

Wallenpaupack Area School District

Planned Course Curriculum Guide

Department:
Mathematics

Course Name:
Honors Probability and Statistics

Course Description:

This course includes units from statistics and probability, advanced algebra, and finance. This course introduces students to the foundational concepts of data analysis, uncertainty, and statistical inference. It typically covers probability theory, distributions, hypothesis testing, and regression analysis. This course emphasizes both theoretical understanding and practical applications. It is designed for students across disciplines who need to interpret data, assess uncertainty, and make informed decisions based on statistical reasoning. It is recommended as a fourth-year mathematics course for academic students who choose not to study Trigonometry or Calculus.

Initial Creation Date (if applicable) and Revision Dates:

Initial Creation Date:

Revision Date: 2007

Revision Date: October, 2025

Curriculum Team: Lynn Cunningham
April Hessling

Wallenpaupack Area School District Curriculum	
COURSE: Probability and Statistics	GRADE/S: 11, 12
UNIT 1: Introduction to Statistics	TIMEFRAME: 4 blocks

PA COMMON CORE/NATIONAL STANDARDS:

CC.2.4.HS.B.4 - Recognize and evaluate random processes underlying statistical experiments.

C.C.2.4.HS.B.5 - Make inference and justify conclusions based on sample surveys, experiments and observational studies.

UNIT OBJECTIVES (SWBATS):

Students will be able to:

- Define statistics.
- Distinguish between a population and a sample.
- Distinguish between a parameter and a statistic.
- Distinguish between descriptive and inferential statistics.
- Distinguish between qualitative and quantitative data.
- Classify data with respect to the four levels of measurement: nominal, ordinal, interval and ratio.
- Design a statistical study.
- Distinguish between an observational study and an experiment.
- Collect data by performing an experiment, using a simulation, taking a census or using sampling.
- Create a sample using random sampling, stratified sampling, cluster sampling, systematic sampling and convenience sampling.

INSTRUCTIONAL STRATEGIES/ACTIVITIES:

- Direct instruction with guided examples
- Discovery learning
- Textbook problem solving
- Partner and group work
- Interactive board work with class discussions

ASSESSMENTS (Diagnostic/Benchmark/Formative/Summative):

- Class participation
- Classwork and homework
- Group work
- Partner activities
- Quizzes and tests
- Projects
- Teacher Observation

DIFFERENTIATED INSTRUCTION (Remediation/Acceleration/Enrichment):

- Math lab opportunities
- Peer tutoring
- Small group reteaching/instruction
- Challenge questions
- Utilize the gifted resource room

*will vary based on IEP/GIEP goals

RESOURCES (Technology Based Resources, Text Resources, etc.):

- Board approved textbook: Elementary Statistics Picturing the World 6th Edition Textbook
- Online assessment programs
- Interactive whiteboard or projector
- Graphing Calculator

KEY VOCABULARY:

- | | |
|---------------------------------|------------------------|
| • Data | • Observational Study |
| • Statistics | • Experiment |
| • Population | • Treatment group |
| • Sample | • Control group |
| • Parameter | • Placebo |
| • Statistic | • Confounding variable |
| • Descriptive statistics | • Blinding |
| • Inferential statistics | • Randomization |
| • Qualitative data | • Replication |
| • Quantitative data | • Simple random sample |
| • Nominal level of measurement | • Stratified sample |
| • Ordinal level of measurement | • Cluster sample |
| • Interval level of measurement | • Systematic sample |
| • Ratio level of measurement | • Convenience sample |

Wallenpaupack Area School District Curriculum	
COURSE: Probability and Statistics	GRADE/S: 11, 12
UNIT 2: Descriptive Statistics	TIMEFRAME: 18 blocks

PA COMMON CORE/NATIONAL STANDARDS:

CC.2.4.HS.B.1 - Summarize, represent, and interpret data on a single count or measurement variable.

CC.2.4.HS. B.2 - Summarize, represent, and interpret data on two categorical and quantitative variables

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).

UNIT OBJECTIVES (SWBATS):

Students will be able to:

- Construct a frequency distribution including class limits, class boundaries, midpoints, relative frequencies and cumulative frequencies.
- Construct frequency histograms, frequency polygons, relative frequency histograms and ogives.
- Graph and interpret quantitative data sets using stem-and-leaf plots and dot plots.
- Graph and interpret qualitative data sets using pie charts and Pareto charts.
- Interpret paired data sets using scatter plots and time series charts.
- Find mean, median and mode of a population and a sample.
- Find a weighted mean and the mean of a frequency distribution.
- Describe the shape of a distribution as symmetric, uniform or skewed and compare the median and mean for each.
- Find the range of data sets.
- Calculate midrange of data sets.
- Find the variance and standard deviation of a population and of a sample.
- Use the Empirical Rule and Chebychev's Theorem to interpret standard deviation.
- Approximate the sample standard deviation for grouped data.
- Use the coefficient of variation to compare variation in different data sets.
- Calculate the mean absolute deviation.
- Calculate and interpret Pearson's Index of Skewness
- Find the first, second and third quartiles of a data set.
- Find the interquartile range of a data set.
- Use the interquartile range to determine outliers.
- Represent a data set graphically using box-and-whisker plots and modified box-and-whisker plots.
- Calculate and interpret percentiles and deciles.
- Find and interpret the standard score of a normally distributed data set (z-score).
- Calculate the midquartile.

INSTRUCTIONAL STRATEGIES/ACTIVITIES:

- Direct instruction with guided examples
- Discovery learning
- Textbook problem solving
- Partner and group work
- Interactive board work with class discussions

ASSESSMENTS (Diagnostic/Benchmark/Formative/Summative):

- Class participation
- Classwork and homework
- Group work
- Partner activities
- Quizzes and tests
- Projects
- Teacher Observation

DIFFERENTIATED INSTRUCTION (Remediation/Acceleration/Enrichment):

- Math lab opportunities
- Peer tutoring
- Small group reteaching/instruction
- Challenge questions
- Utilize the gifted resource room

*will vary based on IEP/GIEP goals

RESOURCES (Technology Based Resources, Text Resources, etc.):

- Board approved textbook: Elementary Statistics Picturing the World 6th Edition Textbook
- Online assessment programs
- Interactive whiteboard or projector
- Graphing Calculator

KEY VOCABULARY:

- | | |
|--------------------------------|------------------------------------|
| • Frequency distribution | • Weighted mean |
| • Range | • Mean of a frequency distribution |
| • Midpoint | • Symmetric |
| • Relative frequency | • Uniform |
| • Cumulative frequency | • Skewed |
| • Frequency histogram | • Population variance |
| • Relative frequency histogram | • Population standard deviation |
| • Frequency polygon | • Sample variance |
| • Ogive | • Sample standard deviation |
| • Stem-and-leaf plot | • Empirical Rule |
| • Dot plot | • Chebychev's Theorem |
| • Pie chart | • First quartile |
| • Pareto chart | • Second quartile |
| • Scatter plot | • Third quartile |
| • Time series chart | • Box-and-whisker plot |
| • Mean | • Interquartile range |
| • Median | • Percentile |
| • Mode | • Decile |
| • Outlier | • z-score |

Wallenpaupack Area School District Curriculum	
COURSE: Probability and Statistics	GRADE/S: 11, 12
UNIT 3: Probability	TIMEFRAME: 17 blocks

PA COMMON CORE/NATIONAL STANDARDS:

CC.2.4.HS.B.4 – Recognize and evaluate random processes underlying statistical experiments.

CC.2.4.HS.B.6 - Use concepts of independence and conditional probability to interpret data.

CC.2.4.HS.B.7 - Apply the rules of probability to compute probabilities of compound events in a uniform probability model.

CCSS.Math.Content.HSS.CP.A.1 - Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or," "and," "not").

CCSS.Math.Content.HSS.CP.A.3 - Understand the conditional probability of A given B as $P(A \text{ and } B)/P(B)$, and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A , and the conditional probability of B given A is the same as the probability of B .

CCSS.Math.Content.HSS.CP.A.4 - Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities.

CCSS.Math.Content.HSS.CP.A.5 - Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations.

CCSS.Math.Content.HSS.CP.B.6 - Find the conditional probability of A given B as the fraction of B 's outcomes that also belong to A , and interpret the answer in terms of the model.

CCSS.Math.Content.HSS.CP.B.7 - Apply the Addition Rule, $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$, and interpret the answer in terms of the model.

CCSS.Math.Content.HSS.CP.B.8 - Apply the general Multiplication Rule in a uniform probability model, $P(A \text{ and } B) = P(A)P(B|A) = P(B)P(A|B)$, and interpret the answer in terms of the model.

CCSS.Math.Content.HSS.CP.B.9 - Use permutations and combinations to compute probabilities of compound events and solve problems.

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.

UNIT OBJECTIVES (SWBATS):

Students will be able to:

- Identify the sample space of a probability experiment and identify simple events.
- Distinguish between classical, empirical and subjective probability.
- Find classical or theoretical probability.
- Find empirical or statistical probability.
- Use tree diagrams to find probabilities.
- Use Venn diagrams to find probabilities.
- Use intersect and union set notation with probabilities.
- Calculate odds.
- Use frequency distribution to find probability.
- Identify and use properties of probability.
- Find the probability of an event given that another event has occurred.
- Distinguish between independent and dependent events.
- Use the multiplication rule to find conditional probabilities.
- Determine if two events are mutually exclusive.

• Use the addition rule to find the probability of two events. • Use the Fundamental Counting Principle to find the number of ways two or more events can occur. • Use permutations and combinations to find the number of ways to choose several objects. • Use permutations and the Fundamental Counting Principle to determine probabilities.																					
INSTRUCTIONAL STRATEGIES/ACTIVITIES: • Direct instruction with guided examples • Discovery learning • Textbook problem solving • Partner and group work • Interactive board work with class discussions																					
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DIFFERENTIATED INSTRUCTION (Remediation/Acceleration/Enrichment): • Math lab opportunities • Peer tutoring • Small group reteaching/instruction • Challenge questions • Utilize the gifted resource room *will vary based on IEP/GIEP goals																					
RESOURCES (Technology Based Resources, Text Resources, etc.): • Board approved textbook: Elementary Statistics Picturing the World 6th Edition Textbook • Online assessment programs • Interactive whiteboard or projector • Graphing Calculator																					
KEY VOCABULARY: <table border="0"> <tbody> <tr> <td>• Probability experiment</td><td>• Conditional probability</td></tr> <tr> <td>• Outcome</td><td>• Independent event</td></tr> <tr> <td>• Sample space</td><td>• Dependent event</td></tr> <tr> <td>• Events</td><td>• Multiplication rule</td></tr> <tr> <td>• Simple event</td><td>• Mutually exclusive</td></tr> <tr> <td>• Fundamental Counting Principle</td><td>• Addition rule</td></tr> <tr> <td>• Classical probability</td><td>• Permutation</td></tr> <tr> <td>• Empirical probability</td><td>• Factorial</td></tr> <tr> <td>• Subjective probability</td><td>• Distinguishable permutations</td></tr> <tr> <td>• Complement</td><td>• Combination</td></tr> </tbody> </table>		• Probability experiment	• Conditional probability	• Outcome	• Independent event	• Sample space	• Dependent event	• Events	• Multiplication rule	• Simple event	• Mutually exclusive	• Fundamental Counting Principle	• Addition rule	• Classical probability	• Permutation	• Empirical probability	• Factorial	• Subjective probability	• Distinguishable permutations	• Complement	• Combination
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Wallenpaupack Area School District Curriculum	
COURSE: Probability and Statistics	GRADE/S: 11, 12
UNIT 4: Discrete Probability Distributions:	TIMEFRAME: 5 blocks

PA COMMON CORE/NATIONAL STANDARDS:

CC.2.4.HS.B.4 - Recognize and evaluate random processes underlying statistical experiments.

C.C.2.4.HS.B.5 - Make inference and justify conclusions based on sample surveys, experiments and observational studies.

CCSS.Math.Content.HSS.MD.A.1 - Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space; graph the corresponding probability distribution using the same graphical displays as for data distributions.

CCSS.Math.Content.HSS.MD.A.2 - Calculate the expected value of a random variable; interpret it as the mean of the probability distribution.

CCSS.Math.Content.HSS.MD.A.3 - Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value.

CCSS.Math.Content.HSS.MD.A.4 - Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value.

CCSS.Math.Content.HSS.MD.B.5 - Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values.

UNIT OBJECTIVES (SWBATS):

Students will be able to:

- Distinguish between discrete random variables and continuous random variables.
- Construct a discrete probability distribution and its graph.
- Determine if a distribution is a probability distribution.
- Find the mean, variance and standard deviation of a discrete probability distribution.
- Find the expected value of a probability distribution.
- Determine if a probability experiment is a binomial experiment.
- Find binomial probabilities using the binomial probability formula, a binomial probability table and technology.
- Construct a binomial distribution and its graph.
- Find the mean, variance and standard deviation of a binomial probability distribution.
- Find probabilities using the Geometric distribution.
- Find probabilities using the Poisson distribution.
- Determine probabilities of a multinomial experiment.

INSTRUCTIONAL STRATEGIES/ACTIVITIES:

- Direct instruction with guided examples
- Discovery learning
- Textbook problem solving
- Partner and group work
- Interactive board work with class discussions

ASSESSMENTS (Diagnostic/Benchmark/Formative/Summative):

- Class participation
- Classwork and homework
- Group work
- Partner activities
- Quizzes and tests
- Projects
- Teacher Observation

DIFFERENTIATED INSTRUCTION (Remediation/Acceleration/Enrichment):

- Math lab opportunities
- Peer tutoring
- Small group reteaching/instruction
- Challenge questions
- Utilize the gifted resource room

*will vary based on IEP/GIEP goals

RESOURCES (Technology Based Resources, Text Resources, etc.):

- Board approved textbook: Elementary Statistics Picturing the World 6th Edition Textbook
- Online assessment programs
- Interactive whiteboard or projector
- Graphing Calculator

KEY VOCABULARY:

- | | |
|---|---|
| • Random variable | • Binomial experiments |
| • Discrete | • Binomial probability distribution |
| • Continuous | • Mean of a binomial distribution |
| • Discrete probability distribution | • Variance of a binomial distribution |
| • Mean of a discrete probability distribution | • Standard deviation of a binomial distribution |
| • Variance of a discrete probability distribution | • Geometric distribution |
| • Standard deviation of a discrete probability distribution | • Poisson distribution |
| • Expected value | |

Wallenpaupack Area School District Curriculum	
COURSE: Probability and Statistics	GRADE/S: 11, 12
UNIT 5: Normal Probability Distribution	TIMEFRAME:10 blocks

PA COMMON CORE/NATIONAL STANDARDS:

C.C.2.4.HS.B.5 - Make inference and justify conclusions based on sample surveys, experiments and observational studies.

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.

UNIT OBJECTIVES (SWBATS):

Students will be able to:

- Interpret graphs of normal probability distributions.
- Understand mean and standard deviation as it pertains to the normal distribution.
- Find areas under the standard normal curve using the standard normal table.
- Find probabilities for normally distributed variables using a table and using technology.
- Find a z-score given the area under the normal curve.
- Find a z-score given a percentile.
- Transform a z-score to an x-value.
- Find a specific data value of a normal distribution given the probability.
- Compare data from two normal distributions.
- Find sampling distributions and verify their properties.
- Interpret the Central Limit Theorem.
- Apply the Central Limit Theorem to find the probability of a sample mean.
- Determine when the normal distribution can approximate the binomial distribution.
- Find the continuity correction.
- Use a normal distribution to approximate binomial probabilities.

INSTRUCTIONAL STRATEGIES/ACTIVITIES:

- Direct instruction with guided examples
- Discovery learning
- Textbook problem solving
- Partner and group work
- Interactive board work with class discussions

ASSESSMENTS (Diagnostic/Benchmark/Formative/Summative):

- Class participation
- Classwork and homework
- Group work
- Partner activities
- Quizzes and tests
- Projects
- Teacher Observation

DIFFERENTIATED INSTRUCTION (Remediation/Acceleration/Enrichment):

- Math lab opportunities
- Peer tutoring
- Small group reteaching/instruction
- Challenge questions
- Utilize the gifted resource room

*will vary based on IEP/GIEP goals

RESOURCES (Technology Based Resources, Text Resources, etc.):

- Board approved textbook: Elementary Statistics Picturing the World 6th Edition Textbook
- Online assessment programs
- Interactive whiteboard or projector
- Graphing Calculator

KEY VOCABULARY:

- | | |
|--------------------------------------|------------------------------|
| • Normal distribution | • z-score |
| • Inflection points | • Sampling distribution |
| • Probability density function (pdf) | • Standard error of the mean |
| • Standard normal distribution | • Central Limit Theorem |
| • Area under the normal curve | • Continuity correction |

Wallenpaupack Area School District Curriculum	
COURSE: Probability and Statistics	GRADE/S: 11, 12
UNIT 6: Confidence Intervals	TIMEFRAME: 10 blocks

PA COMMON CORE/NATIONAL STANDARDS:

C.C.2.4.HS.B.5 - Make inference and justify conclusions based on sample surveys, experiments and observational studies.

CCSS.Math.Content.HSS.IC.B.4 - Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.

UNIT OBJECTIVES (SWBATS):

Students will be able to:

- Find the point estimate for a population mean.
- Calculate margin of error.
- Construct and interpret confidence intervals for the population mean when σ is known.
- Determine the required minimum sample size when estimating the population mean.
- Interpret the t-distribution and use a t-distribution table and technology.
- Construct and interpret confidence intervals for the population mean when σ is not known.
- Find a point estimate for a population proportion.
- Construct and interpret confidence intervals for a population proportion.
- Determine a minimum sample size when estimating a population proportion.
- Interpret the chi-square distribution and use a chi-square distribution table.
- Use the chi-square distribution to construct a confidence interval for a population variance and standard deviation.

INSTRUCTIONAL STRATEGIES/ACTIVITIES:

- Direct instruction with guided examples
- Discovery learning
- Textbook problem solving
- Partner and group work
- Interactive board work with class discussions

• **ASSESSMENTS (Diagnostic/Benchmark/Formative/Summative):**

- Class participation
- Classwork and homework
- Group work
- Partner activities
- Quizzes and tests
- Projects
- Teacher Observation

DIFFERENTIATED INSTRUCTION (Remediation/Acceleration/Enrichment):

- Math lab opportunities
- Peer tutoring
- Small group reteaching/instruction
- Challenge questions
- Utilize the gifted resource room

*will vary based on IEP/GIEP goals

RESOURCES (Technology Based Resources, Text Resources, etc.):

- Board approved textbook: Elementary Statistics Picturing the World 6th Edition Textbook
- Online assessment programs
- Interactive whiteboard or projector
- Graphing Calculator

KEY VOCABULARY:

- | | |
|---|---|
| • Point estimate | • t-distribution |
| • Interval estimate | • degrees of freedom |
| • Level of confidence c | • population proportion |
| • Sampling error | • confidence interval for a population proportion p |
| • Margin of error E | • chi-square distribution |
| • Confidence interval | • critical values |
| • Confidence interval for a population mean μ where σ is known, as well as unknown | • confidence interval for σ^2 |
| • Sample size | • confidence interval for σ |

Wallenpaupack Area School District Curriculum	
COURSE: Probability and Statistics	GRADE/S: 11, 12
UNIT 7: Hypothesis Testing with One Sample	TIMEFRAME: 12 blocks

PA COMMON CORE/NATIONAL STANDARDS:

CC.2.4.HS.B.5 – Make inferences and justify conclusions based on sample surveys, experiments, and observational studies.

CCSS.Math.Content.HSS.IC.A.1 - Understand statistics as a process for making inferences about population parameters based on a random sample from that population.

UNIT OBJECTIVES (SWBATs):

Students will be able to:

- State a null hypothesis and an alternative hypothesis.
- Know whether to use a one-tailed or two-tailed statistical test.
- Make and interpret a decision based on the results of a statistical test.
- Write claims for a hypothesis test.
- Find and interpret P-values.
- Use P-value for z-test a mean, μ when σ is known.
- Find critical values and rejection regions in the standard normal distribution.
- Use rejection regions for a z-test for a mean when σ is known.
- Find critical values in a t-distribution.
- Use the t-test to test a mean, μ when σ is unknown.
- Use technology to find P-values and use them with a t-test to test a mean when σ is not known.
- Use the z-test to test a population proportion, p .
- Find critical values for a chi-square test.
- Use the chi-square test to test a variance σ^2 or a standard deviation σ .

INSTRUCTIONAL STRATEGIES/ACTIVITIES:

- Direct instruction with guided examples
- Discovery learning
- Textbook problem solving
- Partner and group work
- Interactive board work with class discussions

ASSESSMENTS (Diagnostic/Benchmark/Formative/Summative):

- Class participation
- Classwork and homework
- Group work
- Partner activities
- Quizzes and tests
- Projects
- Teacher Observation

DIFFERENTIATED INSTRUCTION (Remediation/Acceleration/Enrichment):

- Math lab opportunities
- Peer tutoring
- Small group reteaching/instruction
- Challenge questions
- Utilize the gifted resource room

*will vary based on IEP/GIEP goals

RESOURCES (Technology Based Resources, Text Resources, etc.):

- Board approved textbook: Elementary Statistics Picturing the World 6th Edition Textbook
- Online assessment programs
- Interactive whiteboard or projector
- Graphing Calculator

KEY VOCABULARY:

- | | |
|-------------------------------|--------------------|
| • Statistical hypothesis | • Left-tailed |
| • Null hypothesis | • Right-tailed |
| • Alternative hypothesis | • Two-tailed |
| • Type I and Type II error | • Reject |
| • Level of significance | • Fail to reject |
| • Test statistic | • Support |
| • Standardized test statistic | • Fail to support |
| • P-value | • Rejection region |

Wallenpaupack Area School District Curriculum	
COURSE: Probability and Statistics	GRADE/S: 11, 12
UNIT 8: Hypothesis Testing with Two Samples (if time permits)	TIMEFRAME: 5 blocks

PA COMMON CORE/NATIONAL STANDARDS:

CC.2.4.HS.B.5 – Make inferences and justify conclusions based on sample surveys, experiments, and observational studies.

CCSS.Math.Content.HSS.IC.A.1 - Understand statistics as a process for making inferences about population parameters based on a random sample from that population.

UNIT OBJECTIVES (SWBATS):

Students will be able to:

- Determine whether two samples are independent or dependent.
- Perform a two-sample z-test for the difference between two means using independent samples with both population standard deviations known.
- Perform a two-sample t-test for the difference between two means using independent samples with both population standard deviation unknown.
- Perform a two-sample z-test for the difference between two population proportions.

INSTRUCTIONAL STRATEGIES/ACTIVITIES:

- Direct instruction with guided examples
- Discovery learning
- Textbook problem solving
- Partner and group work
- Interactive board work with class discussions

ASSESSMENTS (Diagnostic/Benchmark/Formative/Summative):

- Class participation
- Classwork and homework
- Group work
- Partner activities
- Quizzes and tests
- Projects
- Teacher Observation

DIFFERENTIATED INSTRUCTION (Remediation/Acceleration/Enrichment):

- Math lab opportunities
- Peer tutoring
- Small group reteaching/instruction
- Challenge questions
- Utilize the gifted resource room

*will vary based on IEP/GIEP goals

RESOURCES (Technology Based Resources, Text Resources, etc.):

- Board approved textbook: Elementary Statistics Picturing the World 6th Edition Textbook
- Online assessment programs
- Interactive whiteboard or projector
- Graphing Calculator

KEY VOCABULARY:

- Null hypothesis
- Alternative hypothesis
- Two-sample z-test
- Standardized test statistic
- Two-sample t-test
- Pooled estimate of the standard deviation

Wallenpaupack Area School District Curriculum	
COURSE: Probability and Statistics	GRADE/S: 11, 12
UNIT 9: Correlation and Regression	TIMEFRAME: 4 blocks

PA COMMON CORE/NATIONAL STANDARDS:

CC.2.4.HS.B.2 – Summarize, represent, and interpret data on two categorical and quantitative variables.

CC.2.4.HS.B.3 – Analyze linear models to make interpretations based on data.

CC.2.4.HS.B.5 – Make inferences and justify conclusions based on sample surveys, experiments, and observational studies.

CCSS.Math.Content.HSS.IC.A.1 - Understand statistics as a process for making inferences about population parameters based on a random sample from that population.

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.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 OBJECTIVES (SWBATS):

Students will be able to:

- Demonstrate knowledge of linear correlation, independent and dependent variables and the types of correlation.
- Construct a scatter plot.
- Find a correlation coefficient both manually and with the aid of technology.
- Test a population correlation coefficient using a table.
- Perform a hypothesis test for a population correlation coefficient.
- Distinguish between correlation and causation.
- Find the equation of a regression line.
- Predict y-values using a regression line.
- Find and interpret the coefficient of determination.

INSTRUCTIONAL STRATEGIES/ACTIVITIES:

- Direct instruction with guided examples
- Discovery learning
- Textbook problem solving
- Partner and group work
- Interactive board work with class discussions

ASSESSMENTS (Diagnostic/Benchmark/Formative/Summative):

- Class participation
- Classwork and homework
- Group work
- Partner activities
- Quizzes and tests
- Projects
- Teacher Observation

DIFFERENTIATED INSTRUCTION (Acceleration/Enrichment):

- Math lab opportunities
- Peer tutoring
- Small group reteaching/instruction
- Utilize the gifted resource room

*will vary based on IEP/GIEP goals

RESOURCES (Technology Based Resources, Text Resources, etc.):

- Board approved textbook: Elementary Statistics Picturing the World 6th Edition Textbook
- Online assessment programs
- Interactive whiteboard or projector
- Graphing Calculator

KEY VOCABULARY:

- | | |
|--------------------------------------|--------------------------------------|
| • Correlation | • Regression line (line of best fit) |
| • Independent (explanatory) variable | • Significant correlation |
| • Dependent (response) variable | • Coefficient of determination |
| • Correlation coefficient | |

Wallenpaupack Area School District Curriculum	
COURSE: Probability and Statistics	GRADE/S: 11, 12
UNIT 10: Chi-Square Tests and the F-Distribution	TIMEFRAME: 5 blocks

PA COMMON CORE/NATIONAL STANDARDS:

CC.2.4.HS.B.5 – Make inferences and justify conclusions based on sample surveys, experiments, and observational studies.

CC.2.4.HS.B.6 – Use the concepts of independence and conditional probability to interpret data.

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.

UNIT OBJECTIVES (SWBATS):

Students will be able to:

- Use the chi-square distribution to test whether a frequency distribution fits and expected distribution (Perform a goodness-of-fit test).
- Use a contingency table to find expected frequencies.
- Use a chi-square distribution to test whether two variables are independent.
- Use one-way analysis of variance (One way ANOVA) to test claims involving three or more means.

If time permits:

- Interpret the F-distribution.
- Use an F-table to find critical values.
- Perform a two-sample F-test to compare two variances.

INSTRUCTIONAL STRATEGIES/ACTIVITIES:

- Direct instruction with guided examples
- Discovery learning
- Textbook problem solving
- Partner and group work
- Interactive board work with class discussions

ASSESSMENTS (Diagnostic/Benchmark/Formative/Summative):

- Class participation
- Classwork and homework
- Group work
- Partner activities
- Quizzes and tests
- Projects
- Teacher Observation

DIFFERENTIATED INSTRUCTION (Remediation/Acceleration/Enrichment):

- Math lab opportunities
- Peer tutoring
- Small group reteaching/instruction
- Utilize the gifted resource room

*will vary based on IEP/GIEP goals

RESOURCES (Technology Based Resources, Text Resources, etc.):

- Board approved textbook: Elementary Statistics Picturing the World 6th Edition Textbook
- Online assessment programs
- Interactive whiteboard or projector
- Graphing Calculator

KEY VOCABULARY:

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|-----------------------------------|--------------------------------|
| • Chi-square goodness-of-fit test | • Joint frequencies |
| • Observed frequency | • Degrees of freedom |
| • Expected frequency | • Right-tailed test |
| • Test statistic | • Two-tailed test |
| • Contingency table | • Analysis of variance (ANOVA) |
| • Cell | • Mean square within |
| • Marginal frequencies | • Mean square between |

If time permits:

- F-distribution
- Critical values

Standards:

CC.2.4.HS.B.1 – Summarize, represent, and interpret data on a single count or measurement value.

CC.2.4.HS.B.2 – Summarize, represent, and interpret data on two categorical and quantitative variables.

CC.2.4.HS.B.3 – Analyze linear models to make interpretations based on data.

CC.2.4.HS.B.4 – Recognize and evaluate random processes underlying statistical experiments.

CC.2.4.HS.B.5 – Make inferences and justify conclusions based on sample surveys, experiments, and observational studies.

CC.2.4.HS.B.6 – Use the concepts of independence and conditional probability to interpret data.

CC.2.4.HS.B.7 – Apply the rules of probability to compute probabilities of compound events in a uniform probability model.

CCSS.Math.Content.HSS.CP.A.1 - Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or," "and," "not").

CCSS.Math.Content.HSS.CP.A.2 - Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent.

CCSS.Math.Content.HSS.CP.A.3 - Understand the conditional probability of A given B as $P(A \text{ and } B)/P(B)$, and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A , and the conditional probability of B given A is the same as the probability of B .

CCSS.Math.Content.HSS.CP.A.4 - Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. *For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.*

CCSS.Math.Content.HSS.CP.A.5 - Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. *For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.*

CCSS.Math.Content.HSS.CP.B.6 - Find the conditional probability of A given B as the fraction of B 's outcomes that also belong to A , and interpret the answer in terms of the model.

CCSS.Math.Content.HSS.CP.B.7 - Apply the Addition Rule, $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$, and interpret the answer in terms of the model.

CCSS.Math.Content.HSS.CP.B.8 - Apply the general Multiplication Rule in a uniform probability model, $P(A \text{ and } B) = P(A)P(B|A) = P(B)P(A|B)$, and interpret the answer in terms of the model.

CCSS.Math.Content.HSS.CP.B.9 - Use permutations and combinations to compute probabilities of compound events and solve problems.

CCSS.Math.Content.HSS.IC.A.1 - Understand statistics as a process for making inferences about population parameters based on a random sample from that population.

CCSS.Math.Content.HSS.IC.A.2 - Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. *For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model?*

CCSS.Math.Content.HSS.IC.B.3 - Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.

CCSS.Math.Content.HSS.IC.B.4 - Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.

CCSS.Math.Content.HSS.IC.B.5 - Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.

CCSS.Math.Content.HSS.IC.B.6 - Evaluate reports based on data.

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.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.

CCSS.Math.Content.HSS.MD.A.1 - Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space; graph the corresponding probability distribution using the same graphical displays as for data distributions.

CCSS.Math.Content.HSS.MD.A.2 - Calculate the expected value of a random variable; interpret it as the mean of the probability distribution.

CCSS.Math.Content.HSS.MD.A.3 - Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value. *For example, find the theoretical probability distribution for the number of correct answers obtained by guessing on all five questions of a multiple-choice test where each question has four choices, and find the expected grade under various grading schemes.*

CCSS.Math.Content.HSS.MD.A.4 - Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value. *For example, find a current data distribution on the number of TV sets per household in the United States, and calculate the expected number of sets per household. How many TV sets would you expect to find in 100 randomly selected households?*

CCSS.Math.Content.HSS.MD.B.5 - Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values.

CCSS.Math.Content.HSS.MD.B.6 - Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).

CCSS.Math.Content.HSS.MD.B.7 - Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).