PROBABILITY AND STATISTICS

CURRICULUM

CARLISLE AREA SCHOOL DISTRICT

DATE OF BOARD APPROVAL: November 16, 2023

COURSE OVERVIEW

Title:	Probability and Statistics
Grade Level:	Grades 10-12
Level:	High School – Option II
Length:	Full Year
Duration:	85 Minute Periods
Frequency:	90 Days
Pre-Requisites:	Algebra 2, Geometry, Essential Math
Credit:	1 Credit
Description:	Probability and Statistics is the study of four key areas: experimental design, descriptive statistics, probability, and inferential statistics. Students will learn the principles of experimental design, how to draw a valid sample, and how to create a survey. Students will learn about and practice processes involving descriptive statistics, that is, the gathering, summarizing, and visually displaying one-variable and two-variable data. Students will also use rules of probability to find the likelihood that certain events or combinations of events occur. Students will gain knowledge of different types of distributions, such as the binomial distribution and the normal distribution, and use these distributions to find probabilities in real-world scenarios. Students will use both formula and calculator processes to find confidence intervals and run various hypothesis tests. They will also learn how to interpret the results of their findings.

COURSE TIMELINE

UNIT	TITLE	KEY CONCEPTS	DURATION (DAYS)
1	Statistical Design	• What is statistics, population vs. sample, levels of measurement • Types of sampling • Experimental design • Surveys, bias in a survey	6 Days
2	Displaying Distributions	• Graphical representations of data • Histograms (frequency and relative frequency) • Stem plots and scatter plots	6 Days
3	Describing Distributions	• Measures of central tendency • Standard deviation • Coefficient of variation • Chebyshev's Theorem	7 Days
4	Regression and Correlation	• Least squares line formula, interpolation, extrapolation • Correlation coefficient • Coefficient of determination	8 Days
5	Probability and Counting Techniques	• Simple events • Tree diagrams, multiplication rule, factorials • Permutations and combinations • Independent vs. dependent events; "given" and "and" rules • Mutually exclusive events, complements, probability with tree diagrams	13 Days
6	Binomial Probability Distributions	• Discrete vs. continuous, expected value and standard deviation • Features of a binomial experiment, binomial formula • Calculator function use: binompdf, binomcdf	10 Days

7	Normal Distributions	• Features of a normal curve, empirical rule • Finding z-scores, raw scores • Finding area under standard normal curve and any normal curve (use of chart) • Finding the original raw score (use the chart method and use InvNorm calculator function) • Normal approximation	12 Days
8	Sampling Distributions	• Discussion of parameter vs statistic, begin to discuss Central Limit Theorem • Answering probability questions using the Central Limit Theorem	4 Days
9	Estimation	• Confidence intervals for large samples for the mean • Confidence intervals for small samples for the mean • Confidence intervals for proportions • Choosing the sample size	10 Days
10	Hypothesis Testing	• Null and alternative hypotheses, type I and type II errors • Hypothesis testing for the mean for large samples • Hypothesis testing for the mean for small samples • Hypothesis testing for proportions	10 Days
11	Inferences about Differences	• Hypothesis test for differences in paired data, confidence intervals • Differences in means for large samples, confidence intervals • Differences in means for small samples, confidence intervals • Differences in means for large samples, confidence intervals	4 Days

DISCIPLINARY SKILLS and PRACTICES

DISCIPLINARY PRACTICE	DESCRIPTION
Make sense of problems and persevere in solving them.	Make conjectures about how real-world application problems may be solved, monitor progress toward a solution, and adjust the problem-solving plan if necessary.
Reason abstractly and quantitatively.	Estimate and check answers to problems and determine the reasonableness of results.
Construct viable arguments and critique the reasoning of others.	Justify and communicate conclusions effectively and respond to arguments logically.
Model with mathematics.	Use mathematics to model real world problems, interpreting the mathematical results in the context of the situation.
Use appropriate tools strategically.	Consider the tools available in solving problems and understand the insights gained by using the tool as well as the limitation of the tool.
Attend to precision.	Calculate accurately and efficiently within the context of problems and communicate results precisely.
Look for and make use of structure.	Examine problems to discern a pattern or structure and utilize this finding in similar problems.
Look for and express regularity in repeated reasoning.	Notice repeated calculations or processes and generalize from those insights in order to solve problems.

UNIT 1

Unit Title	Statistical Design
Unit Description	Students will learn proper collection of data, how to design an experiment, parts of an experiment, bias, and how to prevent bias.
Unit Assessment	Common Unit Assessments

Essential Question	**Learning Goals**	**Content and Vocabulary**	**Standards**
How do we perform an unbiased sample and what are some mistakes people make while sampling? **3 Days**	☐ Identify different types of sampling (convenience, stratified, cluster, systematic, simple random). ☐ Identify basic guidelines for planning a statistical study and potential pitfalls of sampling and surveys. ☐ Distinguish between quantitative and qualitative variables. ☐ Identify the sample and the population of a study. ☐ Categorize the level of measurement of a variable.	**Vocabulary:** individuals, variable, quantitative, qualitative (categorical), population, sample, nominal, ordinal, interval, ratio, descriptive statistics, inferential statistics, simple random sample (SRS), stratified random sample, systematic sample, cluster sample, convenience sample, simulation **Content:** -Data that is collected needs to be identified and classified in several different ways. -The process of collecting sample data has certain requirements that must be met for that data to be reliable and unbiased.	CC.2.4.HS.B.2 Summarize, represent, and interpret data on two categorical and quantitative variables. CC.2.4.HS.B.4 Recognize and evaluate random processes underlying statistical experiments. CC.2.4.HS.B. Make inferences and justify conclusions based on sample surveys, experiments, and observational studies.

How do we conduct an experiment that will produce the best possible data minimizing any bias? **3 Days**	☐ Know how to prevent bias in an experiment (randomization, replication, double-blind experiment).	**Vocabulary:** census, experiment, observation study, placebo effect, control group, block design, treatment, replication, double blind, bias, lurking variable, confounding variable, non-response, voluntary response, causation, correlation **Content:** -The process of collecting experimental data has certain requirements that must be met for that data to be reliable and unbiased.	CC.2.4.HS.B.2 Summarize, represent, and interpret data on two categorical and quantitative variables. CC.2.4.HS.B.4 Recognize and evaluate random processes underlying statistical experiments. CC.2.4.HS.B.5-Make inferences and justify conclusions based on sample surveys, experiments, and observational studies.

UNIT 2

Unit Title	Displaying Distributions		
Unit Description	Students will learn that an integral part of statistics is being able to create and read visual representations of data.		
Unit Assessment	Common Unit Assessments		
Essential Question	**Learning Goals**	**Content and Vocabulary**	**Standards**
How do we construct and use bar graphs, circle graphs, and time plots? **2 Days**	☐ Understand that there are different types of graphs appropriate for specific data sets. ☐ Construct bar graphs, pareto charts, circle graphs, and time plots.	**Vocabulary:** bar graph, x-axis, y-axis, pareto chart, circle graph (pie chart), time plot **Content:** -The different types of data will relate to the different types of graphs that can be constructed.	CC.2.4.HS.B.2 Summarize, represent, and interpret data on two categorical and quantitative variables.
How do we construct and interpret a histogram? **3 Days**	☐ Recognize the basic distribution shapes: uniform, skewed left, skewed right, bimodal, symmetric. ☐ Understand that there are different types of graphs appropriate for specific data sets. ☐ Construct frequency and relative frequency histograms.	**Vocabulary:** histograms, frequency, relative frequency, classes, class width, symmetrical, uniform, skewed right/left, bimodal **Content:** -The shape of a distribution tells us information about our data. -Histograms organize data and the shape of our distribution can be observed.	CC.2.4.HS.B.2 Summarize, represent, and interpret data on two categorical and quantitative variables.

How do you construct and interpret a stem and leaf plot? **1 Day**	☐ Understand that there are different types of graphs appropriate for specific data sets. ☐ Recognize the basic distribution shapes: uniform, skewed left, skewed right, bimodal, symmetric. ☐ Compare stem-and-leaf plots to histograms. ☐ Construct stem-and-leaf plots.	**Vocabulary:** stem-and-leaf, stem, leaf, key, labels **Content:** -Stem-and-leaf plots organize data, and the shape of our distribution can be observed. Stem-and-leaf still preserves the individual data points on the graph. -When a stem-and-leaf plot is turned sideways it looks like a histogram.	CC.2.4.HS.B.2 Summarize, represent, and interpret data on two categorical and quantitative variables.

UNIT 3

Unit Title	Describing Distributions
Unit Description	Students will learn how to compare multiple sets of data; the spread of the data and measures of central tendency help describe certain aspects of the data set.
Unit Assessment	Common Unit Assessments

Essential Question	**Learning Goals**	**Content and Vocabulary**	**Standards**
What is central tendency, how and why do we calculate it? **2 Days**	☐ Calculate the mean, median, and mode. ☐ Explain how the mean, median, and mode are affected by extreme values. ☐ Calculate a 5 or 10% trimmed mean.	**Vocabulary:** mean, median, mode, sigma, resistant measure, non-resistant measure, trimmed mean **Content:** -Mean, median, and mode are used to describe the center of a data set.	CC.2.4.HS.B.2 Summarize, represent, and interpret data on two categorical and quantitative variables.
How do we calculate and interpret the variation of a set of data? **3 Days**	☐ Calculate the range, variance, and standard deviation**.** ☐ Define and interpret the standard deviation. ☐ Identify and calculate the formula for the coefficient of variation. ☐ Identify the three parts of Chebyshev's theorem and apply the results to raw data.	**Vocabulary:** range, standard deviation, variance, variability, maximum, minimum, deviations, sum of squares, coefficient of variation **Content:** -Standard deviation, variance, coefficient of variation, and Chebyshev's Theorem all help measure spread (variability). -Chebyshev's Theorem is the beginning of the 68-95-99.7 rule.	CC.2.4.HS.B.2 Summarize, represent, and interpret data on two categorical and quantitative variables.

What information is needed to construct a box and whisker plot and how is a box and whisker plot constructed? **2 Days**	☐ Calculate percentiles. ☐ Construct a box and whisker plot (modified). ☐ Use the inter quartile range (IQR) to calculate any outliers for a data set.	**Vocabulary:** percentiles, quartiles, 5 number summary, inter quartile range (IQR), outliers **Content:** -Box and whisker plots are constructed out of the 5 number summary. -Box and whisker plots are used to organize data and analyze how a data set is distributed.	CC.2.4.HS.B.2 Summarize, represent, and interpret data on two categorical and quantitative variables.

UNIT 4

Unit Title	Regression and Correlation
Unit Description	Students will learn data sets can be modeled by many mathematical models, linear regression being one of them. Students will create and analyze scatter plots for a linear relationship. They will also find the LSRL (least squares regression line) and use that line to predict what might happen.
Unit Assessment	Common Unit Assessments

Essential Question	**Learning Goals**	**Content and Vocabulary**	**Standards**
How are a scatter plot and least squares regression line (LSRL) related? **2 Days**	☐ Explain the difference between an explanatory (independent) variable and a response (dependent) variable. ☐ Construct a scatter plot by hand and with a calculator. ☐ Estimate the location of a least-squares line.	**Vocabulary:** scatter plot, LSRL (least squares regression line), independent variable, dependent variable **Content:** -The independent variable (x) determines what the dependent variable (y) will be. -The scatterplot shows if there is an initial association between the independent and dependent variable. -If the scatterplot appears to be linear, then we proceed with calculating and drawing a least squares regression line (LSRL).	CC.2.4.HS.B.2 Summarize, represent, and interpret data on two categorical and quantitative variables.

How do we calculate the LSRL (least squares regression line) by hand and with a calculator? **3 Days**	☐ Know and interpret the formula for the least-squares regression line. ☐ Know the calculator commands for the least-squares line. ☐ Use sample data to compute and graph a least-squares line (by hand and with the calculator). ☐ Calculate predictions using the LSRL and identify whether the prediction is reasonable.	**Vocabulary:** interpolation, extrapolation **Content:** -Calculating the LSRL by hand requires several formulas and calculations. -Calculating the LSRL can also be done with the TI-84. -The LSRL is used to make predictions of interpolation and extrapolation.	CC.2.4.HS.B.2 Summarize, represent, and interpret data on two categorical and quantitative variables. C.C.2.4.HS.B.3 Analyze linear models to make interpretations based on the data.
What are r and r-squared and how do we calculate them? **3 Days**	☐ Explain the meaning of correlation coefficient and coefficient of determination. ☐ Know the calculator commands for the correlation and the coefficient of determination. ☐ Use sample data to compute the correlation coefficient and the coefficient of determination (by hand and with a calculator).	**Vocabulary:** correlation coefficient, coefficient of determination, causation **Content:** -R and r-squared tell us how accurate the LSRL is. -Without r and r-squared we might be making predictions that should not be done.	CC.2.4.HS.B.2 Summarize, represent, and interpret data on two categorical and quantitative variables. C.C.2.4.HS.B.3 Analyze linear models to make interpretations based on the data.

UNIT 5

Unit Title	Probability and Counting Techniques
Unit Description	Students will learn what probability represents and how it is calculated for basic events. Students will calculate probabilities for compound and conditional events. Counting principles will be used to determine sample space for events.
Unit Assessment	Common Unit Assessments

Essential Question	**Learning Goals**	**Content and Vocabulary**	**Standards**
What is probability and how do we calculate it? **4 Days**	☐ Assign probabilities to events. ☐ Explain how the law of large numbers relates to relative frequencies. ☐ Use the notation for probability of events. ☐ Determine the sample space of an experiment.	**Vocabulary:** probability, event, sample space, complement **Content:** -Sample space is everything that could happen. -Each event in the sample space must have a valid probability assigned to it.	CC.2.4.HS.B.4 Recognize and evaluate random processes underlying statistical experiments.

Why are probability rules necessary and how do we calculate probability with them? **5 Days**	☐ Compute probabilities of general compound statements. ☐ Use probability rules to compute probabilities involving independent events or mutually exclusive events. ☐ Distinguish between mutually exclusive events and not mutually exclusive events. ☐ Distinguish between independent and dependent events. ☐ Distinguish between a situation involving conditional probability and non-conditional probability.	**Vocabulary:** independent, dependent, conditional probability, and vs or, mutually exclusive (disjoint) **Content:** -Compound events are having multiple events occurring together. Finding those probabilities is more challenging and involves counting and/or formulas. -Mutually exclusive is when events have no intersection (cannot occur at the same time). -Independent events are events that do not affect each other. There are two methods (formulas) to prove independence.	CC.2.4.HS.B.4 Recognize and evaluate random processes underlying statistical experiments.
What are combinations and permutations and how are they used to calculate probability? **4 Days**	☐ Use factorial notation ☐ Identify whether a situation is a combination or a permutation. ☐ Compute the number of non-ordered arrangements of outcomes using combinations. ☐ Compute the number of ordered arrangements of outcomes using permutations. ☐ Construct tree diagrams and two-way charts.	**Vocabulary:** tree diagram, permutations, combinations, factorial **Content:** -A permutation is a situation when order matters. -Order matters in situations like passwords and order of finishing in a track meet. -A combination is when order does not matter. Order doesn't matter when people are serving on a committee or in a giveaway where the prizes are all the same.	CC.2.4.HS.B.4 Recognize and evaluate random processes underlying statistical experiments.

UNIT 6

Unit Title	Binomial Probability Distributions
Unit Description	Students will learn what a binomial setting is and what the conditions are for it. Students will also learn how to calculate a probability for a binomial setting using the formula and the function on the calculator.
Unit Assessment	Common Unit Assessments

Essential Question	**Learning Goals**	**Content and Vocabulary**	**Standards**
What are discrete and continuous random variables and how do we tell the difference between them? **5 Days**	☐ Determine if a variable is discrete or continuous. ☐ Provide examples of discrete and continuous random variables. ☐ Calculate the expected value of a set. ☐ Compute mu and sigma for a discrete probability distribution. ☐ Graph a discrete probability distribution.	**Vocabulary:** random variable, discrete, continuous, probability distribution, expected value **Content:** -The type of variable determines what type of calculations we should be doing with our variables. -The mean and standard deviation of a discrete random variable can be calculated using a formula or a TI-84 calculator.	CC.2.4.HS.B.2 Summarize, represent, and interpret data on two categorical and quantitative variables. CC.2.4.HS.B.4 Recognize and evaluate random processes underlying statistical experiments.

What are the conditions for a binomial setting and how do we calculate binomial probabilities? **5 Days**	☐ Identify the features of a binomial experiment. Determine if a situation is binomial. ☐ Use the binomial rule to find the probability of exactly one number of successes occurring. ☐ Use the calculator binomial function to find the probability of exactly one number of successes occurring. ☐ Use the binomial rule or the calculator to find the probability of more than one number of successes occurring. ☐ Find the mean and standard deviation for a binomial situation.	**Vocabulary:** binomial, binomial distribution function, cumulative distribution function **Content:** -There are four conditions that must be met for a random variable to be Binomial. Once those are met, we can use the binomial formula to do probability calculations.	CC.2.4.HS.B.2 Summarize, represent, and interpret data on two categorical and quantitative variables. CC.2.4.HS.B.4 Recognize and evaluate random processes underlying statistical experiments.

UNIT 7

Unit Title	Normal Distributions
Unit Description	Students will learn what a normal distribution is and why it is so important. They will be able to use the empirical rule to answer questions with a normal distribution and a standard normal curve. Probabilities will be calculated from the standard normal curve and real-world connections will be made.
Unit Assessment	Common Unit Assessments

Essential Question	**Learning Goals**	**Content and Vocabulary**	**Standards**
What is the empirical rule for a normal distribution and how is it used to construct a graph of a normal distribution? **3 Days**	☐ Identify and draw a normal distribution. ☐ Know and use the empirical rule to answer questions about normal distributions. ☐ Draw the standard normal curve.	**Vocabulary:** normal curve, normal distribution, empirical rule. standard normal curve **Content:** -The empirical rule can be used for a normal distribution when the scores fall on integer standard deviations (z-scores).	CC.2.4.HS.B.2 Summarize, represent, and interpret data on two categorical and quantitative variables. CC.2.4.HS.B.4 Recognize and evaluate random processes underlying statistical experiments.

What is a z-score and how is it used to calculate probabilities of random events? **3 Days**	☐ Identify and use formulas for z-score and raw score. ☐ Convert raw data into z-scores and z-scores to raw data, given mu and sigma. ☐ Graph the standard normal distribution and find the area under the standard normal curve (using the calculator and the chart). ☐ Compute the probability of "standardized" events.	**Vocabulary:** z-score, standard normal curve **Content:** -A z-score tells you how far above or below the mean something is. -We can use z-scores along with our standard normal table to find probabilities of specific events	CC.2.4.HS.B.2 Summarize, represent, and interpret data on two categorical and quantitative variables. CC.2.4.HS.B.4 Recognize and evaluate random processes underlying statistical experiments.
How do I apply the z-score to real life problems and how do I use inverse norm to solve problems? **3 Days**	☐ Find a z-score from a given probability (inverse norm). ☐ Use the inverse norm to solve "guarantee" problems (probability to raw score).	**Vocabulary:** inverse norm **Content:** -Using inverse norm is when we have a probability of an event happening and we want to find the raw score that goes with that likelihood of the event occurring.	CC.2.4.HS.B.2 Summarize, represent, and interpret data on two categorical and quantitative variables. CC.2.4.HS.B.4 Recognize and evaluate random processes underlying statistical experiments.
How do we use the normal approximation for a binomial distribution? **3 Days**	☐ Identify assumptions needed for the normal approximation to the binomial. ☐ Compute the mean and standard deviation for normal approximation. ☐ Convert a range of r (success) values to a corresponding range of normal x values and then solve the probability (continuity correction).	**Vocabulary:** continuity correction, binomial approximation **Content:** -Binomial probabilities can be very difficult to calculate when the sample size and/or event starts to increase. -Using the normal approximation makes calculating probabilities for those events much easier.	CC.2.4.HS.B.2 Summarize, represent, and interpret data on two categorical and quantitative variables. CC.2.4.HS.B.4 Recognize and evaluate random processes underlying statistical experiments.

UNIT 8

Unit Title	Sampling Distributions
Unit Description	Students will learn that taking many samples of different sizes from a population helps normalize the distribution. Students will learn about the central limit theorem (CLT) and how to apply that to sampling and data collection.
Unit Assessment	Common Unit Assessments

Essential Question	**Learning Goals**	**Content and Vocabulary**	**Standards**
What is sampling distribution and why is it important? **2 Days**	☐ Differentiate between a parameter and a statistic. ☐ Identify and calculate the mean and standard deviation of the sample means. ☐ Identify and calculate the mean and standard deviation of the sample proportions.	**Vocabulary:** parameter, statistic, population, sample, sampling distribution, population proportion **Content:** -A sampling distribution of a statistic is the distribution of values taken by the statistic in all possible samples of the same size from the same population. -Knowing this helps us estimate a population parameter from collecting many samples.	CC.2.4.HS.B.2 Summarize, represent, and interpret data on two categorical and quantitative variables. CC.2.4.HS.B.4 Recognize and evaluate random processes underlying statistical experiments.

What is a central limit theorem (CLT) and how do we apply it in calculating probabilities? **2 Days**	☐ Use the central limit theorem (CLT) to determine if a sampling distribution is normal. ☐ Find probabilities of sampling distributions (by hand and with the calculator).	**Vocabulary:** central limit theorem **Content:** -The CLT allows us to use a normal distribution when the sample size becomes large enough. Being large enough is based on the type of data (quantitative or categorical) you are looking at.	CC.2.4.HS.B.2 Summarize, represent, and interpret data on two categorical and quantitative variables. CC.2.4.HS.B.4 Recognize and evaluate random processes underlying statistical experiments.

UNIT 9

Unit Title	Estimation
Unit Description	Students will learn where confidence intervals are used and why they are used. Finding intervals for which a value should fall is a good estimation tool.
Unit Assessment	Common Unit Assessments

Essential Question	**Learning Goals**	**Content and Vocabulary**	**Standards**
What is a confidence interval and how do we calculate one? **3 Days**	☐ Identify if a large or a small sample was collected. ☐ Find the critical value (Zc) for the correct confidence level. ☐ Create and interpret a confidence interval for the mean for large samples.	**Vocabulary:** confidence level, critical value, point estimate, standard error, margin of error **Content:** **-**Confidence intervals are used to estimate a population parameter that we don't know. -To calculate a confidence interval, you need to find the point estimate along with the margin of error. -For a large sample size, you will calculate a z interval. -The formula is PE + or – CV(SE) PE is the point estimate. CV is the critical value. SE is the standard error.	CC.2.4.HS.B.5 Make inferences and justify conclusions based on sample surveys, experiments, and observational studies.

How do we calculate confidence intervals for μ using small samples and interpret the results? **3 Days**	☐ Find the critical value (Tc) for the correct confidence level. ☐ Create and interpret a confidence interval for the mean for small samples.	**Vocabulary:** degrees of freedom **Content:** -For a small sample size, you will calculate a t interval. This changes the critical value and how it is found.	CC.2.4.HS.B.5 Make inferences and justify conclusions based on sample surveys, experiments, and observational studies.
How do we calculate confidence intervals for proportions and interpret the results? **2 Days**	☐ Find the critical value (Zc) for the correct confidence level. ☐ Create and interpret a confidence interval for proportions.	**Content:** -For a large or small sample size you will calculate a z interval for proportions.	CC.2.4.HS.B.5 Make inferences and justify conclusions based on sample surveys, experiments, and observational studies.
How do we determine the sample size needed for specific Margin of Error? **2 Days**	☐ Determine the sample size for a problem based on the mean. ☐ Determine the sample size for a problem based on a known and unknown proportion. ☐ Margin of error/maximal error of tolerance.	**Vocabulary:** sample size, margin of error/maximal error of tolerance **Content:** -We use the margin of error formula to find the sample size we need to hold to a specific margin of error.	CC.2.4.HS.B.5 Make inferences and justify conclusions based on sample surveys, experiments, and observational studies.

UNIT 10

Unit Title	Hypothesis Testing
Unit Description	Students will learn what a hypothesis test is and why they are used. Students will find evidence or not find evidence against a claim made by outside groups.
Unit Assessment	Common Unit Assessments

Essential Question	**Learning Goals**	**Content and Vocabulary**	**Standards**
What is the purpose of hypothesis testing and how do we write the hypotheses? **3 Days**	☐ Write the null hypothesis for a claim. ☐ Write the alternative hypothesis against a claim. ☐ Identify type 1 error in context. ☐ Identify type 2 error in context.	**Vocabulary:** null hypothesis, alternative hypothesis, type 1 error, type 2 error, alpha value **Content:** -The null hypothesis is what is known to be true. The alternative is something that is questioning the null hypothesis. -Type 1 error is a false positive. -Type 2 error is a false negative.	CC.2.4.HS.B.5 Make inferences and justify conclusions based on sample surveys, experiments, and observational studies.

How do you perform hypothesis testing for a population mean with a large sample size? **3 Days**	☐ Find the critical value for a population mean from a large sample. ☐ Calculate a z test statistic for a population mean. ☐ Calculate and interpret a p-value from a z-test statistic for a population mean.	**Vocabulary:** level of significance, critical value z star, critical region, left tail, right tail, double tail, statistically significant, p-value **Content:** -Once a null and alternative hypothesis is written, a z test statistic for means should be calculated and a p-value found from our Table A. -The p-value should be compared to our alpha value and a decision should be made to either reject the null hypothesis or fail to reject the null hypothesis.	CC.2.4.HS.B.5 Make inferences and justify conclusions based on sample surveys, experiments, and observational studies.
How do you perform hypothesis testing for a population mean with a small sample size? **2 Days**	☐ Find the critical value for a population mean from a small sample. ☐ Calculate a t test statistic for a population mean. ☐ Calculate and interpret a p-value from a t-test statistic for a population mean.	**Vocabulary:** critical value t star, degrees of freedom **Content:** -Once a null and alternative hypothesis is written, a t test statistic for means should be calculated and a p-value found from our Table B. -The p-value should be compared to our alpha value and a decision should be made to either reject the null hypothesis or fail to reject the null hypothesis.	CC.2.4.HS.B.5 Make inferences and justify conclusions based on sample surveys, experiments, and observational studies.

How do you perform hypothesis testing for a population proportion? **2 Days**	☐ Find the critical value for a population proportion. ☐ Calculate a z test statistic for a population proportion. ☐ Calculate and interpret a p-value from a z-test statistic for a population proportion.	**Vocabulary:** population proportion, sample proportion **Content:** -Once a null and alternative hypothesis is written, a z test statistic for proportions should be calculated and a p-value found from our Table A. -The p-value should be compared to our alpha value and a decision should be made to either reject the null hypothesis or fail to reject the null hypothesis.	CC.2.4.HS.B.5 Make inferences and justify conclusions based on sample surveys, experiments, and observational studies.

UNIT 11

Unit Title	Inferences about Differences
Unit Description	Students will learn how to perform hypothesis tests when comparing two dependent sets of data and how to perform hypothesis tests when comparing two independent sets of data.
Unit Assessment	Common Unit Assessments

Essential Question	**Learning Goals**	**Content and Vocabulary**	**Standards**
How do you perform hypothesis testing for a paired difference? **1 Day**	☐ Write a null and alternative hypothesis for and against a claim. ☐ Calculate a test statistic for a population mean for a matched pairs data. ☐ Calculate and interpret a p-value from a test statistic for a population mean for a matched pairs data.	**Vocabulary:** dependent samples, match pairs, difference of means **Content:** -A matched pairs design can be used with a null and alternative hypothesis when you are tracking data on a pre and posttest to see if there was significant improvement from before to after the treatment that was imposed.	CC.2.4.HS.B.5 Make inferences and justify conclusions based on sample surveys, experiments, and observational studies.

How do you perform hypothesis testing for a difference of two independent means from a large sample? **1 Day**	☐ Write a null and alternative hypothesis for and against a claim. ☐ Calculate a z test statistic for the difference of two means of two independent populations from large sample sizes. ☐ Calculate and interpret a p-value from a test statistic for the difference of two population means of two independent populations from large sample sizes.	**Vocabulary:** independent samples **Content:** -Once a null and alternative hypothesis is written, a z test statistic for the difference in means should be calculated and a p-value found from our Table A. -The p-value should be compared to our alpha value and a decision should be made to either reject the null hypothesis or fail to reject the null hypothesis.	CC.2.4.HS.B.5 Make inferences and justify conclusions based on sample surveys, experiments, and observational studies.
How do you perform hypothesis testing for a difference of two independent means from a small sample? **1 Day**	☐ Write a null and alternative hypothesis for and against a claim. ☐ Calculate a t test statistic for the difference of two means of two independent populations from small sample sizes. ☐ Calculate and interpret a p-value from a test statistic for the difference of two population means of two independent populations from small sample sizes.	**Content:** -Once a null and alternative hypothesis is written, a t test statistic for the difference in means should be calculated and a p-value found from our Table B. -The p-value should be compared to our alpha value and a decision should be made to either reject the null hypothesis or fail to reject the null hypothesis.	CC.2.4.HS.B.5 Make inferences and justify conclusions based on sample surveys, experiments, and observational studies.

How do you perform hypothesis testing for a difference of two independent proportions? **1 Day**	☐ Write a null and alternative hypothesis for and against a claim. ☐ Calculate a z test statistic for the difference of two proportions of two independent populations. ☐ Calculate and interpret a p-value from a test statistic for the difference of two population proportions of two independent populations.	**Vocabulary:** pooled p hat **Content:** -Once a null and alternative hypothesis is written, a z test statistic for the difference in proportions should be calculated and a p-value found from our Table A. -The p-value should be compared to our alpha value and a decision should be made to either reject the null hypothesis or fail to reject the null hypothesis.	CC.2.4.HS.B.5 Make inferences and justify conclusions based on sample surveys, experiments, and observational studies.

ACCOMMODATIONS AND MODIFICATIONS

Adaptations or modifications to this planned course will allow exceptional students to earn credits toward graduation or develop skills necessary to make a transition from the school environment to community life and employment. The I.E.P. team has determined that modifications to this planned course will meet the student's I.E.P. needs.

Adaptations/Modifications may include but are not limited to:

INSTRUCTION CONTENT

- Modification of instructional content and/or instructional approaches
- Modification or deletion of some of the essential elements

SETTING

- Preferential seating

METHODS

- Additional clarification of content
- Occasional need for one to one instruction
- Minor adjustments or pacing according to the student's rate of mastery
- Written work is difficult, use verbal/oral approaches
- Modifications of assignments/testing
- Reasonable extensions of time for task/project completion
- Assignment sheet/notebook
- Modified/adjusted mastery rates
- Modified/adjusted grading criteria
- Retesting opportunities

MATERIALS

- Supplemental texts and materials
- Large print materials for visually impaired students
- Outlines and/or study sheets
- Carbonless notebook paper
- Manipulative learning materials
- Alternatives to writing (tape recorder/calculator)