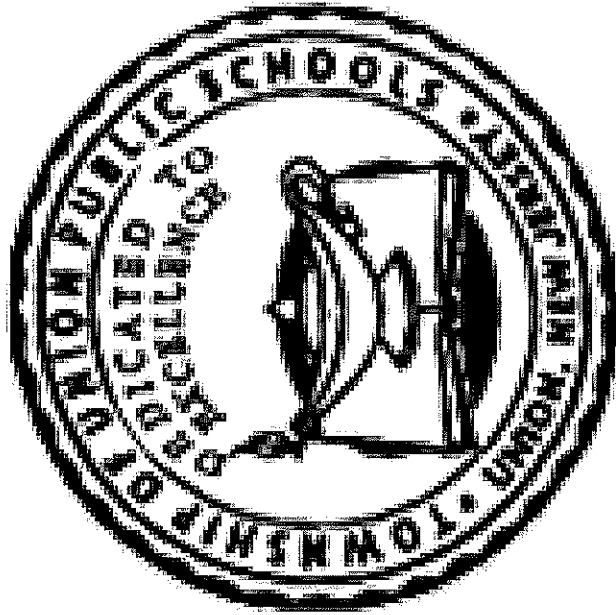


TOWNSHIP OF UNION PUBLIC SCHOOLS



**Introduction to Pre-Calculus with Statistics
Curriculum Guide Approved June 15, 2011
Updated December 18, 2018**

Mission Statement

The Township of Union Board of Education believes that every child is entitled to an education designed to meet his or her individual needs in an environment that is conducive to learning. State standards, federal and state mandates, and local goals and objectives, along with community input, must be reviewed and evaluated on a regular basis to ensure that an atmosphere of learning is both encouraged and implemented. Furthermore, any disruption to or interference with a healthy and safe educational environment must be addressed, corrected, or when necessary, removed in order for the district to maintain the appropriate educational setting.

Philosophy Statement

The Township of Union Public School District, as a societal agency, reflects democratic ideals and concepts through its educational practices. It is the belief of the Board of Education that a primary function of the Township of Union Public School System is to formulate a learning climate conducive to the needs of all students in general, providing therein for individual differences. The school operates as a partner with the home and community.

Course Description

Introduction to Pre-Calculus is divided into three units covering the traditional skills and concepts required for advancement into pre-calculus in a rigorous college preparatory program.

Students will model and solve algebraic problems that involve the study of linear, polynomial, quadratic, radical and logarithmic functions. Students will model and solve basic trigonometry, trigonometric identities, equations and application problems. Students will learn a variety of random sampling methods, describe quantitative and categorical data sets, and calculate the probability of events.

Each of the three units will include the use of group explorations, scientific and graphing calculators, and computer software to study real world problems solving techniques and presentation strategies.

Recommended Textbooks

Student Texts:

College Algebra & Trigonometry (5th edition) (Lial, Hornsby & Schneider) - Pearson

Statistics: The Art and Science of Learning from Data (Agresti & Franklin) - Pearson

Curriculum Units

Unit 1: Trigonometry Concepts and Applications

Unit 2: Statistics: Gathering and Interpreting Categorical and Quantitative Data

Gathering and describing Data

Interpreting Categorical and Quantitative Data

Probability

Unit 3: Functions, Operations and Graphs

Functions: Linear, Quadratic, Rational, Exponential and Logarithmic

Solving systems of equations and inequalities using matrices

Pacing Guide

Unit 1: Trigonometry Concepts and Applications

Title	Number of Days (45)
Trigonometric Functions	10
Circular functions and their graphs	10
Trigonometric Identities and Equations	20
Applications of Trigonometry	5

Unit 2 - Statistics: Collecting and analyzing data, probability

Title	Number of Days (45)
Introduction to Statistics and How to Learn from Data	4
Exploring Data with Graphs and Descriptive Numerical Summaries	12
Association: Contingency, Correlation, and Regression	9
Experiments and Sampling Methods	11
Probability	9

Unit 3: Functions, Operations and Graphs

Title	Number of Days (90)
Review sets, polynomials and radicals	6
Equations and Inequalities	12
Graphs and Functions	12
Polynomial and Rational Functions	10
Inverse, Exponential and Logarithmic Functions	22
Systems and Matrices	23
Review	5

Unit 1: Trigonometry Concepts and Applications

Essential Questions	NJSLS/Instructional Outcomes	Activities	Assessments
What relationship exists among the sides of a right triangle?	To find the values of the six trigonometric functions and use them to solve right triangles G-SRT.6, 8	Cooperative learning groups	Classwork
How can you convert an angle measured in degrees to radian measure?	To find measure of angles in standard position using degree and radian measure F-TF.1, 2	Discussion Drill and Practice	Homework
Why must the angle θ be measured in radians when finding the arc length of a sector of a circle?	To calculate arc lengths and areas of sectors G-C.5	Drill and Practice	Class work
Is trigonometry used in real life?	Application problems F-TF.1, 2, G-C.5 (Interdisciplinary Connection)	Cooperative learning groups	Class work and Homework
What is the reference angle for a non-quadrantal angle?	To evaluate trigonometric functions of any angle F-TF.5	Drill and Practice	Class work
What are you finding when you take the inverse of the sine, cosine, or tangent functions?	To evaluate inverse trigonometric functions F-TF.6, 7	Discussion Drill and Practice	Class work and Homework
What given information indicates using the law of cosines instead of the law of sines?	To use the Law of Sines and the Law of Cosines to find the sides and angles of a triangle. G-SRT.10,11	Discussion	Class work and Homework
What is the definition of the terms cycle and period of a trigonometric function graph?	To graph sine, cosine, and tangent functions. To give the amplitude, period, intercepts, maximum, and	Cooperative learning groups Use of graphing	Class work

	minimum F-TF.5	calculators	
What is a trigonometric identity?	To use trigonometric identities to simplify expressions and to verify other identities F-TF.8	Discussion Drill and Practice	Class work and Homework
Can you describe three techniques that you might use to solve a trigonometric equation?	To solve trigonometric equations F-TF.7	Drill and Practice	Class work and Homework
What are some of the uses of the sum and difference formulas?	To evaluate trigonometric functions of the sum or difference of two angles F-TF.9	Discussion Drill and Practice	Class work and Homework

Suggested Differentiation for Unit 1

- **Tier 1 Learners:**
 - Have guided notes filled out at different levels according to ability.
 - Give assignments that contain tasks of varying difficulty. Each task should focus on essential learning that all students should master, but the tasks will vary in difficulty.
 - Group students by similar interest when working on application problems.
 - Use mini lessons to reteach to those having difficulty.
 - Group students so that each group contains all level learners. The tier 3 learners can serve as peer helpers.
 - Assign a basic homework assignment. Require students to spend a set amount of time to work (showing effort) on the assignment rather than completing the entire assignment.
 - Allow students to choose a method for completing a project: video, PowerPoint, paper, or presentation.
- **Tier 2 Learners:**
 - Utilize foldables creating tangible products to help students digest information while incorporating several of the multiple intelligences.
- **Tier 3 Learners:**
 - Have problems posted around the room. Have students loop to specific questions based on difficulty.

Curriculum Development Resources

- Course textbook - College Algebra & Trigonometry
- Graphing calculator
- Kuta software
- <https://www.khanacademy.org/math/trigonometry>
- <https://www.mathspad.co.uk/teach/trigonometry.php>

Unit 2a: Interpreting Categorical and Quantitative Data

Essential Questions	NJSLS/Instructional Outcomes	Activities	Assessments
<ol style="list-style-type: none"> How can we construct and interpret graphical displays of distributions of univariate data? (stemplot, histogram, cumulative frequency plot) How can we summarize distributions of univariate data? How can we compare distributions of univariate data (back-to-back stem plots and parallel boxplots)? How can we explore bivariate data? How can we explore categorical data? 	<ol style="list-style-type: none"> Identify center, spread, clusters, outliers and other unusual features of univariate data by reading graphical representations. S-ID2 Calculate center, spread and position of univariate data S-ID3 Compare and contrast features of different univariate distributions. S-ID3 Analyze patterns in scatterplots, recognize correlation and linearity. Find least-squares regression line and verify its validity by checking residual plots, outliers, and influential points. S-ID6 Construct and interpret representations of categorical data. S-ID5 	<ol style="list-style-type: none"> Instructor and student use of interactive computer software applet to demonstrate resistance of mean and median by outliers in a data set. Use of correlation by eye computer applet designed to aid students in recognizing strength of correlation. Use Microsoft Excel computer program to complete least squares regression project (See Appendix C) (Interdisciplinary Connection) Organize univariate data into logical graphical representations using the graphing calculator that can be used to make conclusions about univariate distributions. Enter data into graphing calculator and run one variable statistics to find the mean, median, mode, range, standard deviation, percentiles, and z-scores for univariate data. Estimate population percentages using normal distribution. Use calculators, spreadsheets, and tables to estimate areas under the normal curve Check the validity of least-squares regression by analyzing patterns in residual plots Fit a function to the data, use linear, quadratic and exponential functions fitted to data to solve problems in the context of the data. Construct and interpret frequency tables, bar charts, and other representations of categorical data. (See Appendix A) 	<p>Use given data of test grades from the previous statistics test to answer questions 1-3</p> <p>58, 89, 67, 99, 74, 91, 84, 86, 70, 73, 97, 61, 52, 88, 55, 12, 78, 60</p> <ol style="list-style-type: none"> Calculate mean, median, mode, range, and standard deviation of data. Construct a stem leaf plot of the data. Describe the distribution of the data. Calculate boundaries for and make mention of any outliers.

Unit 2b: Collecting data and randomization

Essential Questions	NJSL/Instructional Outcomes	Activities	Assessments
<p>1. What are the methods of data collection?</p> <p>2. How can we conduct random sampling using stratified, cluster, systematic, and simple random sampling?</p> <p>3. How can we plan and conduct surveys to avoid bias?</p> <p>4. When is it appropriate to use each of the following experimental techniques will be discussed: randomization, blinding, double blinding, replication, and the placebo effect?</p> <p>5. How can we generalize results and types of conclusions that can be drawn from observational studies, experiments, and surveys?</p>	<p>1. Understand methods of data collection. S-IC3</p> <p>2. Identify characteristics of a well-designed, well-conducted survey. S-IC3</p> <p>3. Randomly select from a population in order to have a sample from which valid conclusions can be drawn. S-IC4</p> <p>4. Identify different sampling methods and sources of bias. S-IC4</p> <p>5. Identify characteristics of a well designed, well conducted experiment. S-IC4</p>	<p>1. Discussion of different types of bias including sampling bias, response bias, nonresponse bias, observer bias.</p> <p>2. Plan a well-designed survey.</p> <p>3. Draw an appropriate sample from the population.</p> <p>4. Identify possible sources of bias.</p> <p>5. Analyze sample data appropriately.</p> <p>6. Complete Sample Survey Project (Project description in Appendix B) (Interdisciplinary Connection)</p>	<p>1. Gathering Data Sample Problems. A survey is to be conducted in your high school. There is to be a total of 40 students in the sample. Describe how you would choose the participants if:</p> <ol style="list-style-type: none"> i. There are to be the same number of freshman, sophomores, juniors, and seniors in the sample. ii. There are to be the same number of males and females in the sample. iii. There are no restrictions on the choice of the participants. iv. Identify the source of the bias and specify the direction of the bias. <p>2. A flour company wants to know what fraction of Minneapolis households bake tier own bread. An SRS of 500 residential addresses is drawn and interviewers are sent to these addresses. The interviewers are employed during regular working hours on weekdays and they interview only during those hours.</p>

Unit 2c: Calculating Probability

Essential Questions	NJSL/Instructional Outcomes	Activities	Assessments
<ol style="list-style-type: none"> How can we use the Law of Large Numbers to understand probability? How can we use the Addition rule, multiplication rule, conditional probability, and independence to find the probability of an event occurring? How can we combine independent random variables How can we use the normal distribution to understand probability? 	<ol style="list-style-type: none"> Interpret probability including long-run relative frequency interpretation. S-CP2 Find probabilities based on distributions of discrete random variables. S-MD2 Simulate the random behavior of events based on probability distributions. S-MDI Calculate expected value and standard deviation of a random variable and linear transformations of a random variable. S-ID6 Differentiate between independent and dependent events. S-CP2 Identify properties of a normal distribution and use normal distribution tables S-MD3 	<ol style="list-style-type: none"> Calculate probability based on both independent and dependent events Find probability based on binomial and geometric random variables. Use graphing calculator functions binompdf and binomcdf to calculate binomial probabilities. Find the mean and standard deviation for sums and differences of independent random variables. Find probabilities based on normally distributed random variables. Use sampling distributions reach conclusions about sample data. (Interdisciplinary Connection) 	<ol style="list-style-type: none"> A set of 2000 measurements has a symmetric, mound-shaped distribution. The mean is 5.3 and the standard deviation is 0.7. Determine an interval that contains approximately 1360 data values. In a group of 100 scouts who took the physical exam for summer camp, 20% had type A blood. Six percent had both blond hair and type A blood. Find the probability that one scout selected at random will have blond hair, given that the blood test reveals type A. Rogers High will play Memorial High in baseball six times during the upcoming season. Assume the teams are of equal ability; that is, $p = .5$. Within the context of a binomial experiment, what is the probability that: Rogers will win 4 games and lose 2 Rogers will win <i>at least</i> 4 games?

Suggested Differentiation for Unit 2

- **Tier 1 Learners:**
 - Have guided notes filled out at different levels according to ability.
 - Give assignments that contain tasks of varying difficulty. Each task should focus on essential learning that all students should master, but the tasks will vary in difficulty.
 - Group students by similar interest when working on application problems.
 - Use mini lessons to reteach to those having difficulty.
 - Group students so that each group contains all level learners. The tier 3 learners can serve as peer helpers.
 - Assign a basic homework assignment. Require students to spend a set amount of time to work (showing effort) on the assignment rather than completing the entire assignment.
 - Allow students to choose a method for completing a project: video, PowerPoint, paper, or presentation.
- **Tier 2 Learners:**
 - Utilize foldables creating tangible products to help students digest information while incorporating several of the multiple intelligences.
- **Tier 3 Learners:**
 - Have problems posted around the room. Have students loop to specific questions based on difficulty.

Curriculum Development Resources

- Course textbook - The Art and Science of Learning from Data
- Graphing calculator
- Kuta software
- <https://stattrek.com/statistics/resources.aspx>
- <https://www.amstat.org/ASA/Education/Useful-Websites-for-Teachers.aspx>

Unit 3 – Functions, Operations, and Graphs

Essential Questions	NJSLS/Instructional Outcomes	Activities	Assessments
How do we solve a quadratic equation?	To solve and graph a linear equation. A-REI.4ab	Drill/Practice	Classwork/homework
What is a complex number?	To use properties of complex and imaginary numbers. N-CN 1,2	Drill/practice	Classwork/homework
Can we use graphs of quadratic and linear equations/systems in real life?	To use graphs of quadratic and linear equations/systems to solve real world problems.A-REI2,3 (Interdisciplinary Connection)	Cooperative Groups	Classwork/Homework
How do we solve an inequality/systems of inequalities?	To solve and graph an inequality/system of inequalities. A-REI3	Drill and practice	Classwork/Homework
Are there any other types of equations?	To define, solve, and graph a rational equation. A-REI-2	Drill and practice	Classwork/Homework
How do I recognize a function?	To define a function and the elements of a function. F-IF1-3	Discussion	Classwork/Homework
What kinds of functions exist?	To identify the types of functions.F-IF1-3	Cooperative Groups	Classwork/Homework
How do I construct a graph of a function without any electronic aid?	To graph a function by creating a chart. F-IF7	Drill/practice	Classwork/Homework
What is a zero of a function?			

<p>What is a parabola?</p>	<p>To determine whether $x-k$ is a factor of $f(x)$. A-APR3</p>	<p>Discussion/drill and practice</p>	<p>Classwork/Homework</p>
<p>Can we graph functions higher than degree two?</p>	<p>To define and graph a parabola. A-REI 4a,b</p>	<p>Drill and practice</p>	<p>Classwork/Homework</p>
<p>What is an asymptote?</p>	<p>To graph and model higher order functions. A-APR3</p>	<p>Drill and practice</p>	<p>Classwork/Homework</p>
<p>What is an inverse function?</p>	<p>To define asymptote and identify the asymptotes of a function. F-EE1b,c</p>	<p>Discussion</p>	<p>Classwork/Homework</p>
<p>What is an exponential function?</p>	<p>To solve and graph inverse functions. F-BF4</p>	<p>Drill and practice</p>	<p>Classwork/Homework</p>
<p>Can we graph logarithmic functions?</p>	<p>To define and graph an exponential function. F-LE3, F-IF7e</p>	<p>Discussion/drill and practice</p>	<p>Classwork/Homework</p>
<p>Can we apply an exponential function to a real world situation?</p>	<p>To define and graph a logarithmic function. F-LE4</p>	<p>Cooperative groups</p>	<p>Classwork/Homework</p>
<p>How do we solve a system of equations?</p>	<p>To apply the properties of an exponential function to a real life situation. F-LE1b,c</p>	<p>Drill and practice</p>	<p>Classwork/Homework</p>
<p></p>	<p>To solve systems of equations by graphing, elimination, and</p>	<p></p>	<p></p>

<p>Is there another way to solve a system of equations/What is a matrix?</p>	<p>substitution. A-REI5,6</p>	<p>Discussion/drill and practice</p>	<p>Classwork/Homework</p>
<p>What is the determinant of a matrix?</p>	<p>To solve a system of equations using an augmented matrix. A-REI5,6N-VM6</p>	<p>Drill and practice</p>	<p>Classwork/Homework</p>
<p>Do matrices have any other properties?</p>	<p>To define and calculate the determinant of a matrix.N-VM6</p>	<p>Discussion/drill and practice</p>	<p>Classwork/Homework</p>
<p>Can I apply matrices to real world situations?</p>	<p>To apply operators to matrices.N-VM7,9</p>	<p>Drill and practice</p>	<p>Classwork/Homework</p>
<p>What is a nonlinear system of equations?</p>	<p>To use matrix multiplication to model house plans.N-VM6</p>	<p>Cooperative groups</p>	<p>Classwork/Homework</p>
<p>When using linear combinations, why would you want the coefficient of one of the variables to be opposite?</p>	<p>To solve a nonlinear system of equations. A-REI 6</p>	<p>Drill and practice</p>	<p>Classwork/Homework</p>
	<p>To solve systems of equations in 3 and 4 variables algebraically. A-REI6</p>	<p>Drill and practice/cooperative groups</p>	<p>Classwork/Homework</p>

Suggested Differentiation for Unit 3

- **Tier 1 Learners:**
 - Have guided notes filled out at different levels according to ability.
 - Give assignments that contain tasks of varying difficulty. Each task should focus on essential learning that all students should master, but the tasks will vary in difficulty.
 - Group students by similar interest when working on application problems.
 - Use mini lessons to reteach to those having difficulty.
 - Group students so that each group contains all level learners. The tier 3 learners can serve as peer helpers.
 - Assign a basic homework assignment. Require students to spend a set amount of time to work (showing effort) on the assignment rather than completing the entire assignment.
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- **Tier 2 Learners:**
 - Utilize foldables creating tangible products to help students digest information while incorporating several of the multiple intelligences.
- **Tier 3 Learners:**
 - Have problems posted around the room. Have students loop to specific questions based on difficulty.

Curriculum Development Resources

- Course textbook - College Algebra & Trigonometry
- Graphing calculator
- Kuta software

Additional Suggested Modifications for Units

Below is an additional list of modifications and accommodations opportunities. This includes, but is not limited to ;

1. English Language Learners.
 - a. Read written instructions.
 - b. Model and provide examples
 - c. Extended time on assessments when needed.
 - d. Establish a non-verbal cue to redirect student when not on task.
 - e. Students may use a bilingual dictionary.

English Language Development Standard 3: Language of Mathematics: English language learners communicate information, ideas and concepts necessary for academic success in the content area of mathematics.

2. Special Education/504 Students.
 - a. Extended time on assessments when needed.
 - b. Preferred seating to be determined by student and teacher.
 - c. Provide modified assessments when necessary.
 - d. Student may complete assessments in alternate setting when requested.
 - e. Establish a non-verbal cue to redirect student when not on task.
 - f. Maintain strong teacher / parent communication.
 - g. Conversion chart

New Jersey Student Learning Standards - Technology

- 8.1 Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.
 - A. Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations
 - B. Creativity and Innovation: Students demonstrate creative thinking, construct knowledge and develop innovative products and process using technology.

C. Communication and Collaboration: Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning.

E: Research and Information Fluency: Students apply digital tools to gather, evaluate, and use information.

F: Critical thinking, problem solving, and decision making: Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.

Students will be instructed on how to use TI-84 Plus graphing calculators, Microsoft Excel, and Fathom to generate graphs, compute statistics, and analyze data. Such technology will be required on homework, projects, and other assessments.

*See Activities/Appendix for further Technology Integration.

Career Readiness Practices

- CRP1. Act as a responsible and contributing citizen and employee.
- CRP2. Apply appropriate academic and technical skills.
- CRP4. Communicate clearly and effectively and with reason.
- CRP6. Demonstrate creativity and innovation.
- CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
- CRP11. Use technology to enhance productivity.

NJSLS 9.2 - Career Awareness, Exploration, and Preparation

9.2.8.B.3 Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.


Appendix A: Statistics Quantitative Data Project

Due: _____

Objective

To use descriptive statistics to organize, summarize, and graphically represent data.

Project Requirements

1. Collect quantitative data on a variable of interest to you. List the values of the observations. ($n \geq 30$) Sample topics are listed on the back of this page.
2. Determine if the variable is discrete/continuous. Explain why.
3. Make a frequency table from the data.
4. 
 - a. Construct a dotplot from the data. Describe the main features of the dotplot.
 - b. Construct a stem and leaf plot from the data. Describe the main features of the stem and leaf plot.
 - c. Construct a histogram from the data. Describe the main features of the histogram.
5. Determine the shape of the distribution of the data.
6. Calculate the mean, median and mode of the data.
7. Determine whether the mean or median is a better estimate of the center for your data? Explain why.
8. Calculate the range, variance and standard deviation of the data.
9. Does the empirical rule apply to your data? Explain why or why not?
10. Calculate the 5-Number Summary for the data.
11. State and interpret the quartiles for the data.
12. Calculate the interquartile range for the data.
13. Are there any outliers in your data? Show your calculations.
14. Construct a boxplot for the data.
15. Calculate the z-score for the last observation you collected based on your data. Show your calculation. Interpret this z-score.
16. Give a brief 2-minute presentation showing the results of your descriptive statistic analysis.



Complete all starred requirements using a computer (preferably Excel).

Appendix B: Statistics Sample Survey Group Project

Due:

Objective: Design and implement an observational study to answer your topic question.

Requirements

Each student must hand in their own individual project.

Topic questions must be approved by the teacher.

Steps 2-7 should be the same for every member in your group.

Steps 8-12 should be different for every member.

On your title page, write your name and topic question. Also list your group members. Please number the requirements in your final report.

Group Project Requirements

1. Each person in your group must decide on an individual topic question with a common group theme.
2. Combine all the topic questions from your group into one survey. Think carefully about the wording of these questions. Include this survey in your individual report.
3. What is the population for your study?
4. What sampling method will your group use to gather your data? What will the sample size be? Explain why your group chose that sampling method over the others.
5. Explain exactly how the subjects for your sample will be chosen. Will the sample be representative of the population? Be as specific as possible.
6. Collect the sample based on the survey your group prepared and sampling method your group selected. (This step does not need to be included in the final written report.)
7. Discuss any problems that your group ran into with the sampling process. Are there any biases that may occur as a result of the sample your group collected? Explain. (It's OK to mention problems or biases that you find. In practice, almost no sample is without its share of problems. Just mention the issues your group ran into and how your group dealt with them.)

The group aspect of the project is complete. The rest of the project will be individual, using the data for your individual topic question only.

Individual Project Requirements

8. Display the data collected on your *individual* topic question from the survey.
9. Construct a table to display the data.
10. Make an appropriate graph based on your data.
11. If the data is categorical, calculate the relative frequency of each category.
If the data is quantitative, calculate the mean, median, mode, standard deviation.
12. Summarize the conclusions that you found based on the graphs and calculations. Explain the results of the sample.

Results Presentation

Students must present their findings to the class in a clear and concise manner with emphasis on the use of proper statistical vocabulary and terminology.

Sampling Project Holistic Scoring Rubric

	1	2	3	4	5	6
Topic Question	Mostly incorrect grammar & punctuation; Biased wording	Mostly correct grammar & punctuation; Biased wording	Mostly correct grammar & punctuation; Unbiased wording	Mostly correct grammar & punctuation; Unbiased wording	Correct grammar & punctuation; Unbiased wording	Correct grammar & punctuation; Unbiased wording
Population	Description of incorrect population is given	Description of incorrect population is given	Description of correct population is given	Somewhat detailed description of correct population is given	Detailed description of correct population is given	Detailed description of correct population is given
Sampling Method	Just mention which sampling method you chose	Incorrect reasons for choosing your sampling method	Somewhat correct reasons for choosing your sampling method	Somewhat correct reasons for choosing your sampling method	Clearly stated reasons for choosing your sampling method	Clearly stated reasons for choosing your sampling method
Description Of Sample	Missed many steps in the data collection process	Mentioned most steps in the data collection process	Detailed description of some steps in the data collection process	Detailed description of most steps in the data collection process	Detailed description of most steps in the data collection process	Detailed description of every step in the data collection process
Problems	Did not discuss any sampling problems	Discussion of sampling problems without possible solutions	Discussion of sampling problems without possible solutions	Discussion of sampling problems without realistic solutions	Discussion of sampling problems with possible solutions	Discussion of sampling problems with realistic solutions
Table of	Inaccurate and	Inaccurate table	Accurate table or	Accurate table and	Somewhat neat	Neat and accurate

Data	sloppy table and graph that displays your data	and graph that displays your data	graph that displays your data	graph that displays your data	graph that displays your data	and accurate table and graph that displays your data	table and graph that displays your data
Descriptive Statistics	No calculations of descriptive statistics	Inaccurate calculations of descriptive statistics	Accurate calculations of descriptive statistics	Accurate calculations of descriptive statistics	Accurate calculations of descriptive statistics	Accurate calculations of descriptive statistics	Accurate calculations of descriptive statistics
Conclusions	Conclusion is not well stated and not supported by the data	Conclusion is not well stated, but is somewhat supported by the data	Somewhat clearly stated and well-thought out conclusion is supported by the data	Somewhat clearly stated and well-thought out conclusion is supported by the data	Somewhat clearly stated and well-thought out conclusion is supported by the data	Somewhat clearly stated and well-thought out conclusion is supported by the data	Clearly stated and well-thought out conclusion is supported by the data

Appendix C: Statistics Baseball Project (Linear Regression)

Objective: To describe the association between quantitative variables and to predict values of the response variable based on the values of the explanatory variable. In baseball terms, we will find which variable is most correlated with winning and predict the number of wins based on this variable. All starred steps must be done on the computer using EXCEL.

★ **Requirements**

1. Collect the following baseball data from the _____ baseball season:
Hitting Stats: *R, HR, SB, BA*, _____
Pitching Stats: *Wins, R, SO*, _____

Select one more Batting and one More Pitching statistic that you want to explore

Directions

- a. Go to <http://www.baseball-reference.com/leagues/MLB/>
- b. click on the link for that year which brings you to Team and League Standard Batting
- c. Copy and paste batting and pitching statistics into EXCEL. (be sure to select everything from “Team and League Standard Batting” down to the bottom of the page.
- d. Put Batting on Sheet 1 and rename Batting, Put Pitching on Sheet 2 and rename Pitching
- e. Highlight then Copy/Paste pitching wins column into batting Stats page.
- f. Clean up the data and delete all unnecessary columns. (be careful)
- g. Print out batting data landscape on one page
- h. Print out pitching data landscape on a separate page.

- ★ 2. Use EXCEL to construct 8 scatterplots that plots each quantitative variable as the x variable against *Wins* as the y variable. (Note: since every win is credited to a pitcher on the team, pitcher wins is the same as team wins. Rename Sheet 3 Scatterplots and put all scatterplots there.)

INSERT>CHART>SCATTERPLOT>SELECT COLUMNS>LABEL AXES>ADD AS OBJECT

Add the regression equation (trend line) and r^2 value by right clicking on a point on the scatterplot and clicking “add trendline”; then on the options tab add the equation and r^2 value.

Print scatterplots all on the same page (create as objects in one sheet instead of giving each scatterplot its own sheet.) On a separate page, discuss any associations visible in each scatterplot.

- ★ 2. Calculate and interpret the correlation for each of these eight variables with *Wins*. Comment on the validity of the correlation.

3. Interpret r^2 for each of the eight variables with *Wins*.
 4. Are there any influential points in any of your scatterplots? If so, identify them by *Team* name.
 5. Based on the results of steps #2-4, identify which of the eight variables seems to be the best predictor of *Wins*? Why?
 6. Use the regression line of the variable you selected in step #5 to predict the number of *Wins* the New York Yankees should have had, based on this variable.
 7. Calculate and interpret the residual for the New York Yankees based on the same regression line.
 - ★ 8. Use EXCEL to construct a residual plot for the same regression you chose in step #5. Does this residual plot verify that the least squares regression line fits the data well? Explain. (Show the predicted values, residuals and residual plot all on the same page.)

Display the data collected on your *individual* topic question from the survey.
 9. Construct a table to display the data.
 10. Make an appropriate graph based on your data.
 11. If the data is categorical, calculate the relative frequency of each category.

If the data is quantitative, calculate the mean, median, mode, standard deviation.
 12. Summarize the conclusions that you found based on the graphs and calculations. Explain the results of the sample.
Results Presentation
- Students must present their findings to the class in a clear and concise manner with emphasis on the use of proper statistical vocabulary and terminology.

