence interval from the difference p1-p2 between proportions in two populations based on independent samples from the populations ▪ Use a z statistic to test the hypothesis Ho: p1=p2 that proportions in two distinct populations are equal
Name:	**Dates: April/Beginning of May**
Course/Subject: AP Statistics	**Unit 13**
Stage 1 – Desired Results	
PA Standard(s)/Assessment Anchors Addressed: ▪ **2.6.11.B: Use appropriate technology to organize and analyze data taken from the local community.** ▪ **2.6.11.F: Determine the degree of dependence of two quantities specified by a two-way table.**	
Understanding(s): ***Students will understand . . .*** 1. There are multiple settings in which the chi-square test of significance is useful 2. In a goodness of fit test, the object is to determine if a population distribution has changed 3. In the chi-square test for homogeneity of populations, the object is to determine if there is good reason to reject the hypothesis that the	**Essential Question(s):** ▪ When is the chi-square test applicable? ▪ What information can the chi-square test provide?

distribution of a categorical variable is the same in several populations 4. In the chi-square test of association/independence, the object is to test the null hypothesis that there is "no relationship" between the row variable and the column variable in a two-way table	
Learning Objectives: ***Students will know . . .*** ▪ To use percents and bar graphs to compare hypothesized and actual distributions when using a goodness-of-fit test ▪ The difference between tests of homogeneity of populations and test of association/independence	***Students will be able to:*** ▪ Organize categorical data in a two-way table, then use percents and bar graphs to describe the relationship between the categorical variables ▪ Explain what null hypothesis is being tested, calculate expected counts, calculate the component of the chi-square statistic for any cell, give the degrees of freedom, and use the chi-square critical values (Table E) to approximate P-values when performing chi-square tests ▪ Locate expected cell counts, the chi-square statistic, and its P-value on the TI83 calculator
Name:	**Dates: May**
Course/Subject: AP Statistics	**Post Exam**
Stage 1 – Desired Results	
PA Standard(s)/Assessment Anchors Addressed: ▪ **2.6.11.C: Determine the regression equation of best fit (e.g., linear, quadratic, exponential).** ▪ **2.6.11.D: Make predictions using interpolation, extrapolation, regression and estimation using technology to verify them.** ▪ **2.6.11.B: Use appropriate technology to organize and analyze data taken from the local community.** ▪ **2.7.11.D: Use experimental and theoretical probability distributions to make judgments about the likelihood of various outcomes in uncertain situations.** ▪ **2.7.11.E: Solve problems involving independent simple and compound events.** ▪ **2.6.11.H: Use sampling techniques to draw inferences about large populations.** ▪ **2.6.11.I: Describe the normal curve and use its properties to answer questions about sets of data that are assumed to be normally distributed.** ▪ **2.7.5.J: Develop a tree diagram and list the elements.**	
Understanding(s): ***Students will understand . . .*** 1. A scatterplot shows the relationship between two quantitative variables measured on the same individuals. 2. The correlation measures the direction and strength of the linear relationship between two quantitative variables.	**Essential Question(s):** ▪ What information can a scatterplot give someone? ▪ What is correlation and what does it say about a set of data? ▪ What is a least squares regression line and when it is appropriate to use it as a line of best fit. What can be gained from

3. The least squares regression line of y on s is the line that makes the sum of the squares of the vertical distances of the data points as small as possible. 4. Confidence intervals give correct results within a specified margin of error a set percent of the time. 5. Significance tests provide support to reject or accept the null hypothesis. 6. Two errors are possible when conducting significance tests - Type I and Type II errors. 7. The margin of error of a confidence interval changes with the sample size and the level of confidence C. 8. Probability describes the pattern of chance outcomes and provide the basis for inference. 9. There are discrete and continuous random variables. 10. The mean and variance of a random variable can be calculated.	a line of best fit? ▪ How reliable are the conclusions made based on the calculations completed? ▪ How strong is the evidence for some claim about a parameter? ▪ Are the given events disjoint? Complementary? Independent? What is the union or intersection? ▪ When is it reasonable to assume independence as part of a probability model? ▪ What are examples of random variables in real life? ▪ How can random variables be used to describe various situations?
Learning Objectives: ***Students will know . . .*** ▪ How to make a scatterplot ▪ What correlation is and how it is calculated ▪ How to find the least squares regression line ▪ How to assess statistical significance ▪ Significance testing does not measure the size or importance of an effect ▪ The difference between type i and type ii errors ▪ What is meant by a specified level of significance ▪ The probability rules and be able to apply them to determine probabilities of defined events ▪ How to construct tree diagrams to organize the use of the multiplication and addition rules to solve problems with several stages. ▪ How to find conditional probabilities for individuals chosen at random from a table of counts of possible outcomes ▪ There are discrete and continuous random variables ▪ How to calculate the mean and variance of a random variable ▪ The law of large numbers ▪ The rules for means and rules for variances involving sums, differences, and linear combinations of random variables	***Students will be able to:*** ▪ Interpret a scatterplot ▪ Calculate correlation for a small set of data by hand and large set through their calculator ▪ Calculate and construct a least squares regression line ▪ State the null and alternative hypotheses in a testing situation when the parameter in question is the population mean. ▪ Explain the meaning of the p-value ▪ Calculate the one-sample z statistic and the p-value for both a one-sided and two-sided test about the mean of a normal population] ▪ Calculate the powering a significance testing problem ▪ Calculate a confidence interval for the mean of a normal population with a known standard deviation ▪ Find the sample size required to achieve a specified margin of error when the confidence level is given ▪ Use the multiplication principle to determine the number of outcomes (if finite). ▪ Use venn diagrams and tree diagrams to determine simple probabilities. ▪ For the continuous case, use geometric areas to find probabilities of events ▪ Differentiate between discrete and

	continuous random variables ▪ Determine probabilities of events under a density curve ▪ Construct a probability histogram for a random variable ▪ Find the expected value of a game of chance ▪ Use the law of large numbers to approximate the mean of a distribution