

Gateway School District Curriculum Map Gateway High School 3000 Gateway Campus Blvd. Monroeville, PA 15146 412-373-5744

Curriculum Map: Mathematics

Course: AP STATISTICS Grade(s): 11/12

Unit 1: • Chapter 1/2: Exploring Data

Brief Summary of Unit

The tools of data analysis are graphs such as histograms and scatterplots and numerical measures such as means and correlation. We will study variables and their distributions.

Stage One—Desired Results

- 1. Identify individuals and variables
- 2. Construct Bar Graphs, Circle Graphs, Time Plots, Histograms, Stem-and-Leaf Plots, and Frequency Tables. (Minitab software is used to all graphs)
- 3. Look for overall pattern and major deviations from pattern
- 4. Determine whether data is Categorical or Quantitative.
- 5. Find mean (sample), median, mode. (Minitab software is used to find one variable statistics and Calculator used to find one variable statistics)
- 6. Find range, variance, and standard deviation.
- 7. Give the center and spread and a verbal definition of shape.
- 8. Interpret percentiles and find quartiles and interquartile range.
- 9. Construct a Box-and-Whisker Plot (Minitab and calculator)

Understandings:	Essential Questions:
 Graphs can be used to summarize large sets of data. Measures of central tendency (mean, median, mode) can be useful when trying to summarize a group of data. However, a more accurate representation can be gained by also using measures of variation. Mean and IQR and more resistant measures. 	 What is data and are there different types of data? What are the numerical and graphical methods for data representation? Which are the best types of graphs to use for different types of data? How can technology be helpful in the study of statistics? What information does a graph reveal about a distribution of data?

	6. What are some examples of statistics used in real life?	
Stage Two—Assessment Evidence		
Performance Tasks:		
Other Evidence: :(quizzes, tests and so on)		

Unit 2: • Chapter 3: Normal Distributions

Brief Summary of Unit

This chapter is primarily about using density curves to model the distribution of a random variable. The Normal distribution is described by its parameters and used to compute proportions or cumulative proportions.

Stage One—Desired Results

Established Goals: (Standards of Learning, Content Standards)

- 1. Use normal probability distributions to solve problems.
- 2. Find and use z-scores and standard score for z-score.
- 3. Use 68-95-99.7% rule and symmetry to state what percent of observations fall between two scores.
- 4. Find the area under a standard normal curve.
- 5. Find area under any normal curve using x scores, z scores, and standard normal table.
- 6. Convert x values to z values.

Understandings: **Essential Questions: 1.** What is a density curve? 1. Definition and properties of a Normal 2. How can density curves be used to express Curve relative standing? 2. The Empirical Rule. **3.** What is a normal distribution? 3. Definition and formula for z-score and 4. What does a normal distribution imply about standard score for z-score(x score) the spread of data? 4. Standard Normal Distribution and 5. How does one assess normality? Standard Normal Table and their uses. 5. Area under the curve represents probability. **Stage Two—Assessment Evidence** Performance Tasks:

Other Evidence: :(quizzes, tests and so on)

Stage Three—Learning Plan

Unit 3: • Chapter 4/5: Examining Relationships

Brief Summary of Unit

These chapters set the foundation for linear regression. The concept of how and to what degree two variables are related is studied. Finding the least squares regression line, measuring the goodness of fit and considering any undue influence of potential outliers is the final concept studied.

Stage One—Desired Results

- 1. Scatterplots making and interpreting (Minitab software will be used to draw and interpret results. As well as the ti-84 calc)
- 2. Describe the direction form and strength of a scatterplot
- 3. Correlation and facts about it (correlation will be calculated on and the students will interpret the result on minitab software and the ti-84 Calc.)
- 4. Least-Square Regression
- 5. Explain what the slope and intercept means in the problem
- 6. Use regression line to predict y for a given x.
- Least squares regression facts; r² (Calculated and interpreted on minitab software and ti-84 calc)
- 8. Residuals, outliers, influential observations

Understandings:	Essential Questions:
 The difference between explanatory and response variables. Facts about correlation. Both r and the least-squares regression line can be strongly influenced by a few extreme observation. Possible lurking variables may explain association between x and y. Association does not imply causation. 	 How can we assess the association between two variables? What is regression? How well does data fit a regression model? What are the properties of a linear regression model?
Stage Two—Asse	ssment Evidence
Performance Tasks:	
Other Evidence: :(quizzes, tests and so on)	
Stage Three—Learning Plan	

Unit 4: • Chapter 6: More on Two-Variable Data

Brief Summary of Unit		
This chapter is concerned with revealing relationsh	ips between two categorical variables. Marginal	
distribution and conditional distribution is discusse	ed.	
Stage One—D	esired Results	
Established Goals: (Standards of Learning, Conten	t Standards)	
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1. From a two-way table of counts, find the marginal distributions of both variables by obtaining		
the row sums and column sums.		
2. Express any distribution in percents		
3. Describe the relationship between two categorical variables by computing and comparing		
percents		
4. Conditional distributions & Simpson's Parad	4. Conditional distributions & Simpson's Paradox and explain	
Understandings:	Essential Questions:	
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1. Two-way tables and the use of marginal	5.	
and conditional distributions.		
2. When can Simpson's Paradox occur?		
Stage Two—Asse	ossment Fyidence	
Stage 1 w0—Assessment Evidence		
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Other Evidence: :(quizzes, tests and so on)		
Stage Three—Learning Plan		

Unit 5: • Chapter 8: Producing Data

Brief Summary of Unit

This unit deals with collecting data and making the sample more likely to represent the population. The common ways in which data is collected is studied as well as bad sampling methods. Experiments vs. observational studies are also examined.

Stage One—Desired Results

- 1. Identify the population in a sampling situation
- 2. Recognize bias due to voluntary response samples and inferior sampling methods
- 3. Use random digit table to select a sample
- 4. Recognize the presence of undercoverage and nonresponse as sources of error.
- 5. Experiments vs Observation
- 6. Randomized comparative experiments; The principles of experimental design

7. More complex designs: blocking & matched pairs 8. Cautions about experiments Understandings: Essential Questions:	
 The population of a sampling distribution. Undercoverage and bias in sampling. Observational study vs. Experiment. Factors, treatments, response and individuals The use of placebos and double-blind experiments. Matched pair vs. Block study. 	 How do we collect data? How do we avoid bias? How can causation be established? What are the parts of a well-designed experiment? What cautions about experimentation exist?
Stage Two—Assessment Evidence	
Performance Tasks: Other Evidence: :(quizzes, tests and so on)	

Unit 6: • Chapter 10/12: Probability

Brief Summary of Unit

The chapter enforces the concept of probability of an event representing the proportion of times the event would occur in the long run. General rules of multiplication and conditional probability are also taught.

Stage One—Desired Results

- 1. Probability Models
- 2. Probability rules basic
- 3. Independence and the multiplication rule
- 4. General addition rule/Venn diagrams
- 5. Conditional probability & Bayes' Theorem
- 6. Discrete random variables
- 7. Continuous random variables uniform & normal
- 8. Mean and variance of a discrete random variable
- 9. Law of large numbers; rules for means
- 10. Rules for variances and independence

Understandings:	Essential Questions:
1. Probability describes the long run regularity of random phenomena.	1. What is Randomness?

 Probability of an event is the proportion of times the event occurs in very many repetitions of a random phenomenon. Discrete vs. continuous variables Idea of independence Idea of conditional probability. 	 What is a Probability Model and how does it affect our world? What is a Probability Distribution? How can we compute and express probabilities in simple and complex situations? How can simulations be used to model probability?
Stage Two—Assessment Evidence	
Performance Tasks: Other Evidence: :(quizzes, tests and so on)	

Unit 7: • Chapter 13: Binomial Distributions

Brief Summary of Unit

The number of successes in a fixed number of independent trials called a binomial distribution. The chapter concludes the Normal approximation the binomial distribution.

Stage One—Desired Results

Established Goals: (Standards of Learning, Content Standards)

- 1. Binomial settings –fixed number of independent success-failure trials with same probability.
- 2. Calculating binomial probabilities: by formula and ti-84 calculator (Minitab Software will also be used for students to create a Probability Table and a Cumulative probability table and interpret the results.)
- 3. Mean and standard deviation of binomial
- 4. Normal approximation to the binomial

Essential Questions:

- **1.** What is a Random Variable?
- **2.** What is a Probability Distribution for a Random Variable?
- **3.** How do we combine Independent Random Variables?
- **4.** How does one identify a Binomial or Geometric Variable?
- 5. How are Binomial or Geometric Probability models used?

Understandings:

- 1. The binomial setting.
- 2. The Binomial distribution.
- 3. Normal approximation to the binomial.

Stage Two—Assessment Evidence		
Performance Tasks:		
Other Evidence: (avizzes, tests and so on)		
Other Evidence: .(quizzes, tests and so on)		
Stage Three—Learning Plan		

Unit 8: • Chapter 11: Sampling Distributions

Brief Summary of Unit

This chapter discusses sampling distributions. The Central Limit theorem is taught and is uses as well as the Law of Large Numbers.

Stage One—Desired Results

- 1. Identify parameters and statistics
- 2. Use the Law of Large Numbers to describe behavior of x-bar
- 3. Sampling distributions: sampling variability & bias
- 4. Sampling distribution of sample proportion
- 5. Sampling distribution of sample mean; the Central Limit Theorem

Understandings:	Essential Questions:
 Understand the x-bar is an estimator of μ and that the variability of x-bar about its mean get smaller as the sample size increases. Understand that x-bar has approximately a Normal distribution when the sample is large. 	 How do Statistics Vary? What is a Sampling Distribution? How does sample size effect the distribution of means? What is the impact of the Central Limit Theorem? How does one model the distribution of sample proportions?
Stage Two—Assessment Evidence	
Performance Tasks:	
Other Evidence: :(quizzes, tests and so on)	

Unit 9: • Chapter 14/15/16 Introduction to Inference

Brief Summary of Unit

These chapters will introduce the basic reasoning behind statistical estimation and tests of significance. The conditions for which our procedures for inference do not hold.

Stage One—Desired Results

- 1. Estimating with confidence: connecting your thinking to the sampling distribution
- 2. Confidence interval for population mean
- 3. How confidence intervals behave; choosing sample size; cautions
- 4. Logic of significance tests; stating hypotheses
- 5. P-values and statistical significance
- 6. Carrying out a significance test; including fixed significance level tests
- 7. Test from a confidence interval
- 8. Calculate the one sample z-statistic and p-value for both one sided and two-sided tests about the mean using the TI-84 calculator as well as Minitab software.
- 9. Making Sense of Statistical Significance
- 10. Inference as Decision
- 11. Concepts of Type I, Type II error & power

Understandings:	Essential Questions:
 What 95% confidence means How the margin of error of a confidence interval charges with the sample size and level of confidence C Null and alternative hypothesis Four-step process Conditions of a test. Power of a test. 	 What does it mean to make an inference? How do we use statistics to estimate parameters? What is a margin of error? What is a confidence interval? How do we draw conclusions from samples? How do we assess the strength of a claim based on a sample? What is a test of significance? What is the process for running a test of significance?
Stage Two—Asse	ssment Evidence
Performance Tasks:	
Other Evidence: :(quizzes, tests and so on)	

Unit 10: Chapters 17/18/19: Inference for Means

Brief Summary of Unit

These chapters analyze data on quantitative variables. It begins with the Normal distribution for a quantitative variable, the t-procedures are based on this assumption. It ends with comparing two populations' means.

Stage One—Desired Results

Established Goals: (Standards of Learning, Content Standards)

- 1. Inference for the Mean of a Population
- 2. What to do when SIGMA is unknown t Comparing two Means
- 3. Confidence intervals and significance tests with t
- 4. Matched pairs a special case of one-sample t
- 5. Robustness of t procedures; calculator use
- 6. Comparing Two Means
- 7. Matched pairs vs. two independent samples
- 8. Comparing two population means
- 9. More accurate degrees of freedom from technology Use the TI-84 calculator and Minitab software to obtain confidence intervals and test hypotheses.

Essential Ouestions:

1. How and why do we test statistics?

2. How do we distinguish between 2 sample

inference and matched-pair inference?

3. How does one construct a confidence interval

for two population proportions or means?

4. How does one execute a test of significance for two population proportions or means?

Understandings:

- 1. A poor study design
- 2. When a t-procedure can be used
- 3. Matched pair data for a t-procedure
- 4. Study design for a two-sample tprocedure.

Stage Two—Assessment Evidence

Performance Tasks:

Other Evidence: :(quizzes, tests and so on)

Stage Three—Learning Plan

Unit 11: • Chapter 20/21: Inference for Proportions

This chapter covers confidence intervals and significance tests for a population proportion. Also discussed are comparisons of two population proportions using two independent samples.	
Stage One—Desired Results	
Established Goals: (Standards of Learning, Content Standards)	
1. Inference for a Population Proportion	

- 2. Inference conditions
- 3. Confidence intervals and significance tests
- 4. Determining sample size
- 5. Comparing Two Proportions
- 6. Confidence intervals about difference in proportions
- 7. Significance tests about difference in proportions
- 8. Use the TI-84 calculator as well as Minitab software to obtain confidence intervals and test hypotheses

Understandings:	Essential Questions:
 When to use the plus four procedure. The true confidence level may be less than you ask for unless the samples are quite large. 	 How does one distinguish among the various confidence intervals? How does one distinguish among the various tests of significance?
Stage Two—Assessment Evidence	
Performance Tasks:	
Other Evidence: :(quizzes, tests and so on)	
Stage Three—Learning Plan	

Unit 12: • Chapter 23: Inference for Distributions

Brief Summary of Unit

Chapter discusses two-way tables and the problem of multiple comparisons. The chi-square statistic measuring the distance between counts expected and counts observed across the table is the main topic.

Stage One—Desired Results

- 1. Test for Goodness of Fit
- 2. Inference for Two-Way Tables
- 3. Chi-square test for homogeneity
- 4. Chi-square test for association/independence
- 5. Interpret chi-square test results obtained from Minitab.

Understandings:	Essential Questions:	
 The data for a chi-square test must be presented as two-way table of counts of outcomes. The null hypothesis for a chi-square test. Uses of chi-square test 	 What is a two-way table? When are two categorical variables independent? How does one distinguish between various types of hypothesis testing? How does one conduct a Chi-Square Goodness of Fit test? How does on conduct a Chi-Square test for Homogeneity or Association? 	
Stage Two—Assessment Evidence		
Performance Tasks:		
Other Evidence: (Bquizzes, tests and so on)		
Stage Three—Learning Plan		

Unit 13: • Chapter 24: Inference for Regression Minitab

Brief Summary of Unit

This chapter demonstrates the use of statistical inference in the setting of simple linear regression and correlation.

Stage One—Desired Results

- 1. The idea of the regression model; Interpret computer output from Minitab software.
- 2. Predictions and Conditions
- 3. Confidence intervals and significance tests for the slope of the population regression line

Understandings:	Essential Questions:
 The regression setting. Which type of inference you need in a particular regression setting. Software output for regression. Prediction intervals. 	 How well does data fit a regression model? How can we use mathematical functions to "straighten out" data? What are the properties of a linear regression model? If two variables have a linear relationship, how do we test a claim about the population regression line?

Stage Two—Assessment Evidence		
Performance Tasks:		
Other Evidence: :(quizzes, tests and so on)		
Stage Three—Learning Plan		

Unit 14: • Chapter 25 ANOVA

Brief Summary of Unit		
This chapter represents the extension of comparing more than two population means. ANOVA is concerned with comparing group or treatment means in different samples by comparing variations		
between groups with variation within groups.		
Stage One—D	esired Results	
Established Goals: (Standards of Learning, Content Standards)		
 Comparing Several means-F-Test Conditions for ANOVA F-distributions and degrees of freedom Calculate and interpret ANOVA results from Minitab software 		
Understandings:	Essential Questions:	
 Testing the equality of several means is helpful in understanding data. The statistical significance of differences among sample means depends on the size of the sample and on how much variation there is within the sample. You can safely use ANOVA to compare means. 	 How does one execute a test of significance for multiple means? 	
Stage Two—Asse	ssment Evidence	
Performance Tasks:		
Other Evidence: :(quizzes, tests and so on)		
Stage Three—Learning Plan		