

# Saint Patrick High School

## Curriculum Guide

<b>Department:</b>	Mathematics	<b>Grade and Level:</b>	11 and 12 (PACC)
<b>Class:</b>	Probability and Statistics	<b>Term (Semester or Year):</b>	Semester

<b>Required Text:</b>	• Elementary Statistics - Tenth Edition (Mario F. Triola) Pearson, 2006 (ISBN # 0-321-33183-4)
<b>Additional Resources (i.e. texts, materials, apps, etc.):</b>	<u>iPad Apps</u> : Showbie, Good Reader, and Numbers  <u>Other</u> : Triola Supplement CD - Power Point Presentations, Graphing Calculator, Microsoft Excel

## Course Description

553 H PROBABILITY AND STATISTICS (1/2 credit/AP/PACC weight)

This course is offered to students with a strong mathematical background. The course is designed to introduce students to the use of statistical methods and concepts with numerous examples of the importance of statistics in everyday life. Topics include Design of Experiments, Descriptive and Inferential Statistics, The Laws of Probability, Probability Distributions, Population Estimates and Sample Sizes, Hypothesis Testing, Chi-Square Tests, Nonparametric Statistical Tests, and Correlation and Regression. Appropriate technology, including Graphing Calculators, and Excel will be used to aid in calculations and interpreting the results of a statistical study or graph. Three hours of college credit can be earned through enrollment in St. Mary's PACC Program.

## Academic Standards Addressed (CCSS or equivalent):

- CCSS.MATH.CONTENT.HSS.ID.A.1

Represent data with plots on the real number line (dot plots, histograms, and box plots).

- CCSS.MATH.CONTENT.HSS.ID.A.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.

- CCSS.MATH.CONTENT.HSS.ID.A.3

Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).

- CCSS.MATH.CONTENT.HSS.ID.A.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.

- *CCSS.MATH.CONTENT.HSS.ID.B.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.*

- *CCSS.MATH.CONTENT.HSS.ID.B.6*

*Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.*

- *CCSS.MATH.CONTENT.HSS.ID.B.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.*

- *CCSS.MATH.CONTENT.HSS.ID.B.6.B*

*Informally assess the fit of a function by plotting and analyzing residuals.*

- *CCSS.MATH.CONTENT.HSS.ID.B.6.C*

*Fit a linear function for a scatter plot that suggests a linear association.*

- *CCSS.MATH.CONTENT.HSS.ID.C.7*

*Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.*

- *CCSS.MATH.CONTENT.HSS.ID.C.8*

*Compute (using technology) and interpret the correlation coefficient of a linear fit.*

- *CCSS.MATH.CONTENT.HSS.ID.C.9*

*Distinguish between correlation and causation.*

## **Unit Themes (Table of Contents)**

<b>Theme 1:</b>	Introduction to Statistics & Summarizing and Graphing Data
<b>Theme 2:</b>	Statistics for Describing, Exploring, and Comparing Data
<b>Theme 3:</b>	Probability
<b>Theme 4:</b>	Discrete Probability Distributions & The Binomial Distribution
<b>Theme 5:</b>	Normal Probability Distribution
<b>Theme 6:</b>	Correlation and Regression
<b>Theme 7:</b>	Hypothesis Testing

## **Agreed Upon Assessments**

Forms of assessments may include but are not limited to....

- Chapter Quizzes and Tests
- Homework Assignments
- Partner Class Activities
- Excel / Numbers Lab Assignments
- Quarter Projects
- Semester Exam

## **Research and Writing Expectations**

### **Students are expected to:**

- Answer all homework questions using complete sentences or short essays.
- Use data to discover Theorems presented throughout the semester.
- Research to find graphs, or data as needed to run various Hypothesis Tests.

<b>Unit: 1</b>	Introduction to Statistics and Summarizing and Graphing Data	<b>Duration:</b>	2 Weeks
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### Essential Questions:

- What is the meaning of sample, population, statistic, and parameter?
- What is the difference between qualitative and quantitative data?
- What makes a good statistical study?
- How do we design a statistically accurate experiment?
- Why are the characteristics of center, variation, distribution, outliers, and changes over time important for investigating the distribution of data?
- How do we correctly interpret a graph?

### Affirmation Statements:

Students will be able to...:

- Distinguish between a population and a sample and distinguish between a parameter and a statistic.
- Understand the importance of good experimental design, including the control or variable effects, replication, and randomization.
- Recognize the importance of good sampling methods in general, and recognize the importance of a simple random sample.
- Summarize data by constructing a frequency distribution or relative frequency distribution.
- Visually display the nature of the distribution by constructing a histogram or relative frequency histogram.
- Investigate important characteristics of a data set by creating visual displays, such as a frequency polygon, dotplot, stemplot, Pareto chart, pie chart, scatterplot, or a time-series graph.

### Common Assessments:

- Daily Homework Assignments
- Excel Project: Create Various Graphs Using Different Data Sets
- Mid-Chapter Quiz
- Unit Exam

<b>Unit 2:</b>	Statistics for Describing, Exploring, and Comparing Data	<b>Duration:</b>	2 weeks
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### Essential Questions:

- What is a measure of center?
- What is a measure of variation?
- What determines the distribution of a data set?
- What is meant by an outlier?
- How do characteristics of data change over time?

### Affirmation Statements:

Students will be able to...:

- Calculate the measures of center by finding the mean and median.
- Calculate the measures of variation by finding the standard deviation, variance, and range.
- Calculate the mean and standard deviation of a frequency distribution.
- Compare individual values in a data set by using z-scores, quartiles, or percentiles.
- Investigate and explore the spread of data, the center of the data, and the range of values by constructing a boxplot.
- Understand and interpret the calculated statistics.
- Determine whether a particular value would be considered usual or unusual in a particular data set.

### Common Assessments:

- Daily Homework Assignments
- Mid-Chapter Quiz
- Excel Lab involving Measures of Center for Large Data Sets
- Unit Exam

<b>Unit 3:</b>	Probability	<b>Duration:</b>	2 weeks
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### **Essential Questions:**

- What is the basic definition of the probability of an event?
- What is the difference between the probability of an event and the relative frequency of an event?
- How do you determine the probability of compound events that have the word “and”, “or”, or “given” in the example?
- Why is replacement vs no replacement important?
- How can we easily count the number of outcomes of an event?
- How can simulation be used to find the probability of an event?
- What is the difference between probability and odds?
- What is the difference between a combination and a permutation?

### **Affirmation Statements:**

Students will be able to...:

- Calculate simple and compound probabilities.
- Complete a chart containing “probability for”, “probability against”, “odds for”, and “odds against”.
- Determine the number of outcomes in an event.
- Use combinations and permutations to determine probabilities.
- Use simulations to estimate the probabilities of events.

### **Common Assessments:**

- Daily Homework Assignments
- Horse Racing Experiment to determine the sample space when a pair of dice is tossed
- Mid-Chapter Quiz
- Excel Lab: Use the random number generator function in excel to determine probabilities.
- Unit Exam

<b>Unit 4:</b>	Discrete Probability Distributions and The Binomial Distribution	<b>Duration:</b>	3 Weeks
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### Essential Questions:

- What is a Random Variable?
- What conditions are necessary for a probability distribution to be considered valid?
- What is meant by expected value?
- How do you calculate the mean and standard deviation of a probability distribution?
- What are the four requirements of any Binomial Distribution?
- How do you calculate Binomial Probabilities?
- How do you find the mean and standard deviation of a Binomial Distribution?

### Affirmation Statements:

Students will be able to...:

- Verify that a probability distribution is valid.
- Calculate the expected value of a probability distribution.
- Calculate the mean and standard deviation of any probability distribution.
- Decide if a procedure results in a binomial distribution.
- Determine the minimum and maximum usual values for a data set.

### Common Assessments:

- Daily Homework Assignments
- Slot Machine Simulation
- Mid-Chapter Quiz
- Excel Lab: Does the Binomial Distribution Approach the Normal Distribution? When?
- Unit Exam



<b>Unit 5:</b>	Normal Probability Distributions	<b>Duration:</b>	2 weeks
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### **Essential Questions:**

- What is meant by a continuous probability distribution?
- What is the shape of any Normal Distribution when graphed?
- How do you standardize a Normal Distribution?
- What does the Central Limit Theorem tell us?
- How can we approximate a Binomial Distribution with a Normal Distribution?

### **Affirmation Statements:**

Students will be able to...:

- Use the Normal Distribution Table to determine a probability under the Normal Curve.
- Use the given normal distribution data to draw and shade under the curve, standardize by finding a z-score, and calculating the corresponding probability.
- Determine mean and standard deviation of the sample means using the Central Limit Theorem.
- Visually look at a data set and decide if it comes from a Normal Distribution.

### **Common Assessments:**

- Daily Homework Assignments
- Mid-Chapter Quiz
- Solving numerous real-life word problems involving normal distributions
- Unit Exam

<b>Unit 6:</b>	Correlation and Regression	<b>Duration:</b>	2 weeks
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### **Essential Questions:**

- How can we determine if a relationship exists between two variables?
- From a scatterplot how do we decide if there is a positive, negative, or no correlation between the variables?
- How do we calculate the correlation coefficient between two variables?
- How do we find a regression equation?

### **Affirmation Statements:**

Students will be able to...:

- Create a scatterplot with a set of paired data.
- Determine the correlation coefficient between a set of paired data.
- Determine if the correlation is significant.
- Determine the regression equation.
- Use the regression equation to make predictions outside of the data set.

### **Common Assessments:**

- Daily Homework Assignments
- Excel Lab: Draw Scatterplots, determine the correlation, and regression equation
- Mid-Chapter Quiz
- Unit Exam

<b>Unit 7:</b>	Hypothesis Testing	<b>Duration:</b>	3 weeks
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### **Essential Questions:**

- What is meant by a hypothesis test?
- What is meant by a p-value, significance level, right-tail test, left-tail test, or two-tailed test?
- What is a distribution-free hypothesis test?
- What is the difference between parametric and nonparametric tests?

### **Affirmation Statements:**

Students will be able to...:

- Use the sign test to test the claimed value of average with one sample, differences between matched pairs, or the claimed value of a proportion.
- Use the Wilcoxon-Signed Rank to test for a difference between matched pairs.
- Use the Wilcoxon rank-sum test to test for the difference between two independent samples.
- Use the Kruskal-Wallis test to test more than two independent populations have the same median.
- Use the Rank Correlation test to test the relationship between two variables.
- Use the Runs test to test for randomness of sample data.

### **Common Assessments:**

- Daily Homework Assignments
- Mid-Chapter Quiz
- Solving numerous real-life word problems involving hypothesis testing
- Vietnam Draft Project
- Unit Exam

<b>Unit:</b>		<b>Duration:</b>	
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**Essential Questions:**

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**Affirmation Statements:**

Students will be able to...:

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**Common Assessments:**

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## Appendix

### **CCSS Resources**

Common Core Website: <http://www.corestandards.org/read-the-standards/>

Common Core App:

### **Essential Questions**

Essential Questions help structure and plan an academic unit. For information regarding developing Essential Questions, please refer to the file shared with you on Google Drive.

### **Affirmation Verbage (Action Words)**

Examples of Action Verbs:

Discuss, recall, state, measure, identify, collect, create, hypothesize, analyze, identify, define, describe