Southern York County School District Instructional Plan

Course/Subject: Probability and Statistics

Grade Level(s) : 10,11,12

Textbook(s)/Instructional Materials Used:

The Basic Practice of Statistics Fifth Edition; W.H. Freeman and Company; ISBN-13: 978-1-4292-0121-6; ISBN-10: 1-4292-0121-5

Dates: End of August - October	**Unit Plan 1: Probability Chapters 10 and 12**

Stage 1 – Desired Results

PA Core State Assessments/Standards:

- **CC.2.4.HS.B.4, CC.2.4.HS.B.5, CC.2.4.HS.B.6, CC.2.4.HS.B.7, CC.2.4.7.B.3**
- **A1.2.3.3.1, A2.2.3.2.1, A2.2.3.2.2, A2.2.3.2.3**

Understanding(s): ***Students will understand***	**Essential Question(s):**
1. Probability describes the pattern of chance outcomes and provide the basis for inference. (CC.2.4.7.B.3) 2. This unit develops the rules and tools which will be used later to help describe the behavior of statistics from random samples.(CC.2.4.HS.B.4) 3. The two types of probability are experimental and theoretical. (CC.2.4.HS.B.7) 4. There are different types of random variables discrete and continuous. (CC.2.4.HS.B.4) 5. The mean and variance of a random variable center and spread of a distribution. (CC.2.4.HS.B.4)	▪ Are the given events disjoint? Complementary? Independent? What is the union or intersection? ▪ (CC.2.4.HS.B.6) ▪ When is it reasonable to assume independence as part of a probability model? (CC.2.4.HS.B.7) ▪ What are examples of random variables in real life? (CC.2.4.HS.B.4), (CC.2.4.HS.B.5) ▪ How can random variables be used to describe various situations? (CC.2.4.HS.B.4), (CC.2.4.HS.B.5) ▪ How is the likelihood of an event determined and communicated? (CC.2.4.7.B.3)
Learning Objectives: ***Students will know…***	***Students will be able to:***
▪ The probability rules and be able to apply them to determine probabilities of defined events ▪ How to construct tree diagrams to organize the use of the multiplication and addition rules to solve problems with several stages. ▪ There are discrete and continuous random variables ▪ How to find conditional probabilities for individuals chosen at random from a table of counts of possible outcomes	▪ Use the multiplication principle to determine the number of outcomes (if finite). ▪ Use Venn Diagrams and tree diagrams to determine simple probabilities. ▪ For the continuous case, use geometric areas to find probabilities of events ▪ Differentiate between discrete and continuous random variables

Dates: October-November	**Unit Plan 2: Picturing Distributions with Graphs**

Stage 1 – Desired Results

PA Core State Assessments/Standards:

- CC.2.1.HS.F.3, CC.2.4.HS.B.2, CC.2.4.HS.B.5
- A1.2.3.2.1, A1.2.3.2.2

Understanding(s): ***Students will understand…*** 1. Variables are divided into two groups, categorical and quantitative. (CC.2.4.HS.B.2) 2. There are different ways to evaluate a set of data – pie charts, bar graphs for categorical and dotplots, stemplots and histograms for quantitative. (CC.2.1.HS.F.3)	**Essential Question(s):** ▪ How can variables be used? (CC.2.4.HS.B.2) ▪ How can we describe any given set of data graphically? (CC.2.1.HS.F.3) ▪ What data display is appropriate for a given set of data? (CC.2.1.HS.F.3) ▪ How do charts, tables, and graphs help you interpret data? (CC.2.4.HS.B.5) ▪ How can you collect, organize, and display data? (CC.2.4.HS.B.2)
Learning Objectives: ***Students will know…*** ▪ Categorical vs. Quantitative variables ▪ Graphical displays– how to read, create and evaluate ▪ Predictions can be made from graphs	***Students will be able to:*** ▪ Describe a set of data ▪ Create and evaluate all types of graphical summaries. ▪ Decide which graphical display is best for the given data?
Dates: November	**Unit Plan 3: Describing Distributions with Numbers**
Stage 1 – Desired Results	
PA Core State Assessments/Standards: ▪ **CC.2.4.HS.B.1, CC.2.4.HS.B.5** ▪ **A1.2.3.1.1, A1.2.3.2.1, A1.2.3.2.2**	
Understanding(s): ***Students will understand…*** 1. Data can be evaluated numerically – counts, percents, proportions, mean, median, mode, range, standard deviation, interquartile range (CC.2.4.HS.B.1) 2. Different sets of data require different numerical summaries (CC.2.4.HS.B.1) 3. Measures of central tendency can be used to describe the shape of data (CC.2.4.HS.B.1) 4. Five number summary or standard deviation can be used depending on if the data is skewed or symmetric (CC.2.4.HS.B.1)	**Essential Question(s):** ▪ How can variables be used? (CC.2.4.HS.B.1) ▪ How can we describe any given set of data numerically? (CC.2.4.HS.B.1) ▪ What can be gained from numerical summaries of data? (CC.2.4.HS.B.1) ▪ In what ways can sets of data be represented by statistical measures? (CC.2.4.HS.B.1) ▪ How can the mean, median, mode, and range be used to describe the shape of the data? (CC.2.4.HS.B.1) ▪ How can mean, median, and mode be computed and compared? (CC.2.4.HS.B.1)
Learning Objectives: ***Students will know…*** ▪ How to find and evaluate numerical summaries for a given set of data ▪ How to organize a statistical problem ▪ How to calculate and compare mean, median, mode, range, standard deviation, interquartile range	***Students will be able to:*** ▪ Describe a set of data ▪ Calculate the numerical summaries of a set of data, by hand and through the use of their calculator. This includes mean, median, mode, standard deviation, Q1, Q3, IQR, outliers, and range.
Dates: December	**Unit Plan 4: Normal Distributions**
Stage 1 – Desired Results	
PA Core State Assessments/Standards:	

- **CC.2.4.HS.B.1, CC.2.4.HS.B.2, CC.2.4.HS.B.5**
- **A1.2.3.2.1, A1.2.3.2.2**

Understanding(s): ***Students will understand…***	**Essential Question(s):**
1. A density curve is a curve that is always on the horizontal axis and has total area under it of 1. (CC.2.4.HS.B.2) 2. Given a normal distribution, we can approximate both the mean and standard deviation. (CC.2.4.HS.B.1) 3. A histogram, stemplot and/or boxplot can be used to assess normality. (CC.2.4.HS.B.2)	▪ How can the mean and median be located in a density curve? What happens if the curve is symmetric? (CC.2.4.HS.B.1) ▪ How can you calculate a z-score and what does it mean? (CC.2.4.HS.B.1) ▪ What is the empirical rule and how can we use it to interpret and/or compare normal distributions? (CC.2.4.HS.B.2)
Learning Objectives: ***Students will know…***	***Students will be able to:***
▪ How to locate the median and mean on a density curve. ▪ What the empirical rule is and how to apply it to a normal distribution. ▪ How to determine the proportion of observations within one, two or three standard deviations.	▪ Identify the mean and median of a density curve. ▪ Identify density curves, normal curves and apply the empirical rule ▪ Find the z-score of any stated value in a distribution.
Dates: January	**Unit Plan 5: Scatterplots and Correlation**

Stage 1 – Desired Results

PA Core State Assessments/Standards:

- **CC.2.4.HS.B.3, CC.2.4.HS.B.5, CC.2.1.HS.F.3**
- **A1.2.3.2.1, A1.2.3.2.2, A1.2.3.2.3, A2.2.3.1.1, A2.2.3.1.2**

Understanding(s): ***Students will understand…***	**Essential Question(s):**
1. A scatterplot shows the relationship between two quantitative variables measured on the same individuals (CC.2.1.HS.F.3). 2. The differences between explanatory and response variables and how they are used to create scatterplots (CC.2.1.HS.F.3). 3. The correlation measures the direction and strength of the linear relationship between two quantitative variables (CC.2.4.HS.B.3).	▪ What can a scatterplot tell us about a set of data (CC.2.4.HS.B.5)? ▪ How can explanatory and response variables be used to label a graph correctly (CC.2.1.HS.F.3). ▪ What is correlation and what does it tell us about a set of data (CC.2.4.HS.B.3)? ▪ How can scatterplots be used to analyze real world data (CC.2.4.HS.B.5)?
Learning Objectives: ***Students will know…***	***Students will be able to:***
▪ How to create a scatterplot ▪ Explanatory and response variables ▪ What correlation is and how it is calculated	▪ Interpret a scatterplot ▪ Describe the explanatory and response variables for each problem. ▪ Calculate correlation for a small set of data by hand and large set through their calculator ▪ Analyze real world data with scatterplots
Dates: February - March	**Unit Plan 6: Regression and Residuals**

Stage 1 – Desired Results

PA Core State Assessments/Standards:

- **CC.2.4.HS.B.1, CC.2.4.HS.B.3, CC.2.4.HS.B.5**

- **A1.2.3.2.1, A1.2.3.2.2, A1.2.3.2.3**

Understanding(s): ***Students will understand…***	**Essential Question(s):**
▪ The least squares regression line of y on s is the line that makes the sum of the squares of the vertical distances of the data points as small as possible (CC.2.4.HS.B.3). ▪ Correlation determines the strength and direction of a linear relationship. (CC.2.4.HS.B.1). ▪ Residual Plots are used to assess the fit of a model which could be linear, exponential, or power regression. (CC.2.4.HS.B.5).	▪ What is a least squares regression line and when it is appropriate to use it as a line of best fit. What can we gain from a line of best fit (CC.2.4.HS.B.3)? ▪ Are there any lurking or confounding variables associated with the data? Is there a common response (CC.2.4.HS.B.5)? ▪ What can a residual plot tell you about the data and regression equation (CC.2.4.HS.B.5)?
Learning Objectives: ***Students will know…***	***Students will be able to:***
▪ How to find the least squares regression line ▪ Deviations from the overall pattern of data are best examined in the residual plot ▪ Both r and the lsrl can be influenced by a few extreme observations	▪ Calculate and construct a least squares regression line ▪ Recognize possible lurking variables between two observed variables, x and y. ▪ Use a residual plot to determine which regression is best fit for the data.
Dates: April	**Unit Plan 7: Two Way Tables**

Stage 1 – Desired Results

PA Core State Assessments/Standards:

- CC.2.4.HS.B.1, CC.2.4.HS.B.2, CC.2.4.HS.B.5
- A1.2.3.2.1, A1.2.3.2.2

Understanding(s): ***Students will understand…***	**Essential Question(s):**
1. Two way tables provide more information through marginal and conditional distributions (CC.2.4.HS.B.2). 2. Simpson's paradox highlights the impact of lurking variables by breaking the data into subcategories. (CC.2.4.HS.B.5).	▪ What is the relationship between two categorical variables (CC.2.4.HS.B.2)? ▪ How can Simpson's paradox be identified in a real world circumstance (CC.2.4.HS.B.5)?
Learning Objectives: ***Students will know…***	***Students will be able to:***
▪ To find the marginal and conditional distributions given a two way table. ▪ How to identify Simpson's paradox when give 2 categorical variables.	▪ Describe the marginal and conditional distributions given a two way table ▪ Recognize Simpson's paradox and be able to explain it
Dates: May	**Unit Plan 8: Producing Data; Sampling**

Stage 1 – Desired Results

PA Core State Assessments/Standards:

- **CC.2.4.HS.B.5**
- **A1.2.3.2.2**

Understanding(s): ***Students will understand…*** 1. Response, Nonresponse, Undercoverage, and Wording are types of bias that affect samples taken from any given population (CC.2.4.HS.B.5). 2. Sampling is an essential means to gather data about a population (CC.2.4.HS.B.5).	**Essential Question(s):** ▪ Is bias evident in this sample? Undercoverage? Response? Wording? Nonresponse? (CC.2.4.HS.B.5) ▪ Why is sampling necessary (CC.2.4.HS.B.5)?
Learning Objectives: ***Students will know…*** ▪ The effects of bias and be able to recognize it. ▪ What an SRS is and how to obtain one.	***Students will be able to:*** ▪ Use a table of random digits to select a SRS. ▪ Recognize possible lurking or confounding variables between two observed variables, x and y.