SUBJECT: Introduction to Statistics	GRADE: 9-12
Unit 1: Introduction to Statistics	**Time Frame: 15 days**

UNIT OVERVIEW

In this unit students will define core aspects of probability and statistics, distinguish between qualitative and quantitative data, design statistical studies while also collecting their own data by using sampling techniques.

LRG SKILLS AND DISPOSITIONS	PA STANDARDS
● Collaboration and Teamwork 9-12: Sampling Methods project (S1C) ● Creativity and Innovation 9-12: Hypothetical Study Essay, Sampling Methods Project (S3C) ● Critical Thinking and Problem Solving 9-12:Hypothetical Study Essay, Sampling Methods Project (S4C)	● CC.2.4.HS.B.5

COMPETENCIES	LEARNING TARGETS
Measurement, Data, and Statistics: ● I can collect, represent, analyze, and interpret data.	● I can explain the difference between a population and a sample. (K1MAB10P1) ● I can describe the difference between descriptive and inferential statistics. (K1MAB10P2) ● I can describe the relationship between parameters and statistics. (K1MAB10P3) ● I can recognize the differences in nominal, ordinal, interval, and ratio scales of measurement. (K1MAB10P4)

	• I can describe the difference between qualitative and quantitative data. (K1MAB10P5) • I can implement components of experimental design (control group, experimental group, placebo, confounding variable, blinding, randomization, and replication). (K1MAB10P6) • I can correctly apply sampling methods to given populations (SRS, Stratified, Cluster, Systematic, and Convenience). (K1MAB10P7)

SUBJECT: Introduction to Statistics	**GRADE: 9-12**
Unit 2: Descriptive Statistics	**Time Frame: 15 days**

UNIT OVERVIEW

In this unit students will construct frequency distributions, graphs, plots, and charts. Students will also work on finding means, weighted means, medians, modes, and other measures of central tendency.

LRG SKILLS AND DISPOSITIONS	**PA STANDARDS**
• Collaboration and Teamwork 9-12: Graphing Project (S1C) • Creativity and Innovation 9-12: Graphing Project (S3C) • Critical Thinking and Problem Solving 9-12: Graphing Project (S4C)	• CC.2.1.HS.F.3 • CC.2.1.HS.F.5 • CC.2.2.HS.C.2 • CC.2.4.HS.B.1 • CC.2.4.HS.B.2 • CC.2.4.HS.B.3 • CC.2.4.HS.B.5
COMPETENCIES	**LEARNING TARGETS**
Graphing : • I can create and interpret graphs as visual representations of the relationship between quantities.	• I can construct absolute frequency, relative frequency, and cumulative frequency tables. (K1MAB7P1) • I can represent data by means of bar charts, histograms, circle graphs, and frequency polygons. (K1MAB7P2)

	• I can present data by means of stem and leaf, dot plots, pie charts, pareto charts, box and whisker plots and scatter plots. (K1MAB7P4)
Measurement, Data, and Statistics: • I can collect, represent, analyze, and interpret data.	• I can interpret data represented as bar charts, histograms, circle graphs, and frequency polygons. (K1MAB7P3) • I can choose the appropriate descriptive statistic for summarizing a set of data. (K1MAB10P8) • I can compute measures of central tendency (mean, median, mode, and weighted mean). (K1MAB10P9) • I can describe the shapes of distributions (symmetric, uniform, skewed left or right). (K1MAB10P10) • I can calculate the mean of a frequency distribution. (K1MAB10P11) • I can correctly calculate standard deviation and variance for samples and populations. (K1MAB10P12) • I can compute measures of variability (range, variance, and standard deviation). (K1MAB10P13) • I can estimate variability using the empirical rule and Chebyshev's Theorem. (K1MAB10P14) • I can summarize data by means of percentages, percentiles, rates, and ratios. (K1MAB10P15) • I can calculate the five-number summary of a data set. (K1MAB10P16) • I can identify outliers within a set of data. (K1MAB10P17)

SUBJECT: Introduction to Statistics	GRADE: 9-12
Unit 3: Probability	**Time Frame: 30 days**

UNIT OVERVIEW

In this unit students will find the probabilities of independent and dependent events along with complements, find the number of ways multiple events occur, along with applying multiplication and addition properties. Students will also use a calculator to calculate permutations and combinations.

LRG SKILLS AND DISPOSITIONS	PA STANDARDS
● Collaboration and Teamwork 9-12: Probability in Games Project (S1C) ● Creativity and Innovation 9-12: Probability in Games Project (S3C) ● Critical Thinking and Problem Solving 9-12: Probability in Games Project (S4C)	● CC.2.4.HS.B.6 ● CC.2.4.HS.B.7
COMPETENCIES	**LEARNING TARGETS**
Probability: ● I can use counting strategies and calculate the probability of events.	● I can recognize the differences in events, samples, and outcomes. (K1MAB11P1) ● I can use the Fundamental Counting Principle to find the number of ways two or more events can occur. (K1MAB11P2) ● I can recognize the differences in subjective, classical, and empirical probability. (K1MAB11P3) ● I can apply the Law of Large Numbers. (K1MAB11P4) ● I can find the probability of the complement of the event. (K1MAB11P5) ● I can calculate probabilities of events using conditional probability formulas. (K1MAB11P6) ● I can calculate probabilities of events using the multiplication rule. (K1MAB11P7)

	• I can recognize the differences between independent and dependent events. (K1MAB11P8) • I can recognize mutually exclusive and non-mutually exclusive events. (K1MAB11P9) • I can find probabilities using the addition rule. (K1MAB11P10) • I can calculate probabilities of events using permutations and combinations. (K1MAB11P11)
Graphing: • I can create and interpret graphs as visual representations of the relationship between quantities.	• I can construct tree diagrams to represent all possible outcomes of a sample space. (K1MAB7P5)

SUBJECT: Introduction to Statistics	GRADE: 9-12
Unit 4: Discrete Probability Distributions	**Time Frame: 30 days**

UNIT OVERVIEW

In this unit students will construct probability distributions and binomial distributions. Students will also find expected value, calculate mean, variance, and standard deviation of probability distributions. Students will also use the probability formula for a geometric distribution.

LRG SKILLS AND DISPOSITIONS	PA STANDARDS
	● CC.2.4.HS.B.6 ● CC.2.4.HS.B.7

COMPETENCIES	LEARNING TARGETS
Measurement, Data, and Statistics: ● I can collect, represent, analyze, and interpret data.	● I can recognize the differences between discrete and continuous random variables. (K1MAB10P18) ● I can calculate and interpret with context the mean (expected value), variance, and standard deviation of a discrete random variable. (K1MAB10P19) ● I can identify binomial experiments using properties. (K1MAB10P20) ● I can calculate and interpret with context the mean, variance, and standard deviation of a binomial distribution. (K1MAB10P21)
Graphing: ● I can create and interpret graphs as visual representations of the relationship between quantities.	● I can construct probability distributions. (K1MAB11P12) ● I can represent probability distributions graphically and interpret results. (K1MAB7P7)
Probability ● I can use counting strategies and calculate the probability of events.	● I can identify and verify probability distributions. (K1MAB11P12) ● I can calculate binomial probabilities using tables, formulas, and technology. (K1MAB11P13) ● I can calculate probabilities using the geometric distribution. (K1MAB11P14)

	• I can calculate probabilities using the Poisson distribution. (K1MAB11P15)

SUBJECT: Introduction to Statistics	GRADE: 9-12
Unit 5: Normal Probability Distributions	**Time Frame: 30 days**

UNIT OVERVIEW

In this unit students will define density curves and normal curves. Students will also work to calculate z-scores and areas under the standard normal curve.

LRG SKILLS AND DISPOSITIONS	PA STANDARDS
	● CC.2.1.HS.F.3

COMPETENCIES	LEARNING TARGETS
Measurement, Data, and Statistics: ● I can collect, represent, analyze, and interpret data.	● I can identify normal distributions using properties. (K1MAB10P22) ● I can explain how mean and standard deviation influence the shape of normal curves. (K1MAB10P23) ● I can identify standard normal distributions using properties. (K1MAB10P24) ● I can convert x-values (raw data) to z-scores using formulas/technology and interpret with context. (K1MAB10P25) ● I can convert areas under the standard normal curve and percentiles to z-scores using tables/technology. (K1MAB10P26) ● I can convert z-scores to x-values and interpret with context. (K1MAB10P27) ● I can recognize sampling distributions and verify their properties. (K1MAB10P28) ● I can recognize when normal distributions can be used to approximate binomials. (K1MAB10P29)

	• I can approximate binomial distributions using normal distribution, correctly apply continuity corrections, and interpret results with context. (K1MAB10P30)
Probability: • I can use counting strategies and calculate the probability of events.	• I can recognize areas under the standard normal curve as probability and calculate using tables/technology. (K1MAB11P16) • I can calculate normal probabilities using tables and technology. (K1MAB11P17) • I can interpret and apply the Central Limit Theorem to find the probability of a sample mean. (K1MAB11P18)

SUBJECT: Introduction to Statistics	GRADE: 9-12
Unit 6: Confidence Intervals	**Time Frame: 30 days**

UNIT OVERVIEW
In this unit students will use standard normal takes and calculate margins of error, minimum sample sizes, and Chi-square distributions.

LRG SKILLS AND DISPOSITIONS	PA STANDARDS
	● CC.2.1.HS.F.3

COMPETENCIES	LEARNING TARGETS
Measurement, Data, and Statistics: ● I can collect, represent, analyze, and interpret data.	● I can define and calculate point estimates, interval estimates, and margin of error. (K1MAB10P31) ● I can construct and interpret confidence interval on a single population mean when the population standard deviation is known(Z-distribution)/unknown(T-distribution). (K1MAB10P32) ● I can calculate minimum sample sizes using formulas. (K1MAB10P33) ● I can recognize when to utilize normal distributions versus t-distributions to construct confidence intervals. (K1MAB10P34) ● I can construct and interpret confidence intervals for population proportions. (K1MAB10P35) ● I can interpret the Chi-Square distribution and utilize distribution tables. (K1MAB10P36) ● I can construct and interpret confidence intervals for a population variance and standard deviation (Chi-Square distribution). (K1MAB10P37)

SUBJECT: Introduction to Statistics	GRADE: 9-12
Unit 7: Hypothesis Testing with One Sample	**Time Frame: 30 days**

UNIT OVERVIEW

In this unit students will work through all steps of a statistical hypothesis test which includes writing null and alternative hypotheses, finding p-values, critical values, rejection regions, and then using that information to come to a conclusion about the set of data.

LRG SKILLS AND DISPOSITIONS	PA STANDARDS
● Critical Thinking and Problem Solving 9-12: Hypothesis Testing project (S4C)	● CC.2.4.HS.B.1 ● CC.2.4.HS.B.4
COMPETENCIES	**LEARNING TARGETS**
Measurement, Data, and Statistics: ● I can collect, represent, analyze, and interpret data.	● I can recognize the relationship between the null/alternative hypothesis when implementing hypothesis tests. (K1MAB10P38) ● I can identify type I and type II errors. (K1MAB10P39) ● I can utilize the correct steps to construct, implement, and interpret a hypothesis test. (K1MAB10P40) ● I can recognize when to utilize a one-tail or two tailed statistical test and find a p-value. (K1MAB10P41) ● I can utilize p-values to make decisions for a z-test for a mean when the standard deviation is known. (K1MAB10P42) ● I can calculate critical values/find rejection regions of a normal curve and utilize it to make decisions for a z-test for a mean when the standard deviation is known. (K1MAB10P43) ● I can calculate critical values/find rejection regions of a normal curve and utilize it to make decisions for a t-test for a mean when the standard deviation is known. (K1MAB10P44) ● I can calculate critical values/find rejection regions of a normal curve and utilize it to make decisions for a one proportion z-test for a mean when the standard deviation is known. (K1MAB10P45)

SUBJECT: Introduction to Statistics	GRADE: 9-12
Unit 8: Hypothesis Testing with Two Samples	**Time Frame: 30 days**

UNIT OVERVIEW

In this unit students will perform hypothesis tests on two samples and then use data from the hypothesis test to come to a conclusion about the researcher's claim.

LRG SKILLS AND DISPOSITIONS	PA STANDARDS
	● CC.2.4.HS.B.1 ● CC.2.4.HS.B.4 ● CC.2.4.HS.B.5
COMPETENCIES	**LEARNING TARGETS**
Measurement, Data, and Statistics: ● **I can collect, represent, analyze, and interpret data.**	● I can determine if two samples are independent. (K1MAB10P46) ● I can perform a z-test for difference in means between two large independent samples. (K1MAB10P47) ● I can utilize p-values to make decisions for a t-test to find differences in means, when the standard deviation is unknown. (K1MAB10P48) ● I can calculate critical values/find rejection regions of a normal curve and utilize it to make decisions for a t-test for a mean when the standard deviation is unknown. (K1MAB10P49)

SUBJECT: Introduction to Statistics	GRADE: 9-12
Unit 9: Correlation and Regression	**Time Frame: 30 days**

UNIT OVERVIEW

In this unit students will create and analyze scatterplots, recognize positive and negative associations, and use the 3-step procedure to analyze association.

LRG SKILLS AND DISPOSITIONS	PA STANDARDS
● Creativity and Innovation 9-12: Correlation Project (S3C)	● CC.2.1.HS.F.3 ● CC.2.2.HS.D.7 ● CC.2.2.HS.C.2 ● CC.2.2.HS.C.3 ● CC.2.2.HS.C.6 ● CC.2.4.HS.B.1 ● CC.2.4.HS.B.2 ● CC.2.4.HS.B.3 ● CC.2.4.HS.B.5
COMPETENCIES	**LEARNING TARGETS**
Measurement, Data, and Statistics: ● **I can collect, represent, analyze, and interpret data.**	● I can identify independent and dependent variables. (K1MAB10P50) ● I can calculate the correlation coefficient. (K1MAB10P51) ● I can perform a hypothesis test for a population correlation coefficient p. (K1MAB10P52) ● I can identify the difference in causation and correlation. (K1MAB10P53) ● I can find the equation of the least squares regression line. (K1MAB10P54) ● I can use the least squares regression line to predict values of the response variable. (K1MAB10P55)