POCONO MOUNTAIN SCHOOL DISTRICT CURRICULUM

Statistics Grade 12	**Unit 1:**	Exploring Data	**Time Frame:**	19 Days

NATIONAL COMMON CORE STANDARDS:

Summarize, represent, and interpret data on a single count or measurement variable

- **S.ID.1** Represent data with plots on the real number line (dot plots, histograms, and box plots).
- **S.ID.2** Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.
- **S.ID.3** Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliners).

Summarize, represent and interpret data on two categorical and quantitative variables

- **S.ID.5** Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.

MATHEMATICAL PRACTICES:

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

ESSENTIAL QUESTIONS	**VOCABULARY**		**ASSESSMENT**
1. What is data? 2. How do we understand and communicate data? 3. Can you lie with statistics? 4. How and to what extent? 5. What assumptions can be made from data? 6. How can graphical displays be manipulated to present misleading information? 7. How can data analysis be used to predict future happenings? 8. Does the data always lead to the truth?	individual variable frequency table relative frequency table distribution pie chart bar graph two-way table marginal distributions conditional distributions side-by-side bar graph association dotplot stemplot histogram symmetric	SOCS outlier symmetric $\bar{x}$ spread variability median quartiles Q_1, Q_3 IQR five-number summary minimum maximum boxplot resistant standard deviation variance	Quiz Section 1.1 Quiz Section 1.2 Quiz Section 1.3 Chapter 1 Test Chapter 1 Project

UNIT OF INSTRUCTION: Exploring Data	PA CORE STANDARDS

CC.2.4.HS.B.1 Summarize, represent, and interpret data on a single count or measurement variable.
CC.2.4.HS.B.2 Summarize, represent, and interpret data on two categorical and quantitative variables.
CC.2.4.HS.B.3 Analyze linear models to make interpretations based on the data.

Essential Understandings/Learning Activities:

1. Identify the individuals and variables in a set of data.
2. Classify variables as categorical or quantitative.
3. Display categorical data with a bar graph. Decide if it would be appropriate to make a pie chart.
4. Identify what makes some graphs of categorical variable from a two-way table.
5. Calculate and display the conditional distribution of a categorical variable for a particular value of the other categorical variable in a two-way table.
6. Describe the association between two categorical variables by comparing appropriate conditional distributions.
7. Make and interpret dotplots and stemplots of quantitative data.
8. Describe the overall pattern (shape, center, and spread) of a distribution and identify any major departures from the pattern (outliners).
9. Identify the shape of a distribution from a graph as roughly symmetric or skewed.
10. Compare distributions of quantitative data using dotplots or stemplots.
11. Make and interpret histograms of quantitative data.
12. Compare distributions of quantitative data using historgrams.
13. Calculate measures of center (mean, median)
14. Calculate and interpret measures of spread (range, IQR).
15. Choose the most appropriate measure of center and spread in a given setting.
16. Identify outliers using the 1.5 x IQR rule.
17. Make and interpret boxplots of quantitative data.
18. Calculate and interpret measures of spread (standard deviation).
19. Choose the most appropriate measure of center and spread in a given setting.
20. Use appropriate graphs and numerical summaries to compare distributions of quantitative variables.

Activity: Water, Water, Water Everywhere!
Activity: Reaction Times
Activity: How long is a minute?

POCONO MOUNTAIN SCHOOL DISTRICT CURRICULUM

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POCONO MOUNTAIN SCHOOL DISTRICT CURRICULUM

Statistics Grade 12	**Unit 2:**	Modeling Distributions of Data	**Time Frame:**	15 Days

NATIONAL COMMON CORE STANDARDS:

Summarize, represent, and interpret data on a single count or measurement variable

- **S.ID.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.

MATHEMATICAL PRACTICES:

9. Make sense of problems and persevere in solving them.
10. Reason abstractly and quantitatively.
11. Construct viable arguments and critique the reasoning of others.
12. Model with mathematics.
13. Use appropriate tools strategically.
14. Attend to precision.
15. Look for and make use of structure.
16. Look for and express regularity in repeated reasoning.

ESSENTIAL QUESTIONS	**VOCABULARY**	**ASSESSMENT**
9. How does one assess normality? 10. Why is the normal distribution essential to the study of statistics? 11. How does the normal distribution apply to real world?	percentiles cumulative relative frequency graphs z-scores transforming data density curves median of density curve transform data mean of density curve normal curves normal distributions 68-95-99.7 rule standard normal distribution standard normal table normal probability plot Mu sigma	Quiz Section 2.1 Quiz Section 2.2 Chapter 2 Test Chapter 2 Project

UNIT OF INSTRUCTION: Modelling Distributions of Data	PA CORE STANDARDS	
	CC.2.4.HS.B.1 Summarize, represent, and interpret data on a single count or measurement variable. **CC.2.4.HS.B.2** Summarize, represent, and interpret data on two categorical and quantitative variables. **CC.2.4.HS.B.3** Analyze linear models to make interpretations based on the data. **Essential Understandings/Learning Activities:** 21. Find and interpret the percentile of an individual value within a distribution of data. 22. Estimate percentiles and individual values using a cumulative relative frequency graph. 23. Find and interpret the standardized score (z-score) of an individual value within a distribution of the data. 24. Describe the effect of adding, subtracting, multiplying by, or dividing by a constant on the shape, center, and spread of a distribution of data. 25. Estimate the relative locations of the median and mean on a density curve. 26. Use the 68-95-99.7 rule to estimate areas (proportions of values) in a Normal distribution. 27. Use Table A or technology to find (i) the proportion of z-values in a specified interval, or (ii) a z-score from a percentile in the standard Normal distribution. 28. Use Table A to technology to find (i) the proportion of values in a specified interval, or (ii) the value that corresponds to a given percentile in any Normal distribution. 29. Determine if a distribution of data is approximately Normal from graphical and numerical evidence. Activity: ACT vs SAT Activity: Walmart Activity Lane Times Activity: Age Distribution Activity	

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POCONO MOUNTAIN SCHOOL DISTRICT CURRICULUM

Statistics Grade 12	**Unit 3:**	Describing Relationships	**Time Frame:**	17 Days

NATIONAL COMMON CORE STANDARDS:

Summarize, represent and interpret data on two categorical and quantitative variables

- **S.ID.6** Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.
- **S.ID.6.A** Fit a function to the data; use functions fitted to data to solve problems in the context of the data. *Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models.*
- **S.ID.6.B** Informally assess the fit of a function by plotting and analyzing residuals.
- **S.ID.6.C** Fit a linear function for a scatter plot that suggests a linear association.

Interpret linear models

- **S.ID.7** Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.
- **S.ID.8** Compute (using technology) and interpret the correlation coefficient of a linear fit.
- **S.ID.9** Distinguish between correlation and causation.

MATHEMATICAL PRACTICES:

17. Make sense of problems and persevere in solving them.
18. Reason abstractly and quantitatively.
19. Construct viable arguments and critique the reasoning of others.
20. Model with mathematics.
21. Use appropriate tools strategically.
22. Attend to precision.
23. Look for and make use of structure.
24. Look for and express regularity in repeated reasoning.

ESSENTIAL QUESTIONS	**VOCABULARY**		**ASSESSMENT**
12. What does it mean to regress? 13. What is association? What is correlation? How are they connected? 14. Does association imply causation? 15. How can modeling data help us to understand patterns? 16. Can we use extrapolation to predict the future? 17. What is the best evidence for causation? 18. Is it possible to test for lack of correlation? 19. How do patterns affect your life?	coefficient of determination r^2 correlation equation of the least-squares regression line explanatory variable extrapolation influential least-squares regression line negative association overall pattern	outlier positive association predicted value regression line residual residual plot response variable scatterplot slope standard deviation of the residual y intercept	Quiz Section 3.1 Quiz Section 3.2 Chapter 3 Test Chapter 3 Project

UNIT OF INSTRUCTION: Describing Relationships

PA CORE STANDARDS

CC.2.4.HS.B.1 Summarize, represent, and interpret data on a single count or measurement variable.
CC.2.4.HS.B.2 Summarize, represent, and interpret data on two categorical and quantitative variables.
CC.2.4.HS.B.3 Analyze linear models to make interpretations based on the data.

Essential Understandings/Learning Activities:

30. Identify explanatory and response variable in situations where one variable helps to explain or influences the other.
31. Make a scatterplot to display the relationship between two quantitative variables.
32. Describe the direction, form, and strength of a relationship displayed in a scatterplot and recognize outliers in a scatterplot.
33. Interpret the correlation.
34. Understand the basic properties of correlation, including how the correlation is influenced by outliers.
35. Use technology to calculate correlation.
36. Explain why association does not imply causation.
37. Interpret the slope of y intercept of a least-squares regression line.
38. Use the least-squares regression line to predict y for a given x. Explain the dangers of extrapolation.
39. Calculate and interpret residuals.
40. Explain the concept of least squares.
41. Determine the equation of a least-squares regression line using technology.
42. Construct and interpret residual plots to assess if a linear model is appropriate.
43. Interpret the standard deviation of the residuals and use these values to assess how well the least-squares regression line models the relationship between two variables.
44. Determine the equation of a least-squares regression line using computer output.
45. Describe how the slop0e, y intercept, standard deviation of the residuals, and are influenced by outliers.
46. Find the slope and y intercept of the least-squares regression line from the means and standard deviations of x and y and their correlation.

Activity: Treadmill Activity
Activity: Consumer Report Activity
Activity: CSI Stats Activity (Cookie Jar)

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POCONO MOUNTAIN SCHOOL DISTRICT CURRICULUM

Statistics Grade 12	**Unit 4:**	Designing Studies	**Time Frame:**	22 Days

NATIONAL COMMON CORE STANDARDS:

Make inferences and justify conclusions from sample surveys, experiments, and observational studies

- **S.IC.3** Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.
- **S.IC.5** Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.
- **S.IC.6** Evaluate reports based on data

Interpret linear models

- **S.ID.9** Distinguish between correlation and causation.

MATHEMATICAL PRACTICES:

25. Make sense of problems and persevere in solving them.
26. Reason abstractly and quantitatively.
27. Construct viable arguments and critique the reasoning of others.
28. Model with mathematics.
29. Use appropriate tools strategically.
30. Attend to precision.
31. Look for and make use of structure.
32. Look for and express regularity in repeated reasoning.

ESSENTIAL QUESTIONS	**VOCABULARY**		**ASSESSMENT**
20. What is data? 21. How do we understand and communicate data? 22. Can you lie with statistics? 23. How and to what extent? 24. What assumptions can be made from data? 25. How can graphical displays be manipulated to present misleading information? 26. How can data analysis be used to predict future happenings? 27. Does the data always lead to the	sample population sample survey voluntary response samples confounded design convenience sampling biased simple random sample table of random digits probability sample stratified random sample cluster sampling inference margin of error strata undercoverage nonresponse response bias sampling frame systematic random sample observational study experimental confounding	subjects random assignment treatment factor level placebo effect single blind experiment control group completely randomized experiment random assignment treatment factor level placebo effect single blind experiment control group completely randomized experiment randomized block design matched pair design statistically significant replication hidden bias double-blind experiment	Quiz Section 4.1 Quiz Section 4.2 Quiz Section 4.3 Chapter 4 Test Chapter 4 Project

truth?	lurking variable experimental units	block design data ethics	

UNIT OF INSTRUCTION: Designing Studies

PA CORE STANDARDS

CC.2.4.HS.B.1 Summarize, represent, and interpret data on a single count or measurement variable.
CC.2.4.HS.B.2 Summarize, represent, and interpret data on two categorical and quantitative variables.
CC.2.4.HS.B.3 Analyze linear models to make interpretations based on the data.
CC.2.4.HS.B.4 Recognize and evaluate random processes underlying statistical experiments.

Essential Understandings/Learning Activities:

1. Identify the population and sample in a statistical study.
2. Identify voluntary response samples and convenience samples. Explain how these sampling methods can lead to bias.
3. Describe how to obtain a random sample using slips of paper, technology, or a table of random digits.
4. Distinguish a simple random sample from a stratified random sample or cluster sample. Give the advantages and disadvantages of each sampling method.
5. Explain how under coverage, nonresponse, question wording, and other aspects of a sample survey can lead to bias.
6. Distinguish between an observational study and an experiment.
7. Explain the concept of confounding and how it limits the ability to make cause-and-effect conclusions.
8. Identify the experimental units, explanatory and response variables, and treatments.
9. Explain the purpose of comparison, random assignment, control, and replication in an experiment.
10. Describe a completely randomized design for an experiment, including how to randomly assign treatments using slips of paper, technology, or a table of random digits.
11. Describe the placebo effect and the purpose of blinding in an experiment.
12. Interpret the meaning of statistically significant in the context of an experiment.
13. Explain the purpose of blocking in an experiment.
14. Describe a randomized block design or a matched pairs design for an experiment.
15. Describe the scope of inference that is appropriate in a statistical study.
16. Evaluate whether a statistical study has been carried out in an ethical manner.

Activity: The Federalist Papers
Activity: Cholesterol Drugs and Matched Pairs
Activity: Gallup Poll

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POCONO MOUNTAIN SCHOOL DISTRICT CURRICULUM

Statistics Grade 12	Unit 5:	Probability: What are the Chances?	Time Frame:	18 Days

NATIONAL COMMON CORE STANDARDS:

Understand and evaluate random processes underlying statistical experiments

- **S.IC.2** Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. *For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model?*

Use probability to evaluate outcomes of decisions

- **S.MD.6** (+) Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).
- **S.MD.7** (+) Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).

Summarize, represent and interpret data on two categorical and quantitative variables

- **S.ID.5** Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.

Understand independence and conditional probability and use them to interpret data

- **S.CP.1** Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or," "and," "not").
- **S.CP.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.
- **S.CP.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*.
- **S.CP.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.*
- **S.CP.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.*

Use the rules of probability to compute probabilities of compound events in a uniform probability model

- **S.CP.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.
- **S.CP.7** Apply the Addition Rule, *P(A or B) = P(A) + P(B) – P(A and B)*, and interpret the answer in terms of

MATHEMATICAL PRACTICES:

33. Make sense of problems and persevere in solving them.
34. Reason abstractly and quantitatively.
35. Construct viable arguments and critique the reasoning of others.
36. Model with mathematics.
37. Use appropriate tools strategically.
38. Attend to precision.
39. Look for and make use of structure.
40. Look for and express regularity in repeated reasoning.

the model.

- **S.CP.8** (+) Apply the general Multiplication Rule in a uniform probability model, *P(A and B) = P(A)P(BIA) = P(B)P (AIB),* and interpret the answer in terms of the model.

ESSENTIAL QUESTIONS	VOCABULARY		ASSESSMENT
28. What is the probability of understanding probability? 29. When is probability a sure thing? 30. How can we base decisions on chance? 31. How can probability be used to simulate events and to predict future happenings? 32. What are the benefits of simulation events as opposed to gathering real data?	law of large numbers probability simulation two-way table sample space S = {H, T} tree diagram probability model replacement event P{A}	complement A^c disjoint mutually exclusive event Venn diagram union (or) intersection (and) conditional probability independent events general multiplication rule general addition rule multiplication rule	Quiz Section 5.1 Quiz Section 5.2 Quiz Section 5.3 Chapter 5 Test Chapter 5 Project

UNIT OF INSTRUCTION: Probability: What are the Chances?

PA CORE STANDARDS

CC.2.4. HS.B.5 Make inferences and justify conclusions based on sample surveys, experiments, and observational studies.

CC.2.4.HS.B.6 Use the concepts of independence and conditional probability to interpret data.

CC.2.4.HS.B.7 Apply the rules of probability to compute probabilities of compound events in a uniform probability model.

Essential Understandings/Learning Activities:

1. Interpret probability as a long-run relative frequency.
2. Use simulation to model chance behavior.
3. Determine a probability model for a chance process.
4. Use basic probability rules, including the complement rule and the addition rule for mutually exclusive events.
5. Use the general addition rule to calculate probabilities.
6. Use the general multiplication rule to calculate probabilities.
7. Use tree diagrams to model a chance process and calculate probabilities involving two or more events.
8. Determine whether two events are independent.
9. When appropriate, use the multiplication rule for independent events to compute probabilities.

Activity: Feel the Power Activity/Simulation
Activity: The Duck Hunters Activity/Simulation
Activity: Airline Overbooking Activity/Simulation

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POCONO MOUNTAIN SCHOOL DISTRICT CURRICULUM

Statistics Grade 12	**Unit 6:**	Random Variable	**Time Frame:**	18 Days

NATIONAL COMMON CORE STANDARDS:

Understand and evaluate random processes underlying statistical experiments

- **S.IC.2** Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. *For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model?*

Calculate expected values and use them to solve problems

- **S.MD.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.
- **S.MD.2** (+) Calculate the expected value of a random variable; interpret it as the mean of the probability distribution.
- **S.MD.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. *For example, find the theoretical probability distribution for the number of correct answers obtained by guessing on all five questions of a multiple-choice test where each question has four choices, and find the expected grade under various grading schemes.*
- **S.MD.4** (+) Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value. *For example, find a current data distribution on the number of TV sets per household in the United States, and calculate the expected number of sets per household. How many TV sets would you expect to find in 100 randomly selected households?*

Use probability to evaluate outcomes of decisions

- **S.MD.5** (+) Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values.
- **S.MD.5.A** Find the expected payoff for a game of chance. *For example, find the expected winnings from a state lottery ticket or a game at a fast-food restaurant.*
- **S.MD.5.B** Evaluate and compare strategies on the basis of expected values. *For example, compare a high-deductible versus a low-deductible automobile insurance policy using various, but reasonable, chances of having a minor or a major accident.*
- **S.MD.6** (+) Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).
- **S.MD.7** (+) Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).

MATHEMATICAL PRACTICES:

41. Make sense of problems and persevere in solving them.
42. Reason abstractly and quantitatively.
43. Construct viable arguments and critique the reasoning of others.
44. Model with mathematics.
45. Use appropriate tools strategically.
46. Attend to precision.
47. Look for and make use of structure.
48. Look for and express regularity in repeated reasoning.

POCONO MOUNTAIN SCHOOL DISTRICT CURRICULUM

ESSENTIAL QUESTIONS	VOCABULARY		ASSESSMENT
1. What is randomness? 2. How can modeling predict the future? 3. To what extent does our world exhibit binomial and geometric phenomena? 4. When is probability a sure thing? 5. How can we base decisions on chance?	random variable discrete random variable probability distribution mean of a random variable variance of a random variable probability density curve continuous random variable standard deviation binomial setting binomial random variable binomial distribution	binomial coefficient binomial probability linear transformation normal approximation geometric probability factorial expected value standard deviation μ_x μ_y uniform distribution	Quiz Section 6.1 Quiz Section 6.2 Quiz Section 6.3 Chapter 6 Test Chapter 6 Project

UNIT OF INSTRUCTION: Random Variables	PA CORE STANDARDS	
	CC.2.4.HS.B.5 Make inferences and justify conclusions based on sample surveys, experiments, and observational studies. **Essential Understandings/Learning Activities:** 1. Compute probabilities using the probability distribution of a discrete random variable. 2. Calculate and interpret the mean (expected value) of a discrete random variable. 3. Calculate and interpret the standard deviation of a discrete random variable. 4. Compute probabilities using the probability distribution of a continuous random variable. 5. Describe the effects of transforming a random variable by adding or subtracting a constant and multiplying or dividing by a constant. 6. Find the mean and standard deviation of the sum or difference of independent random variables. 7. Find probabilities involving the sum or difference of independent Normal random variables. 8. Determine whether the conditions for using a binomial random variable are met. 9. Compute and interpret probabilities involving binomial distributions. 10. Calculate the mean and standard deviation of a binomial random variable. Interpret these values in context. 11. Find probabilities involving geometric random variables. Activity: Casino Lab Activity Activity: Is it a Fair Coin Activity: Airline Overbooking Activity Part 2	

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POCONO MOUNTAIN SCHOOL DISTRICT CURRICULUM

Statistics Grade 12	**Unit 7:**	Sampling Distributions	**Time Frame:**	14 Days

NATIONAL COMMON CORE STANDARDS:

Make inferences and justify conclusions from sample surveys, experiments, and observational studies

- **S.IC.6** Evaluate reports based on data.

MATHEMATICAL PRACTICES:

49. Make sense of problems and persevere in solving them.
50. Reason abstractly and quantitatively.
51. Construct viable arguments and critique the reasoning of others.
52. Model with mathematics.
53. Use appropriate tools strategically.
54. Attend to precision.
55. Look for and make use of structure.
56. Look for and express regularity in repeated reasoning.

ESSENTIAL QUESTIONS	VOCABULARY	ASSESSMENT
6. How can modeling predict the future? 7. To what extent does our world exhibit binomial and geometric phenomena? 8. How does the normal distribution apply to the real world? 9. How can we use the Central Limit Theorem to understand the variability of a statistic? 10. Does the Central Limit Theorem test one's limit?	parameter statistic sampling variability sampling distribution population distribution biased estimator unbiased estimator bias variability variability of a statistic sample proportion mean and standard deviation of sampling distributions	Quiz Section 7.1 Quiz Section 7.2 Quiz Section 7.3 Chapter 7 Test Chapter 7 Project

POCONO MOUNTAIN SCHOOL DISTRICT CURRICULUM

UNIT OF INSTRUCTION: Sampling Distributions

PA CORE STANDARDS

CC.2.4.HS.B.1 Summarize, represent, and interpret data on a single count or measurement variable.
CC.2.4.HS.B.2 Summarize, represent, and interpret data on two categorical and quantitative variables.
CC.2.4.HS.B.3 Analyze linear models to make interpretations based on the data.

Essential Understandings/Learning Activities:

12. Distinguish between a parameter and a statistic.
13. Distinguish among the distribution of a population, the distribution of a sample, and the sampling distribution of a statistic.
14. Use the sampling distribution of a statistic to evaluate and claim about a parameter.
15. Determine whether or not a statistic is an unbiased estimator of a population parameter.
16. Describe the relationship between sample size and the variability of a statistic.
17. Find the mean and standard deviation of the sampling distribution of a sample proportion. Check the 10% condition before calculating.
18. Determine if the sampling distribution is approximately Normal.
19. If appropriate, use a Normal distribution to calculate probabilities involving.
20. Find the mean and standard deviation of the sampling distribution of a sample mean. Check the 10% condition before calculating.
21. If appropriate, use a Normal distribution to calculate probabilities involving.
22. Explain how the shape of the sampling distribution is affected by the shape of the population distribution and the sample size.
23. If appropriate, use a Normal distribution to calculate probabilities involving.

Activity: Airport Security Activity
Activity: Bathroom Scales
Activity: Granny Smith Apples

DIFFERENTIATION ACTIVITIES:
Teacher directed differentiated instructional projects and activities are ongoing and based on student need

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POCONO MOUNTAIN SCHOOL DISTRICT CURRICULUM

Statistics Grade 12	**Unit 8:**	Estimating with Confidence	**Time Frame:**	18 Days

NATIONAL COMMON CORE STANDARDS:

Understand and evaluate random processes underlying statistical experiments

- **S.IC.1** Understand statistics as a process for making inferences about population parameters based on a random sample from that population.

Make inferences and justify conclusions from sample surveys, experiments, and observational studies

- **S.IC.6** Evaluate reports based on data.

MATHEMATICAL PRACTICES:

- **57.** Make sense of problems and persevere in solving them.
- **58.** Reason abstractly and quantitatively.
- **59.** Construct viable arguments and critique the reasoning of others.
- **60.** Model with mathematics.
- **61.** Use appropriate tools strategically.
- **62.** Attend to precision.
- **63.** Look for and make use of structure.
- **64.** Look for and express regularity in repeated reasoning.

ESSENTIAL QUESTIONS	**VOCABULARY**	**ASSESSMENT**
11. How much evidence do you need before you are able to make a reasonable conjecture? 12. Is it reasonable to think that different people require different amounts of convincing? 13. How is statistical inference used to draw conclusions from data? 14. How is probability used to express the strength of our conclusions? 15. How can decisions be based on chance? 16. To what extent should decisions be made based on chance?	point estimator point estimate confidence interval margin of error interval confidence level random normal independent four step process level C confidence interval degrees of freedom standard error one-sample z interval t distribution t-procedures one-sample t interval robust	Quiz Section 8.1 Quiz Section 8.2 Quiz Section 8.3 Chapter 8 Test Chapter 8 Project

UNIT OF INSTRUCTION: Estimating with Confidence	PA CORE STANDARDS	
	CC.2.4.HS.B.1 Summarize, represent, and interpret data on a single count or measurement variable. **CC.2.4.HS.B.2** Summarize, represent, and interpret data on two categorical and quantitative variables. **CC.2.4.HS.B.3** Analyze linear models to make interpretations based on the data. **CC.2.4.HS.B.5** Make inferences and justify conclusions based on sample surveys, experiments, and observational studies. **Essential Understandings/Learning Activities:** 24. Interpret a confidence interval in context. 25. Interpret a confidence level in context. 26. Determine the point estimate and margin of error from a confidence interval. 27. Describe how the sample size and confidence level affect the length of a confidence interval. 28. Explain how practical issues like nonresponse, under coverage, and response bias can affect the interpretation of a confidence interval. 29. State and check the Random, 10%, and Large Counts conditions for constructing a confidence interval for a population proportion. 30. Determine critical values for calculating a C% confidence interval for a population proportion using a table or technology. 31. Construct and interpret a confidence interval for a population proportion. 32. Determine the sample size required to obtain a C% confidence interval for a population proportion with a specified margin of error. 33. Explain how the t distributions are different from the standard Normal distribution and why it is necessary to use a t distribution when calculating a confidence interval for a population mean. Activity: Kayak Airfare Activity Activity: Good Books Activity Activity: Hershey's Kisses Activity Activity: Simulated Confidence Intervals with IT-84	

POCONO MOUNTAIN SCHOOL DISTRICT CURRICULUM

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POCONO MOUNTAIN SCHOOL DISTRICT CURRICULUM

Statistics Grade 12	**Unit 9:**	Testing a Claim	**Time Frame:**	16 Days

NATIONAL COMMON CORE STANDARDS:

Make inferences and justify conclusions from sample surveys, experiments, and observational studies

- **S.IC.4** Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.

MATHEMATICAL PRACTICES:

- **65.** Make sense of problems and persevere in solving them.
- **66.** Reason abstractly and quantitatively.
- **67.** Construct viable arguments and critique the reasoning of others.
- **68.** Model with mathematics.
- **69.** Use appropriate tools strategically.
- **70.** Attend to precision.
- **71.** Look for and make use of structure.
- **72.** Look for and express regularity in repeated reasoning.

ESSENTIAL QUESTIONS	**VOCABULARY**		**ASSESSMENT**
17. To what extent are significance tests reliable? 18. How do you interpret confidence intervals? How do you not interpret them? 19. When are tests of significance and confidence intervals used? 20. How can one prepare for errors from significance tests?	Significance test Null Hypothesis Alternative Hypotheses One sided alternative Two sided alternative p-value level significance level one-sample z test test statistic	one-sample t test paired data four-step process statistically significant Type I Error Type II Error Power Degrees of freedom t-distribution paired t procedures	Quiz Section 9.1 Quiz Section 9.2 Quiz Section 9.3 Chapter 9 Test Chapter 9 Project

UNIT OF INSTRUCTION: Testing a Claim

PA CORE STANDARDS

CC.2.4.HS.B.1 Summarize, represent, and interpret data on a single count or measurement variable.
CC.2.4.HS.B.2 Summarize, represent, and interpret data on two categorical and quantitative variables.
CC.2.4.HS.B.3 Analyze linear models to make interpretations based on the data.

Essential Understandings/Learning Activities:

34. State the null and alternative hypotheses for a significance test about a population parameter.
35. Interpret a P-value in context.
36. Determine if the results of a study are statistically significant and draw an appropriate conclusion using a significance level.
37. Interpret a Type I and a Type II error in context, and give a consequence of each.
38. State and check the Random, 10%, and Large Counts conditions for preforming a significance test about a population proportion.
39. Perform a significance test about a population proportion.
40. Use a confidence interval to draw a conclusion for a two-sided test about a population parameter.
41. Interpret the power of a test and describe what factors affect the power of a test.
42. Describe the relationship among the probability of a Type I error (significance level), the probably of a Type II error, and the power of a test.
43. State and check the Random, 10%, and Normal/Large Sample conditions for performing a significance test about a population mean.
44. Perform a significance test about a population mean.
45. Use a confidence interval to draw a conclusion for a two-sided test about a population parameter.
46. Perform a significance test about a mean difference using paired data.

Activity: Faster Fast Food?
Activity: Spinning Heads?
Activity: Rolling Sixes Activity
Activity: Examining Type 2 Error Through simulation

POCONO MOUNTAIN SCHOOL DISTRICT CURRICULUM

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POCONO MOUNTAIN SCHOOL DISTRICT CURRICULUM

Statistics Grade 12	**Unit 10:**	Comparing Two Populations or Groups	**Time Frame:**	16 Days

NATIONAL COMMON CORE STANDARDS:

Make inferences and justify conclusions from sample surveys, experiments, and observational studies

- **S.IC.5** Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.

MATHEMATICAL PRACTICES:

73. Make sense of problems and persevere in solving them.
74. Reason abstractly and quantitatively.
75. Construct viable arguments and critique the reasoning of others.
76. Model with mathematics.
77. Use appropriate tools strategically.
78. Attend to precision.
79. Look for and make use of structure.
80. Look for and express regularity in repeated reasoning.

ESSENTIAL QUESTIONS	VOCABULARY	ASSESSMENT
21. What does it mean to be 95% confident when speaking to statistical reports? 22. How do you determine if there is a statistical significance? 23. What does it mean to make an inference? 24. How does one distinguish among the various confidence intervals?	difference between two proportions two sample z interval for proportions two sample z test for difference between two proportions two sample z statistic two sample t statistic pooled combined sample proportion standard error randomization distribution paired t-test two sample t test for means two sample t interval for means difference between two means polled two sample t statistics	Quiz Section 10.1 Quiz Section 10.2 Chapter 10 Test Chapter 10 Project

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POCONO MOUNTAIN SCHOOL DISTRICT CURRICULUM

UNIT OF INSTRUCTION: Comparing Two Populations or Groups

PA CORE STANDARDS

CC.2.4.HS.B.1 Summarize, represent, and interpret data on a single count or measurement variable.

CC.2.4.HS.B.2 Summarize, represent, and interpret data on two categorical and quantitative variables.

CC.2.4.HS.B.3 Analyze linear models to make interpretations based on the data.

Essential Understandings/Learning Activities:

47. Describe the shape, center, and spread of the sampling distribution of $\hat{p}_1 - \hat{p}_2$.
48. Construct and interpret a confidence interval to compare two proportions.
49. Perform a significance test to compare two proportions.
50. Describe the shape, center, and spread of the sampling distribution of $\bar{x}_1 - \bar{x}_2$.
51. Describe the shape, center, and spread of the sampling distribution of $\mu_1 - \mu_2$.
52. Construct and interpret a confidence interval to compare two means.
53. Perform a significance test to compare two means.
54. Determine when it is appropriate to use two-sample t procedures versus paired procedures.

Activity: Comparing Pulse Rates?
Activity: Paper Airplanes Experiment
Activity: Helicopter Experiment

DIFFERENTIATION ACTIVITIES:
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