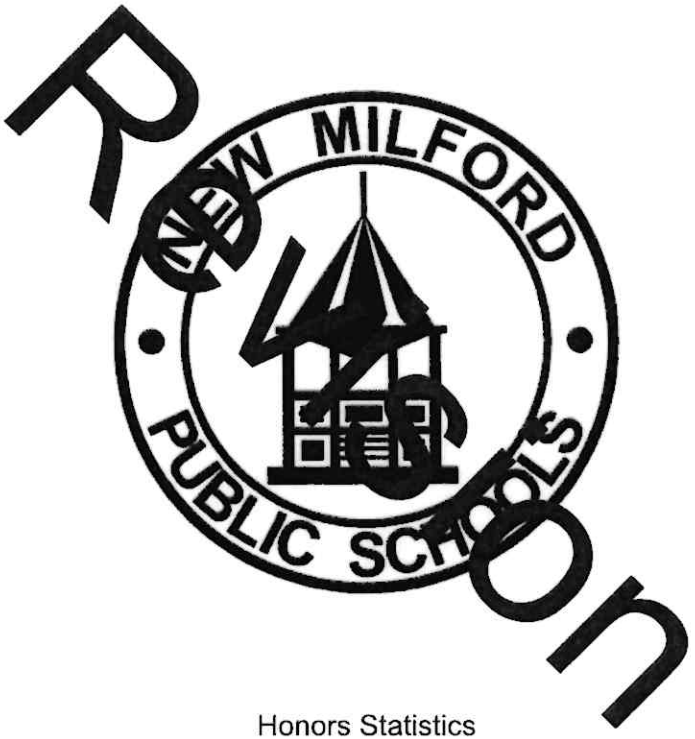
NEW MILFORD PUBLIC SCHOOLS

New Milford, Connecticut



REVISED

Honors Statistics

April 2023

Do Not Distribute Not BOE Approved

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New Milford's Mission Statement

The mission of the New Milford Public Schools, a collaborative partnership of students, educators, family and community, is to prepare each and every student to compete and excel in an ever-changing world, embrace challenges with vigor, respect and appreciate the worth of every human being, and contribute to society by providing effective instruction and dynamic curriculum, offering a wide range of valuable experiences, and inspiring students to pursue their dreams and aspirations.

Honors Statistics

Grades 11/12

This is a full year course designed for students who have passed honors Algebra 2. Topics include: probability, vocabulary, frequency tables and graphs, measures of central tendency, work with usual values and outliers, normal and binomial distributions, scatterplots and hypothesis testing, as well as word problems associated with these topics. Work in the course will provide students with an excellent background in statistics as preparation for work in their college classes. At the honors level, this course is more rigorous by the inclusion of additional topics and more complex questions within each unit. The work here goes beyond the calculations to create a deeper understanding of the material through analysis of data and interpretations of the affect changes in the data have on the outcomes. The use of computers and graphing calculators is an integral part of this course and therefore a graphing calculator (such as TI-83+/TI84+ or comparable casio) is required for the class.

Vision of the graduate

Honors statistics lends itself to focusing a great deal on communication skills and critical thinking skills through thoughtful examination of the data and precise calculations followed by a summary of the analysis and subsequent conclusions drawn from the data. The types of data the students work with allows them to become more socially aware of different aspects of possible career fields such as business, gaming, medicine, politics and production/quality control.

Pacing Guide

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UNIT #	TITLE	Weeks
1	Sample distributions (vocabulary and graphs)	4-5 weeks
2	Numerical Descriptors	5-6 weeks
3	The Relationship between Two Variables(linear regression)	5-6 weeks
Midterm review and exam		1-2 weeks
4	Probability	4-5 weeks
5	Normal Distributions	2-3 weeks
6	Probability Distributions(binomial and geometric)	5-6 weeks
7	Inferential Statistics	5-6 weeks
Final review and exam		1-2 weeks

Subject/Course: Honors Statistics
Grade:11/12
Time frame: approx 4-5 weeks

Unit: 1 sample distributions

<table>
<tr><td rowspan="4">ESTABLISHED GOALS

<u>CCSS.MATH.CONTENT.HSS.ID.A.1</u>

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

<u>CCSS.MATH.CONTENT.HSS.IC.B.3</u>

Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.</td><td colspan="2">Transfer</td></tr>
<tr><td colspan="2">Students will be able to independently use their learning to…

• Support ideas clearly and concisely using proper mathematical language/notation.
• Construct viable arguments involving mathematics and critique the reasoning of others.
• Work carefully to solve the problem and verify that calculations are accurate and solutions are reasonable.
• Make sense of problems and persevere in solving them</td></tr>
<tr><td colspan="2">Meaning</td></tr>
<tr><td>UNDERSTANDINGS
Students will understand that…

• Data is collected for a purpose and has meaning in a context.
• Data can be gathered and classified through a variety of methods
• Data can be presented in both chart and graph form
• Random sampling allows results of surveys and experiments to be extended to the population from which the sample was taken
• Variability is natural and is also predictable and quantifiable
• Data gathered inappropriately can</td><td>ESSENTIAL QUESTIONS
Students will keep considering…

• What are the keys to data classification and experimental design
• How can graphs be used to communicate information and/or misinformation
• What is required to plan and conduct a survey?
• What can cause results to be biased
• What are sampling techniques and how do they reduce bias?
• What are different methods by which data can be displayed?
• How do measures of dispersion describe data?
• What are the various methods of data</td></tr>
</table>

	cause a bias in the conclusions • Inherent bias diminishes as sample size increases. • Graphical displays of data may be analyzed informally. • Sampling can provide sufficient information so that population characteristics may be inferred. • Interpretation is influenced by the way that data is collected, organized and displayed	collection? • What are the differences between controlled experiments and observational studies? • What considerations should be made when designing an experiment? • How do graphs enhance the display of data? • How does one know which graph is appropriate to use for a given set of data?
	Acquisition	
	Students will know… • Vocabulary related to types of data and sampling techniques. • The key issues that can be problematic in data gathering and cause bias in interpretation • How to obtain and generate data • How to organize data into a frequency distribution, relative frequency distribution or a cumulative frequency distribution • How to graph the data as a first step in analyzing data • How to display the distribution of a quantitative variable with a stemplot, dot plot or pie chart • How to make a line graph,bar graph, histogram, and pareto chart • How to make a timeplot of data that	*Students will be skilled at…* • Identifying types of data and recognizing sampling techniques • Understanding issues that arise when gathering data that can cause data to be biased • Identifying the methods for gathering data • Identifying sampling techniques as they relate to 'real world' situations • Identifying common sources of bias in surveys and experiments • Summarizing the data in a frequency table • Gathering data from a variety of sources and determining the appropriate graph • Displaying the distribution with the appropriate line graph, bar graph, or pie chart • Describing the distribution of a

	may vary over time • How to interpret numerical summaries and graphical displays of data • How to create, organize data and produce graphs using appropriate computer software?	quantitative variable in terms of its shape, center and spread. • Entering data into a spreadsheet and using the software to create a graph.

STAGE 2

Code	Evaluative Criteria	Assessment Evidence
T, M, A	Evaluative Criteria consists of: • An explanation of the methods used for gathering the data. • Data organized into an appropriate table • An accurate and appropriate graph of the data • A coherent summation of the data with an explanation of the reason for the differences in salaries across the U.S.	PERFORMANCE TASK(S): *Students will show that they really understand evidence of…* **Goal:** Produce an appropriate graph of data gathered **Role**: Career counselor **Audience**: High school seniors **Situation**: Gather data about salaries for a specific career from the Bureau of Labor Statistics **Product or Performance**: A comparison, in graphic form, of salaries for a specific career relative to a variety of locations within the United States. References will be made to possible reasons for the deferential in salaries from one region in the United States to another. **Standards for Success**: An appropriate graph representative of the data gathered and coherent summation of the reason for the differences in salaries across the United States.

	Evaluative criteria consists of:	OTHER EVIDENCE:
M, A	• Is the correct sampling technique used to gather the data?	• Alternative assessment projects that involve gathering real world data, organizing the data and presenting it in graphic form.
M, A	• Is the correct vocabulary and/or notations used to describe the data?	• Review of standardized test questions to prep students for the challenge of the SAT and ACT exams
T, M, A	• Is the data accurately organized in a frequency table?	• Participation in class discussion, group work, and responses.
T, M, A	• Is the appropriate graph chosen for a specific application?	• Quizzes
T, M, A	• Does the graph model the desired application?	• Unit Test - to include a variety of DOK level of problems and may include SAT style problems.
T, M, A	• Does any bias exist within the data set?	
T, M A	• Are justified conclusions made based on the data gathered?	

Code	***Pre-Assessment***	
M	• Teacher checks for prerequisite and prior knowledge via warm-up and questioning activities, such as basic problems on percents and reading graphs • Teacher will provide review and assessment on prerequisite Sampling distribution vocabulary knowledge to ensure all students are capable of communicating effectively	
	Summary of Key Learning Events and Instruction *Student success at transfer meaning and acquisition depends on…*	Progress Monitoring
M, A	• Students complete an introductory activity that will provide reference during lessons on vocabulary and frequency tables	• Monitoring class work through board work, group work, questioning, and walk-arounds
M, A	• Teacher will introduce statistical vocabulary and provide sampling models to which they apply	• Check for understanding via going over homework and mediums such as reflections and exit tickets
T, M, A	• Teacher discusses sampling techniques which may cause data to be biased	• Class worksheets with direct teacher observation or self assessment
M, A	• Teacher and students will collectively practice using sampling techniques	• Practice on whiteboard/chalkboard with direct teacher observation
M, A	• Students practice problems related to data gathering to determine their level of understanding	• Kahoot quiz or pear deck slideshow with review questions and direct teacher observation
M, A	• Kahoot quizzes used to review and master the vocabulary	• Reflective journals or exit tickets at the end of the lesson
M, A	• Teacher demonstrates how to organize data into frequency tables and identify the various frequency tables used	• Edulastic or google form review assignments
T, M, A	• Teacher and students will collectively practice organizing data into frequency tables	• Homework assignments with direct teacher observation or self assessment
T, M, A	• Students summarize real data in frequency tables	
M, A	• Teacher will introduce and provide practice on creating line and time-series graphs	
M, A	• Teacher will introduce and provide practice on creating bar graphs, histograms and pareto charts	
M, A	• Teacher will introduce and provide practice on creating other graphs: dotplot, stemplot, pie chart	

T, M, A T, M, A T, M, A T, M, A T, M, A T, M, A T, M, A	• Teacher will provide information as to when it is appropriate to use each type of graph • Teacher will discuss scales on the graph and how graphs can be made to be misleading • Teacher and students will collectively practice a variety of graphs using statistical data • Students analyze a series of data sets to determine which graph is appropriate for each given data set and then create graphs by hand • Students create specific graphs for given data using appropriate technology (i.e. Microsoft Excel and Google Sheets) • Students and teacher will collectively look at data sets and their corresponding graphs to analyze and draw conclusions. • Students will explore sampling distributions using the unit's performance task and complete an activity based review in preparation for a unit assessment.	

Suggested Resources and supplies

Resources:

All Resources and materials must adhere to all New Milford Board of Education policies and regulations and are subject to New Milford Board of Education approval. Resources and materials must be researched and vetted by the writers and department heads prior to submission for approval.

- Textbook: Triola, Mario F . *Elementary Statistics.* 13th ed. Boston Ma. : Pearson, Prentice Hall, 2018. Print.
- Resource materials provided by Pearson such as implementation and applications of statistics, differentiation and standardized test practice
- Resource from the Bureau of Labor Statistics
- Kahoot; interactive game: Wiggins and Murphy

	• Desmos; advanced graphing calculator • Google forms and Google slides with pear deck extension • Microsoft excel and google sheets • Supplies: White boards, straight edge, graph paper, colored pencils	

Subject/Course: Honors Statistics
Grade:11/12
Time frame: approx 5-6 weeks

Unit: 2 Numeric Descriptors

<table>
<tr><td rowspan="4">ESTABLISHED GOALS

<u>CCSS.MATH.CONTENT.HSS.ID.A.4</u>
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.

<u>CCSS.MATH.CONTENT.HSS.IC.1</u>
Understand statistics as a process for making inferences about population parameters based on a random sample from that population.

<u>CCSS.MATH.CONTENT.HSS.IC.4</u>
Use data from a sample survey to estimate a population mean or</td><td colspan="2">Transfer</td></tr>
<tr><td colspan="2">Students will be able to independently use their learning to…

• Analyze real data using measures of center
• Model measures of center using graphical representations
• Construct viable conclusions involving mathematical reasoning to describe a data set</td></tr>
<tr><td colspan="2">Meaning</td></tr>
<tr><td>UNDERSTANDINGS
Students will understand that…

• Measures of central tendency describe how the data cluster or group.
• Measures of dispersion describe how the data spread (disperse) around the center of the data.
• Data is collected for a purpose and has meaning within a context.
• Data of the descriptive statistical information generated by a univariate data set should include the interplay</td><td>ESSENTIAL QUESTIONS
Students will keep considering…

• Why is data collected and analyzed?
• How do people use data to influence others?
• How can technology be used as a time saving measure in calculating measure of center?
• How can predictions be made based on data?
• What is an outlier and how does it influence a data set?</td></tr>
</table>

proportion; develop a margin of error through the use of simulation models for random sampling. CCSS.MATH.CONTENT.HSS.IC.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.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.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	between central tendency and dispersion as well as among specific measures. • Median and IQR resist the effects of outliers, while the mean and standard deviation do not. • Skewed Distributions are analyzed with the mean pulled in the direction of the skewness (toward the longer tail) relative to the mean. • Mean and standard deviation can be used to determine if an observation is 'usual' • Z-Score can be used to determine if an observation is 'usual' • 5 Number Summary can be used to create a boxplot for the data	• What does it mean for the data to be skewed? • Do all dispersions contain an outlier? • How are measures of central tendency used? • What is meant by the spread of the data? • When is an observation considered 'usual' • What does it mean for an observation to be considered 'usual'? • How do z-scores determine if an observation is 'usual'
	Acquisition	
	Students will know… • The basic properties of the median and the mean • That an outlier can cause data to be skewed relative to the position of the mean and median on the normal curve • That the standard deviation summarizes how spread out all the data are around the mean. • What z-scores means • How to compare values of two different variables using their z-scores • How to determine if an observation is 'usual' • What it means to be 'usual' • How to calculate a range of usual values using the rule of thumb,	*Students will be skilled at…* • Calculating the mean, median, mode, midrange and standard deviation for a set of data • Selecting and using appropriate statistical methods to analyze data • Calculating weighted means for frequency distributions and to find grades such as for GPA • Using the 1.5 IQR rule to identify possible outliers and identify outliers in boxplots • Calculating the z-score of an observation and determining whether a value is 'usual' • Calculating ranges of usual values using the rule of thumb, empirical rule and Chebyshev's theorem • Determining whether or not an

points (outliers).	empirical rule and Chebyshev's theorem • How to find the value at a specific percentile • How to find the percentage of observations falling below any value in a normal model using appropriate technology • How to use appropriate technology to find the 5 number summary and create a box plot for the data	observation is 'usual' • Creating the 5-number summary of a variable • Constructing a box plot by hand from a 5-number summary • Calculating which value lies at a specific percentile • Calculating the percentile for a specific value

STAGE 2

Code	Evaluative Criteria	Assessment Evidence
T, M, A	Evaluative Criteria consists of • An explanation of the methods used for gathering the data. • Data organized into an appropriate table • Measures of center are accurate and appropriately represented visually • A coherent summation of the data with an explanation of the current housing prices in the area	PERFORMANCE TASK(S): *Students will show that they really understand evidence of…* **Goal**: gather data, produce an appropriate graph and make appropriate calculations for the data. **Role**: Realtor **Audience**: Home buyers **Situation**: gather data about housing prices in a specific area and calculate measures of center for the data. **Product or Performance**: Present the results of the survey to prospective home buyers to give them an understanding of the housing prices in that area. **Standards for Success**: Accurate calculations and a knowledgeable presentation of the data gathered.

	Evaluative criteria consists of:	OTHER EVIDENCE:
T, M, A	• Is the correct sampling technique used to gather the data?	• Alternative assessment projects such as posters, computer generated graphs and real world applications
M, A	• Is the correct vocabulary and/or notation used to describe the data	• Review of standardized test questions to prep students for the challenge of the SAT and ACT exams
M, A	• Are the measures of center calculations (mean, median, mode, weighted mean, and standard deviation) accurate?	• Participation in class discussion, group work, and responses.
		• Quizzes
T, M, A	• Is the data modeled appropriately	
T, M, A	• Was the appropriate technology utilized?	• Unit Test - to include a variety of DOK level of problems and may include SAT style problems.
T, M, A	• Are justified conclusions made based on the data gathered?	

Code	***Pre-Assessment***
	• Teacher checks for prerequisite and prior knowledge via warm-up and questioning activities, such as basic problems on interpreting data and data models. • Teacher will provide review and assessment on prerequisite Sampling distribution vocabulary knowledge to ensure all students are capable of communicating effectively

	Summary of Key Learning Events and Instruction	Progress Monitoring
	Student success at transfer meaning and acquisition depends on…	• Monitoring class work through board work, group work, questioning, and walk-arounds
A	• Teacher will review measures of center	• Check for understanding via going over homework and mediums such as reflections and exit tickets
M, A	• Teacher will discuss the concept of skewed versus normal data	• Class worksheets with direct teacher observation or self assessment
M, A	• Teacher and students will collectively practice calculating measures of center and analyze shape	• Practice on whiteboard/chalkboard with direct teacher observation
T, M, A	• Students should calculate the measures of center for a variety of data sets	• Kahoot quiz or pear deck slideshow with review questions and direct teacher observation
T, M, A	• Students analyze data and determine which measure of center is appropriate based on the presence of an outlier	• Reflective journals or exit tickets at the end of the lesson
M, A	• Teacher will introduce the weighted mean formulas and provide applications of them	• Edulastic or google form review assignments
M, A	• Teacher will introduce the concept of standard deviation and demonstrate how to calculate it using the sample standard deviation formula	• Homework assignments with direct teacher observation or self assessment

T, M, A	• Teacher will demonstrate how to enter a data list in the graphing calculator and how to retrieve the mean and standard deviation calculations	
T, M, A	• Teacher and students will collectively practice calculating weighted means, standard deviations and spread	
T, M, A	• Students should calculate the mean, weighted mean and sample standard deviation on a variety of data sets and then rework them using technology in order to see the benefits of using technology with respect to time spent doing calculations and how it relates to productivity	
M, A	• Teacher will provide examples of the mean and standard deviation formulas involving frequency distributions and then demonstrate how the calculations can be completed using the graphing calculator	
M, A	• Teacher and students will collectively practice calculations involving frequency distributions	
T, M	• Students will use calculations of mean and standard deviation to determine how the concept of normal applies to the data set. Specifically the empirical rule, range rule of thumb and Chebyshev's theorem	
T, M	• Students will use the mean and standard deviations of normal and skewed data to determine the ranges of 'usual values'	
A	• Teacher will explain the concept of percentiles and how to calculate them, focusing specifically on the 1st and 3rd quartiles.	

M, A	• Teacher and students will collectively practice calculating percentiles	
T, M	• Students should be able to calculate the percentile of a value and find the value at a specific percentile	
A	• Teacher will introduce the concept of outliers and use the 1.5 IQR formula to determine the existence of outliers in a data set.	
A	• Teacher explains how to create a boxplot and how it is affected by the existence of outliers in the data set	
M, A	• Teacher will demonstrate how to set up a boxplot using formulas to calculate the 5 number summary and how to find the same information using the graphing calculator	
T, M	• Teacher and students will collectively practice finding the five number summary and creating an appropriate boxplot	
T, M	• Students should use calculations of the 5 number summary, through both formulas and graphing calculator to create boxplots	
T, M	• Students interpret boxplots for information relative to quartiles for the data set.	
T, M	• Students will explore measures of center using the unit's performance task and complete an activity based review in preparation for a unit assessment.	

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- Resource from the Bureau of Labor Statistics
- Kahoot; interactive game: Wiggins and Murphy
- Desmos; advanced graphing calculator
- Google forms and Google slides with pear deck extension
- Microsoft excel and google sheets
- Supplies: White boards, straight edge, graph paper, colored pencils, graphing calculator

Subject/Course: Honors Statistics Unit: 3 The Relationship between Two Variables(linear regression)
Grade:11/12
Time frame: approx 5-6 weeks

CCSS.MATH.CONTENT.HSS.ID.B.6 Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. CCSS.MATH.CONTENT.HSS.ID.B.6.A Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models. CCSS.MATH.CONTENT.HSS.ID.B.6.B Informally assess the fit of a function by plotting and analyzing residuals. CCSS.MATH.CONTENT.HSS.ID.B.6.C Fit a linear function for a scatter plot that suggests a linear	***Transfer*** • Model real data using equations and graphs • Analyze equations and their graphs in order to make predictions • Make sense of problems and persevere in solving them ***Meaning*** UNDERSTANDINGS *Students will understand that…* • Scatter plots serve determine if there is a useful relationship between two variables, • Scatter plots determine the family of equations that describes the relationship. • Data is collected for a purpose and has meaning in a context. • Direction and strength of the ESSENTIAL QUESTIONS *Students will keep considering…* • How can graphs be used to examine data? • What is the role of outliers in data observations? • What is the strength of an association between two variables? • What is the meaning behind the least squares line? • What is the meaning of the slope and

association. CCSS.MATH.CONTENT.HSS.ID.C.7 Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. CCSS.MATH.CONTENT.HSS.ID.C.8 Compute (using technology) and interpret the correlation coefficient of a linear fit. CCSS.MATH.CONTENT.HSS.ID.C.9 Distinguish between correlation and causation.	association between two variables is significant • Strength of an association between two variables reflects how accurately the value of one variable can be predicted based on the value of the other variable. • Outliers are observations with large residuals and do not follow the pattern apparent in the other data points.	y-intercept in the line of regression? • What determines a regression equation is an appropriate model?
	Acquisition	

	Students will know…	*Students will be skilled at…*
	• How to identify the roles of variables and to place the response variable on the y-axis and the explanatory variable on the x-axis using proper context. • The conditions for correlation and how to check them. • Correlations are between -1 and +1 (inclusive), and each extreme indicates a perfect linear association. • How the magnitude of the correlation reflects the strength of the linear association. • The correlation has no units. • The correlation coefficient is not changed by changing the center or scale of either variable. • Causation cannot be demonstrated by a scatterplot or correlation. • How a linear equation summarizes the relationship between two variables. • That the least squares slope is easily affected by extreme values. • Residuals are the differences between data values and the corresponding predicted values. • Residuals have a relation to the least squares linear equation?	• Making a scatter plot by hand (for a small set of data) and with technology. • Computing the correlation of two variables. • Reading a correlation table produced by a statistics program. • Describing the direction, form, and strength of a scatter plot. • Using a correlation as part of the description of the scatterplot. • Being aware of misinterpretations of correlation. • Using a plot of the residuals against predicted values as a check for the appropriateness of the generated line of regression. • Finding a regression equation from the summary statistics for each variable and the correlation between the variables. • Finding a regression equation using a statistics software output table. • Using regression to predict a value of y for a given x. • Computing the residual for each data value and displaying them. • Writing a sentence in context showing the meaning of the slope and y-intercept. • Describing a prediction made from a regression equation, relating the predicted value to the specified x-values

STAGE 2

Code	Evaluative Criteria	Assessment Evidence
	Evaluative Criteria consists of	PERFORMANCE TASK(S): *Students will show that they really understand evidence of…*
T, M, A	• An explanation of the two variables being examined	** continuation of performance task from unit 2
M, A	• Accurate calculations used to determine if a correlation exists	**Goal**: Have students research data for two related variables to determine if there is an existing correlation (one variable is from performance task in unit 2)
T, M,A	• Clear and thoughtful summation of the results of the calculations	**Role**: Statistician
T, M, A	• Final determination as to whether or not a correlation exists	**Audience**: Manager in a field related to the chosen topic **Situation**: Have students choose 2 variables to research and determine if there is a correlation(i.e.: temperature and ice cream sales, height and foot size, etc..) Students should examine the scatter and residual plots, determine the correlation coefficient and the line of regression. Then they should draw a conclusion as to the nature of the correlation; strength, direction and form and the usefulness of the line of regression as a predictive model for the data. **Product or Performance**: Presentation on the data gathered and the corresponding conclusion **Standards for Success**: Accurate calculations and detailed clear explanations of the variables and determination of the existence of a correlation between the two variables

	Evaluative criteria consists of:	OTHER EVIDENCE:
A M, A T, M, A T, M, A T, M, A	• Is appropriate data collected? • Are the correct calculations performed and are the solutions accurate? • Are the correct conclusions drawn about the existence of a correlation between the two variables? • Is there a clear understanding of the values calculated in the context of the data? • Do the residuals tell us anything about the data?	• Alternative assessment projects such as a examining correlations for sets of real data, defining the values calculated in the context of the real data, and looking at the residuals for real data. • Review of standardized test questions to prep students for the challenge of the SAT and ACT exams • Participation in class discussion, group work, and responses. • Quizzes • Unit Test - to include a variety of DOK level of problems and may include SAT style problems.

Stage 3 – Learning Plan

Code	*Pre-Assessment*	
M	• Teacher checks for prerequisite and prior knowledge via warm-up and questioning activities, such as basic problems on graphing equations in slope intercept form and calculating slope, substitution and evaluation, solving equations • Teacher will provide review and assessment on prerequisite correlations vocabulary knowledge to ensure all students are capable of communicating effectively	
	Summary of Key Learning Events and Instruction *Student success at transfer meaning and acquisition depends on…*	Progress Monitoring
A	• Teacher will emphasize the importance of the first rule of data analysis: make a picture.	• Monitoring class work through board work, group work, questioning, and walk-arounds • Check for understanding via going over homework and mediums such as reflections and exit tickets
M, A	• Teacher will continue to emphasize the importance of vocabulary and notation.	• Class worksheets with direct teacher observation or self assessment
M, A	• Teacher will introduce formulas and show examples for calculating regression equations by hand. The teacher will then at some point show students how to use technology to get the identical equations in order for students to make connections with what technology can do and be confident they are getting accurate results.	• Practice on whiteboard/chalkboard with direct teacher observation
M, A	• Each of these topics can be taught individually or by having students work in small groups verifying results.	• Kahoot quiz or pear deck slideshow with review questions and direct teacher observation
M, A	• Teacher supplies visual scatterplots and asks students to describe form, direction, strength, and approximate a correlation coefficient. Students should describe scatter plots verbally indicating direction, form, and strength.	• Reflective journals or exit tickets at the end of the lesson
M, A	• Teacher and students will collectively practice finding lines of regressions	• Edulastic or google form review assignments
T, M, A	• Students plot unusual values and then determine if they understand if and why they are unusual.	• Homework assignments with direct teacher observation or self assessment

T, M, A	• Teacher will instruct students on residuals by using a scatter plot and having students record the residual for each point and explain the meaning of the residuals in the context of the problem.	• Projects/performance tasks modeling real world problems involving all aspects of transformations and symmetry
T, M, A	• Teacher will instruct students on the use of the graphing calculator to access a plot of the residuals and how to use it to determine if the regression equation is a good model for the population	• Summative assessments Quizzes Unit test
M, A	• Teacher and students will collectively practice finding residuals for a regression line	
T, M, A	• Students practice in small groups working problems by hand and verifying results. They should then do the same exercise using technology in order to see the benefits of using technology with respect to time spent doing calculations and how it relates to productivity and accuracy.	
T, M, A	• Students present their work to the class in order for students to observe more instances of good models and models that are not representative of the true nature of the data	
T, M, A	• Students work in small groups to find their own bivariate data. For instance each group could gather measurements of height as related to the golden ratio, write their own regression equations, and compare them with the other groups. They could then learn that the larger their sample sizes, the more closely their equations will resemble each other. They can gain a better understanding of the slope and intercept in the context of the problem. (a brief tangent can be taken into an understanding of the significance of the golden ratio)	
T, M, A	• Students will be given 4 or 5 ordered pairs to plot, write an equation, and find the correlation coefficient. They would then be instructed to change one of the points and see how the values could have dramatically changed. Using a few points gives students a more visual experience.	

T, M, A	• Teacher should explain there are three steps that should be followed when answering these types of questions. **Think** (the students should state the question and make a plan), **Show** (the students should show their calculations), and **Tell** (interpret your results in the context of the problem)	
T, M	• Students will explore lines of regression and residual values using the unit's performance task and complete an activity based review in preparation for a unit assessment.	
	Suggested Resources and supplies Resources: All Resources and materials must adhere to all New Milford Board of Education policies and regulations and are subject to New Milford Board of Education approval. Resources and materials must be researched and vetted by the writers and department heads prior to submission for approval.	
	• Textbook: Triola, Mario F . *Elementary Statistics*. 13th ed. Boston Ma. : Pearson, Prentice Hall, 2018. Print. • Resource materials provided by Pearson such as implementation and applications of statistics, differentiation and standardized test practice • Resource from the Bureau of Labor Statistics • Kahoot; interactive game: Wiggins and Murphy • Desmos; advanced graphing calculator • Google forms and Google slides with pear deck extension • Microsoft excel and google sheets • Supplies: White boards, straight edge, graph paper, colored pencils, graphing calculator	

Subject/Course: Honors Statistics Unit: 4 Probability
Grade:11/12
Time frame: approx 4 - 5 weeks

ESTABLISHED GOALS	***Transfer***	
CCSS.MATH.CONTENT.HSS.CP2 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 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.A4	*Students will be able to independently use their learning to…* • Work carefully to solve problems by looking for and using rules and patterns • Verify that calculations are accurate and solutions are reasonable • Use a simulation to determine the likelihood of an event occurring • Analyze real data by using and/or creating probability models	
	Meaning	
	UNDERSTANDINGS *Students will understand that…* • Probability describes the likelihood an event will occur. • Outcomes which do not occur in event A are considered the compliment to event A. • Mutually exclusive events are events that cannot occur simultaneously are mutually exclusive events.	ESSENTIAL QUESTIONS *Students will keep considering…* • How is probability used in everyday life? • How are events defined and what are examples of each? • How does the study of probability integrate itself into the study of statistics? • How do you conduct a probability experiment?

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. <u>CCSS.MATH.CONTENT.HSS.CP.A.5</u> 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 <u>CCSS.MATH.CONTENT.HSS.CP.B.6</u> Find the conditional probability of A given B as the fraction of B's	• Events A and B are independent if the occurrence of one does not affect the probability of the occurrence of the other. If A and B are not independent, then they are said to be dependent. • Probability is a number between 0 and 1 inclusively • Combinations and permutations can be used in the calculation of a statistical probability	• What is conditional probability? • What is meant by independent/dependent outcomes? • How do you determine if 2 events are mutually exclusive? • Can the fundamental counting principle and rules for combinations and permutations help us calculate statistical probabilities
	Acquisition	
	Students will know…	*Students will be skilled at…*
	• The basic definition and rules of probability • The difference between odds and probability • How and when to apply the Addition Rule	• Calculating simple probabilities, including complements of events • Calculating the odds in favor and against an event • Calculating conditional probabilities • Differentiating between independent and

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 or B) = P(A) + P(B) - P(A 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 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	• How and when to apply the Multiplication Rule • How to use the Complement Rule to make calculating probabilities simpler • How to use combinations and permutations to calculate probabilities • Probabilities have a direct relationship to the gaming and sports industries • Probabilities are used to influence actions in various other industries such as manufacturing,	dependent events • Differentiating between mutually exclusive and overlapping events • Understanding and applying basic concepts of probability • Recognizing and calculating probabilities using combinations and permutations • Working with data in 2-way frequency tables

STAGE 2

Code	Evaluative Criteria	Assessment Evidence

T, M ,A	Evaluative criteria consists of: • An explanation of how the game is played. • An explanation of the method used to determine the probabilities • Accurate calculations of the probabilities • Clear and thoughtful summation of the results of the calculations • Determination and explanation of the profitability of the game.	PERFORMANCE TASK(S): *Students will show that they really understand evidence of…* **Goal**: to create a game of chance for a carnival or boardwalk concession and determine the probabilities associated with the game. **Role**: Entrepreneur **Audience**: Carnival owner or manager of Boardwalk **Situation**: Design a game of chance that can be played at a carnival or on the Boardwalk. **Product or Performance:** completion of the game along with probabilities associated with the game which can be used to determine whether or not the game will be profitable. Students should describe the rules, payouts, and the cost of playing. Games could be based on cards, dice, coins, spinners, etc…Try and get them to create an appealing game that people would be eager to play but have an expected value where the person running the game would be likely to realize a profit. **Standards for Success**: Accurate results for the design of the game and its probabilities

	Evaluative criteria consists of:	OTHER EVIDENCE:
T, M, A	• Is the appropriate method and/or formula used?	• Alternative assessment projects such as posters, computer generated graphs and real world applications(i.e. gaming, business and sporting events)
T, M ,A	• Is the correct vocabulary used when explaining possible outcomes.	• Review of standardized test questions to prep students for the challenge of the SAT and ACT exams
M, A	• Are the correct calculations performed and are the solutions accurate?	• Participation in class discussion, group work, and responses.
T, M, A	• Are the correct conclusions drawn from the probabilities?	• Quizzes
T, M, A	• Is there a clear understanding of the values calculated in the context of the data?	• Unit Test - to include a variety of DOK level of problems and may include SAT style problems.

Code	***Pre-Assessment***	
	• Teacher checks for prerequisite and prior knowledge via warm-up and questioning activities, such as basic problems on solving equations, order of operations and substitution • Teacher will provide review and assessment on prerequisite Sampling distribution vocabulary knowledge to ensure all students are capable of communicating effectively	
	Summary of Key Learning Events and Instruction *Student success at transfer meaning and acquisition depends on…*	Progress Monitoring
A	• Teacher will introduce vocabulary and notation for basic probability	• Monitoring class work through board work, group work, questioning, and walk-arounds
M, A	• Teacher and students will collectively practice using the vocabulary and basic probability	• Check for understanding via going over homework and mediums such as reflections and exit tickets
T, M, A	• Students will complete practice problems to demonstrate their level of understanding of vocabulary and notation	• Class worksheets with direct teacher observation or self assessment
M, A	• Teacher will instruct students on the topic of odds and the difference between odds and probability	• Practice on whiteboard/chalkboard with direct teacher observation
M, A	• Teacher and students will collectively practice odds and probability	• Kahoot quiz or pear deck slideshow with review questions and direct teacher observation
T, M ,A	• Students will complete activity cards designed to review basic concepts and odds using manipulatives and real data	• Reflective journals or exit tickets at the end of the lesson
M, A	• Teacher will instruct students on the use of the addition and multiplication rules of probability and vocabulary associated with these topics	• Edulastic or google form review assignments • Homework assignments with direct teacher observation or self assessment
M, A	• Teacher and students will collectively practice problems comparing the addition and multiplication rules	

T, M, A	• Students will complete practice problems to demonstrate their level of understanding of the addition and multiplication rule. Practice will include work with 2-way frequency tables and problems similar to those seen on standardized tests	
T, M	• Students will analyze information in a series of problems to determine whether the addition or multiplication rule is appropriate in finding the solution	
M, A	• Teacher will instruct students on the counting principle, combinations and permutations and their use in the calculation of probabilities.	
M,. A	• Teacher and students will collectively practice/compare the difference between combinations and permutations	
T, M ,A	• Students will analyze problems in order to distinguish when combinations or permutations are appropriate in solving applications and then use them to calculate probabilities	
T, M	• Students will explore probability using the unit's performance task and complete an activity based review in preparation for a unit assessment. (i.e. carnival games, sporting data and manipulatives)	

Suggested Resources and supplies

Resources:

All Resources and materials must adhere to all New Milford Board of Education policies and regulations and are subject to New Milford Board of Education approval. Resources and materials must be researched and vetted by the writers and department heads prior to submission for approval.

- Textbook: Triola, Mario F . *Elementary Statistics.* 13th ed. Boston Ma. : Pearson, Prentice Hall, 2018. Print.
- Resource materials provided by Pearson such as implementation and applications of statistics, differentiation and standardized test practice
- Resource from the Bureau of Labor Statistics
- Kahoot; interactive game: Wiggins and Murphy
- Desmos; advanced graphing calculator
- Google forms and Google slides with pear deck extension
- Microsoft excel and google sheets
- Supplies: White boards, straight edge, graph paper, colored pencils, graphing calculator, manipulatives(i.e.: dice, spinners, coins cards)

Subject/Course: Honors Statistics Unit: 5 Normal distributions
Grade:11/12
Time frame: approx 2 - 3 weeks

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.	***Transfer*** *Students will be able to independently use their learning to…* • Support ideas clearly and concisely using proper mathematical language/notation. • Construct viable arguments involving mathematics and critique the reasoning of others. • Work carefully to solve the problem and verify that calculations are accurate and solutions are reasonable. • Make sense of problems and persevere in solving them
	Meaning
UNDERSTANDINGS *Students will understand that…* • Mean and standard deviation define the family of curves used in normal distributions. • Areas under the curve represent probabilities associated with continuous distributions. • Area under the curve is always to the left of the corresponding z-score • Total area under the normal curve is 1. • Outcomes of many real life events can	ESSENTIAL QUESTIONS *Students will keep considering…* • What is a normal curve? • What are the properties of a normal probability distribution? • How can one recognize a normal (bell shaped) distribution? • How is the probability of an event calculated using the z-score formula? • How does the standard deviation and mean affect the graph of the normal distribution?

	be approximated by the normal curve • Probability for groups can be found by applying the Central Limit Theorem	• Why is an understanding of the normal curve essential to statistics? • In what situations can the normal curve be applied to data? • When Is it appropriate to use the Central Limit Theorem? • How can one recognize a normal (bell shaped) distribution?
	Acquisition	
	Students will know… • The total area under a normal curve is 1 • Part of the area under a normal curve represents the probability for a specific observation • The z-score formula can be used to find the probability for a specific observation • The probability associated with a z-score always represents the area to the left on the curve • Normal probabilities have a variety of real world applications • How to determine when the Central Limit Theorem is appropriate for solving an application problem	*Students will be skilled at…* • Using the z-score formula to find a normal probability for a specific observation • Using the z-score formula to find a value for a specific percentile or probability • Applying knowledge of normal probabilities to real world situations • Using the graphing calculator to solve problems involving normal probabilities • Using the Central Limit Theorem calculating probabilities for specific applications

STAGE 2

Code	Evaluative Criteria	Assessment Evidence
T, M, A	Evaluative Criteria consists of: • Accurate use of mathematical concepts • Identification of the appropriate formula for the application • Accurate calculations using either the z-score and chart method or the normal functions on the graphing calculator • Complete explanation of final results	PERFORMANCE TASK(S): **Goal:** gather information about a mode of transportation that requires specific safety requirements as they pertain to weight loads(i.e. elevators, ski gondolas, water taxis) and to provide the statistical basis for the limitations to be imposed **Role:** Construction Supervisor **Audience**: Contractors **Situation**: gather data about safety specifications for construction as how statistics is used to determine the limits for weight loads in **Product or Performance**: Present a clear explanation as to the need for specific safety requirements to be put in place and how the requirements are determined through statistical models

		Standards for Success: Accurate calculations and a knowledgeable presentation of the data gathered
T, M, A T, M, A M, A T, M, A	Evaluative criteria consists of: • Is the correct information identified to be used to solve the problem? • Is the correct method chosen to solve the problem? • Is the solution the result of accurate substitution and calculation • Are the answers to a real world problem reasonable and clearly communicated?	OTHER EVIDENCE: • Alternative assessment projects including a variety of applications involving normal probabilities • Review of standardized test questions to prep students for the challenge of the SAT and ACT exams • Participation in class discussion, group work, and responses. • Quizzes • Unit Test - to include a variety of DOK level of problems and may include SAT style problems.

Code	Pre-Assessment	
M	• Teacher checks for prerequisite and prior knowledge via warm-up and questioning activities, such as basic problems on solving equations,order of operations and substitution and work with the z-score formula • Teacher will provide review and assessment on prerequisite probability vocabulary knowledge to ensure all students are capable of communicating effectively	
	Summary of Key Learning Events and Instruction *Student success at transfer meaning and acquisition depends on…*	Progress Monitoring
A	• Teacher will introduce the z-score charts and how to use them to find probabilities	• Monitoring class work through board work, group work, questioning, and walk-arounds
A	• Teacher will demonstrate how to use the z-score chart to find values for specific probabilities	• Check for understanding via going over homework and mediums such as reflections and exit tickets
M, A	• Teacher and students will collectively practice using the z score chart to find probabilities	
M, A	• Students will practice finding z-scores and probabilities using the z-score chart and complete applications problems	• Class worksheets with direct teacher observation or self assessment
T, M, A	• Teacher will provide training on how to complete the application problems using the appropriate functions on the graphing calculator	• Practice on whiteboard/chalkboard with direct teacher observation
M, A	• Teacher and students will collectively practice applications using both methods	• Kahoot quiz or pear deck slideshow with review questions and direct teacher observation
T, M	• Students will complete a variety of application problems using the formulas and charts and then rework them using technology in order to see the benefits of using technology with respect to time spent doing calculations and how it relates to productivity	• Reflective journals or exit tickets at the end of the lesson
T, M, A	• Students will analyze data related to application problems to determine the appropriate method for finding a solution	• Edulastic or google form review assignments
T, M, A	• Teacher will introduce the Central Limit Theorem and provide examples of real applications(i.e. weight limits, manufacturing specifications)	• Homework assignments with direct teacher observation or self assessment • Projects/performance tasks modeling real

M,A T, M T, M	• Teacher and students will collectively practice using the central limit theorem in calculating probabilities • Students will research uses for the Central Limit Theorem, complete appropriate calculations and provide interpretations of the results • Students will explore Normal Distributions using the unit's performance task and complete an activity based review in preparation for a unit assessment. **Suggested Resources and supplies** <u>Resources:</u> All Resources and materials must adhere to all New Milford Board of Education policies and regulations and are subject to New Milford Board of Education approval. Resources and materials must be researched and vetted by the writers and department heads prior to submission for approval. • Textbook: Triola, Mario F . *Elementary Statistics.* 13th ed. Boston Ma. : Pearson, Prentice Hall, 2018. Print. • Resource materials provided by Pearson such as implementation and applications of statistics, differentiation and standardized test practice • Resource from the Bureau of Labor Statistics • Kahoot; interactive game: Wiggins and Murphy • Desmos; advanced graphing calculator • Google forms and Google slides with pear deck extension • Microsoft excel and google sheets	world problems involving all aspects of area, surface area and volume • Summative assessments Quizzes Unit test

	• Supplies: White boards, straight edge, graph paper, colored pencils, graphing calculator, z-score tables	

Subject/Course: Honors Statistics
Grade:11/12
Time frame: approx 5-6 weeks

Unit: 6 Probability distributions (geometric and binomial)

ESTABLISHED GOALS	***Transfer***	
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	*Students will be able to independently use their learning to…* • Support ideas clearly and concisely using proper mathematical language/notation. • Construct viable arguments involving mathematics and critique the reasoning of others. • Work carefully to solve the problem and verify that calculations are accurate and solutions are reasonable. • Make sense of problems and persevere in solving them	
	Meaning	
	UNDERSTANDINGS *Students will understand that…* • Random Variables are used to create a probability distribution. • Binomial and geometric probability distributions can be developed to model a real-world context. • Mean and standard deviations for probability distributions can be calculated. • Binomial distributions can be used to calculate probabilities associated with	ESSENTIAL QUESTIONS *Students will keep considering…* • How are the mean and standard deviation calculated for a binomial variable? • What are the differences between binomial and geometric probabilities. • What is the relationship between variances and standard deviation? • How are binomial and geometric probabilities determined? • How can these distributions be applied to real-world applications?

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?	experiments for which there are only two possible outcomes. • Expected values are used to simulate real world probabilities. • Unusual values can be identified.	• How can expected values be used to predict real world probabilities
	Acquisition	
	Students will know… • Random variables have values that are determined by chance. • Probability distributions consist of all values of a random variable, along with their respective probabilities. • Probability distributions must satisfy two requirements: the sum of the probabilities equals 1 and each probability is between and including 0 and 1. • Probability histogram construction techniques. • Binomial distributions have two categories of outcomes and a fixed number of independent trials with a constant probability. • Geometric distributions only deal with the probability of when the first success occurs. • Probability distributions have a mean and standard deviation. • Usual outcomes can be distinguished from those considered to be unusual. • Mean, variance, and standard deviation of a random variable can be calculated • Notation for population parameters.	*Students will be skilled at…* • Recognizing the difference between discrete and continuous random variables. • Calculating probabilities for random variables and displaying them in a probability distribution table. • Calculating means and standard deviations for all three types of probability distributions using appropriate formulas. • Calculating expected values, variance, and standard deviation of a random variable. • Determining whether a probability distribution is binomial or geometric • Using a binomial probability formula to calculate an exact, at least, or more than a certain number of successes. • Discerning between a permutation and a combination. • Using a geometric probability formula to determine the probability of the first success on a particular trial. • Using formulas to determine if outcomes are unusual. • Reporting any probabilities or other such values including the parameters in the context of the problem using complete

	• Mean and standard deviation must be recalculated after adding a constant or multiplying by a constant. • Expected value and standard deviation of a random variable must be given meaning in the proper context.	

STAGE 2

Code	Evaluative Criteria	Assessment Evidence

T, M, A	Evaluative Criteria consists of: • Identification of the appropriate formulas needed to complete the probability calculations • Accurate use of mathematical concepts • Precise calculations • Complete explanation of final results	PERFORMANCE TASK(S): **Goal**: To determine the odds and probabilities associated with players on a professional sporting team and the likelihood of a successful performance in their next game **Role**: Team statistician **Audience**: Team manager **Situation**: Students choose a professional sports team and use geometric and binomial probabilities to determine which players are most likely to have a successful performance in their next game. **Product or Performance**: A clear analysis of the probabilities for at least six players on the team and a conclusion on the success of their next outing. **Standards for Success:** Accurate calculations and reasonable conclusions based on the data

	Evaluative criteria consists of:	OTHER EVIDENCE:
T, M, A	• Is the correct information identified to be used to solve the problem?	• Alternative assessment projects including a variety of applications involving geometric and binomial probabilities
T, M, A	• Is the correct method chosen to solve the problem?	• Review of standardized test questions to prep students for the challenge of the SAT and ACT exams
M, A	• Is the solution the result of accurate substitution and calculation	• Participation in class discussion, group work, and responses.
T, M, A	• Are the answers to a real world problem reasonable and clearly communicated?	• Quizzes
		• Unit Test - to include a variety of DOK level of problems and may include SAT style problems.

Code	Pre-Assessment	
M	• Teacher checks for prerequisite and prior knowledge via warm-up and questioning activities, such as basic problems on solving equations,order of operations and substitution • Teacher will provide review and assessment on prerequisite probability vocabulary knowledge to ensure all students are capable of communicating effectively	
	Summary of Key Learning Events and Instruction *Student success at transfer meaning and acquisition depends on…*	Progress Monitoring
A	• Teacher will introduce the z-score charts and how to use them to find probabilities	• Monitoring class work through board work, group work, questioning, and walk-arounds
A	• Teacher will demonstrate how to use the z-score chart to find values for specific probabilities	• Check for understanding via going over homework and mediums such as reflections and exit tickets
M, A	• Teacher and students will collectively practice using the z score chart to find probabilities	
M, A	• Students will practice finding z-scores and probabilities using the z-score chart and complete applications problems	• Class worksheets with direct teacher observation or self assessment
M, A	• Teacher will provide training on how to complete the application problems using the appropriate functions on the graphing calculator	• Practice on whiteboard/chalkboard with direct teacher observation
M, A	• Teacher and students will collectively practice applications using both methods	• Kahoot quiz or pear deck slideshow with review questions and direct teacher observation
T, M	• Students will complete a variety of application problems using the formulas and charts and then rework them using technology in order to see the benefits of using technology with respect to time spent doing calculations and how it relates to productivity	• Reflective journals or exit tickets at the end of the lesson
T, M, A	• Students will analyze data related to application problems to determine the appropriate method for finding a solution	• Edulastic or google form review assignments
M, A	• Teacher will introduce the Central Limit Theorem and provide examples of real applications(i.e. weight limits, manufacturing specifications)	• Homework assignments with direct teacher observation or self assessment
M, A	• Teacher and students will collectively practice using the central limit theorem in calculating probabilities	• Projects/performance tasks modeling real world problems involving all aspects of area,

T, M T, M	• Students will research uses for the Central Limit Theorem and complete appropriate calculations • Students will explore Normal Distributions using the unit's performance task and complete an activity based review in preparation for a unit assessment. **Suggested Resources and supplies** Resources: All Resources and materials must adhere to all New Milford Board of Education policies and regulations and are subject to New Milford Board of Education approval. Resources and materials must be researched and vetted by the writers and department heads prior to submission for approval. • Textbook: Triola, Mario F . *Elementary Statistics.* 13th ed. Boston Ma. : Pearson, Prentice Hall, 2018. Print. • Resource materials provided by Pearson such as implementation and applications of statistics, differentiation and standardized test practice • Resource from the Bureau of Labor Statistics • Kahoot; interactive game: Wiggins and Murphy • Desmos; advanced graphing calculator • Google forms and Google slides with pear deck extension • Microsoft excel and google sheets • Supplies: White boards, straight edge, graph paper, colored pencils, graphing calculator, binomial tables, manipulatives (i.e.: basketball and 'hoop', centimeter cubes, candy)	surface area and volume • Summative assessments Quizzes Unit test

Subject/Course: Honors Statistics
Grade:11/12
Time frame: approx 5-6 weeks

Unit: 7 Inferential Statistics

<table>
<tr><td rowspan="4">ESTABLISHED GOALS

<u>CCSS.MATH.CONTENT.HSS.IC.A1</u>

Understand statistics as a process for making inferences about population parameters based on a random sample from that population.

<u>CCSS.MATH.CONTENT.HSS.IC.A2</u>
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?</td><td colspan="2">Transfer</td></tr>
<tr><td colspan="2">Students will be able to independently use their learning to…

• Support ideas clearly and concisely using proper mathematical language/notation.
• Construct viable arguments involving mathematics and critique the reasoning of others.
• Work carefully to solve the problem and verify that calculations are accurate and solutions are reasonable.
• Make sense of problems and persevere in solving them</td></tr>
<tr><td colspan="2">Meaning</td></tr>
<tr><td>UNDERSTANDINGS
Students will understand that…

• Estimation of the value of a parameter based on a statistic is a primary goal of sampling
• Confidence intervals use the sample statistic to construct an interval of values that one can be reasonably</td><td>ESSENTIAL QUESTIONS
Students will keep considering…

• Why are confidence intervals and tests of significance important?
• How is sampling used and why is it important?
• How do you use inferential models to draw statistically significant conclusions</td></tr>
</table>

CCSS.MATH.CONTENT.HSS.IC.B3 Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each. CCSS.MATH.CONTENT.HSS.IC.B4 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.B5 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.	certain contains the true (unknown) parameter. • Confidence intervals and tests of significance are complementary procedures. • Paired comparisons experimental design allows control for possible effects of extraneous variables. • Z- tests can be used in specific situations . • Correlations exist between sets of data. • Mean can be used to find a confidence interval when the standard deviation is known. • Hypothesis tests determine the difference between the alternative hypothesis and null hypothesis • Null hypothesis can be rejected in certain situations	from data and make inferences about populations? • How can the language of statistics be used to communicate mathematical ideas coherently and precisely? • How can technology be applied to create and interpret models? • How can improperly applied inference procedures lead to bad conclusions? • How do I construct a confidence interval? • What type of information does a confidence interval provide me? • How can hypothesis testing provide the statistical structure to reject or fail to reject the null hypothesis? • When does a person choose to use the z-test type of hypothesis testing?
	Acquisition	
	Students will know… • That the margin of error of a confidence interval for a proportion changes with the sample size and the level of confidence. • How to examine their data for violations of conditions that would make inferences about a population proportion unwise or invalid.	*Students will be skilled at…* • Constructing a one-proportion z-interval. • Interpreting a one-proportion z-interval in a simple sentence or two within the context of the problem. • Stating the null and alternative hypotheses for a one-proportion z-test. • Performing a one-proportion z-test. • Writing a sentence interpreting the results

	• How to find a confidence interval for a population proportion or mean. • The conditions that must be true for a one-proportion z-test to be appropriate and how to check for these conditions. • How to choose between a one-sided and two-sided alternative hypothesis and be able to explain their choice. • How the critical value for a test is related to the specified alpha level. • The close relationship between hypothesis tests and confidence intervals. • That we do not "accept" a null hypothesis if we cannot reject it, but rather that we can only "fail to reject" the hypothesis for lack of evidence against it. • Know that the P-value of a test does not give the probability that the null hypothesis is correct	of a one-proportion z-test in context. • Interpreting the meaning of a P-value in nontechnical language. • Explaining the meaning of a confidence interval for a population mean. • Interpreting the result of a test of a hypothesis about a population mean..

STAGE 2

Code	Evaluative Criteria	Assessment Evidence

T, M, A	Evaluative Criteria consists of: • Accurate use of mathematical concepts • Identification of the appropriate formula to solve the problem • Precise calculations • Complete explanation of final results	PERFORMANCE TASK(S): *Students will show that they really understand evidence of…* **Goal**: Perform a hypothesis test checking the published proportion of blue M&Ms or red Skittles. **Role:** Marketing Department for Mars Co. **Audience:** CEO for Mars Co. **Situation**: Have the marketing department calculate the percentage of blue M&Ms in their bag. Perform a hypothesis test comparing it to the publicly published percentages disclosed by the company. Decide whether they will reject or fail to reject the null hypothesis. **Product or Performance**: Board presentation. **Standards for Success**: Accurate calculations and detailed clear explanations of the testing and the conclusions

T, M, A M, A M, A T,M,A T, M,A	Evaluative criteria consists of: • Are key pieces of information identified properly to be used in solving the problem? • Is the correct calculation used to solve the problem? • Is the solution the result of accurate substitution and calculation • Is the interpretation of the solution clearly explained? • Are the answers to a real world problem clearly communicated?	OTHER EVIDENCE: • Alternative assessment projects such interpreting confidence intervals , identifying real world applications of confidence intervals and looking at real world problems involving the rejection of the null hypothesis • Review of standardized test questions to prep students for the challenge of the SAT and ACT exams • Participation in class discussion, group work, and responses. • Quizzes • Unit Test - to include a variety of DOK level of problems and may include SAT style problems.

Code	***Pre-Assessment***	
M	• Teacher checks for prerequisite and prior knowledge via warm-up and questioning activities, such as basic problems on solving equations, order of operations and substitution and work with the z-score formula • Teacher will provide review and assessment on prerequisite inferential statistics vocabulary knowledge to ensure all students are capable of communicating effectively	
	Summary of Key Learning Events and Instruction *Student success at transfer meaning and acquisition depends on…*	Progress Monitoring • Monitoring class work through board work, group work, questioning, and walk-arounds
M, A	• Teacher will continue to emphasize the importance of vocabulary and notation, specifically related to confidence intervals and margins of error	• Check for understanding via going over homework and mediums such as reflections and exit tickets
T, M, A	• Teacher will introduce formulas and show examples for creating confidence intervals by hand. The teacher will then at some point show students how to use technology to get the identical results in order for students to make connections with what technology can do and be confident they are getting accurate results.	• Class worksheets with direct teacher observation or self assessment
M, A	• Each of these topics can be taught individually or by having students work in small groups verifying results.	• Practice on whiteboard/chalkboard with direct teacher observation
M, A	• Teacher may want to supply organized formula/symbol sheets for students as there are extensive formulas and symbols used in this unit. A z-table needs to be provided.	• Kahoot quiz or pear deck slideshow with review questions and direct teacher observation
M, A	• Teacher and students will collectively practice calculating confidence intervals and margin of error	• Reflective journals or exit tickets at the end of the lesson
T, M, A	• Students research daily or weekly to find statistics available online or as a hard copy relating to the topics in this unit. They may want to share them individually to the class.	• Edulastic or google form review assignments
T, M, A	• Students individually or in small groups create confidence intervals using published percentiles for M&M colors and their own sample bag. They can	• Homework assignments with direct teacher observation or self assessment • Projects/performance tasks modeling real world problems involving all aspects of area, surface area and volume

	check whether the confidence interval they created captured the true proportion. Hopefully not all of them will if our sample size is large enough.	• Summative assessments Quizzes Unit test
T, M, A	• Teacher will introduce hypothesis testing and how to identify the hypothesis, alternative and the null hypothesis for a given claim	
T, M, A	• Teacher will instruct students on the calculation of the test statistic and its use in determining whether or not to reject the null hypothesis	
T, M, A	• Teacher will provide students with practice on hypothesis testing and review how to determine whether the data indicates a one or two tailed test	
M, A	• Teacher and students will collectively practice setting up a hypothesis test and determining its relevance	
M, A	• Students will analyze data to determine whether it indicates a one tailed or two tailed test is appropriate in testing a hypothesis	
M, A	• Students will work in small groups working formulas by hand and verify results with each other.	
T, M	• Students will describe confidence intervals and results of their hypothesis test verbally as well as writing complete sentences in context.	
T, M	• Students will explore confidence intervals and hypothesis testing using the unit's performance task and complete an activity based review in preparation for a unit assessment.	

Suggested Resources and supplies

Resources:

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	• Textbook: Triola, Mario F . *Elementary Statistics.* 13th ed. Boston Ma. : Pearson, Prentice Hall, 2018. Print. • Resource materials provided by Pearson such as implementation and applications of statistics, differentiation and standardized test practice • Resource from the Bureau of Labor Statistics • Kahoot; interactive game: Wiggins and Murphy • Desmos; advanced graphing calculator • Google forms and Google slides with pear deck extension • Microsoft excel and google sheets • Supplies: White boards, straight edge, graph paper, colored pencils, graphing calculator, z-table/t-table	

NEW MILFORD PUBLIC SCHOOLS

New Milford, Connecticut

College Prep Geometry

April 2023

New Milford Board of Education

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New Milford's Mission Statement

The mission of the New Milford Public Schools, a collaborative partnership of students, educators, family and community, is to prepare each and every student to compete and excel in an ever-changing world, embrace challenges with vigor, respect and appreciate the worth of every human being, and contribute to society by providing effective instruction and dynamic curriculum, offering a wide range of valuable experiences, and inspiring students to pursue their dreams and aspirations.

College Prep Geometry

10/11

This course is designed for students who have demonstrated quality work in Algebra I. Topics include geometric terminology, concept of a logical deductive proof, constructions, concept of congruence, similarity, parallelism, the study of polygons and circles, and appropriate word problems. Algebraic concepts will be stressed. Calculators and/or computers will be used. A scientific calculator is required of all students in this course.

Vision of a Graduate

College Prep Geometry lends itself to focus a great deal on creativity in drawing activities that are flexible and encourage students to create a unique product and on communication skills through proof writing and questions involving written explanations. In addition, students will learn to think critically and persevere in problem solving as they learn to identify key pieces of information, label diagrams and retrieve key facts or formulas in order to solve problems.

Pacing Guide

Unit 1 Basics of Geometry	2 - 3 weeks
Unit 2 Transformations	5 - 6 weeks
Unit 3 Congruence, proof and construction	5 - 6 weeks
Unit 4 Properties of Triangles and Quadrilaterals	3 - 4 weeks
Midterm Exam - review and test	1 - 2 weeks
Unit 4 Properties of Triangles and Quadrilaterals(cont.)	2 - 3 weeks
Unit 5 Similarity and Right Triangles	5 - 6 weeks
Unit 6 Volume and Surface Area	5 - 6 weeks
Unit 7 Properties of Circles	3 - 4 weeks
Final Exam - review and test	1 - 2 weeks

Subject/Course: College Prep Geometry

Unit 1: Basics of Geometry

Grade:9/10

Time frame: approx 2-3 weeks

ESTABLISHED GOALS	**Transfer**
CCSS.MATH.CONTENT.HSG.CO.A.1 Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc. CCSS.MATH.CONTENT.7SP Draw, construct and describe geometrical figures and describe the relationships between them. CCSS.MATH.CONTENT.8SP Use facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and solve simple equations for an unknown angle in a figure.	*Students will be able to independently use their learning to…* 1. Model with mathematics 2. Solve problems by looking for and using rules and patterns **3.** Make sense of problems and persevere in solving them 4. Use appropriate tools strategically
	Meaning

	UNDERSTANDINGS *Students will understand that…*	ESSENTIAL QUESTIONS *Students will keep considering…*
	• Geometric terms and notation must be used correctly to ensure accurate communication of information. • Pairs of adjacent angles in geometric figures have specific numeric relationships • Segment addition and angle addition theorems are important tools in solving geometric problems • Pairs of angles formed by the intersection of a transversal with parallel lines have specific numeric relationships • Segment length in the coordinate plane can be determined using the distance and midpoint formulas	• How does one express items in correct geometric terms? • How is geometric notation used as a means of communication? • What are the pairs of adjacent angles and what is the numeric relationship between them? • What are the segment addition and angle addition theorems and how are they used? • What are the pairs of angles created by a transversal intersecting parallel lines and what are their numeric relationships? • What application do the distance and midpoint formulas have in geometric work?
	Acquisition	

	Students will know… • Communication in geometric work is done through the use of vocabulary, markings and notations. • That pairs of adjacent angles have specific numeric relationships • The angle addition and segment addition theorems play an important role in solving geometric problems • That a transversal intersecting parallel lines creates multiple angles where designated pairs have specific numeric relationships. • That the distance and midpoint formulas can be used in calculating the lengths of segments in a coordinate plane.	*Students will be skilled at…* • Identifying and using Geometric vocabulary • Communicating using markings in diagrams or in notations used to identify information about the segments and angles in the diagrams. • Calculating angle measures based on the relationship between the pairs of angles in a diagram. • Determining the length of a segment in a coordinate plane using the distance and midpoint formula.

Code	Evaluative Criteria	Assessment Evidence
T, M, A	Evaluative Criteria consists of • a carefully drawn diagram of the wall unit or entertainment center which includes a variety of angles. • accurate use of vocabulary and notation to identify the geometric angles and segments within the diagram • accurate use of numeric relationships to include segment and angle measures for the builders to use	PERFORMANCE TASK(S): **Goal**: To design a wall unit or entertainment center using lines and angles **Role**: Furniture designer **Audience**: Furniture company **Situation**: A furniture company is looking for new designs for wall units/entertainment centers to build and sell at their stores **Product**: A completed drawing of the unit with measurement specifications for the builders to use to calculate materials needed to build the unit **Standards for Success**: Scoring Rubric including focus on uniqueness of the design and accurate calculations of the angles in the diagram **Differentiation**: Scaffolding where students can create a design that is more complex and involves numerous concepts in their calculations

	Evaluative criteria consists of:	OTHER EVIDENCE:
M, A	• Is the correct vocabulary and/or notation used to identify the elements in a diagram?	• Alternative assessment projects such as a logo design activity, designing patterns or finding angle measures in existing diagrams
M, A	• Is the correct diagram created based on the given vocabulary and/or notations ?	• Review of standardized test questions to prep students for the challenge of the SAT and ACT exams
T, M, A	• Are the calculation of angles and segment lengths in a diagram accurate?	• Participation in class discussion, group work, and responses.
T, M, A	• Does the design created include the required elements?	• Quizzes • Unit Test - to include a variety of DOK level of problems and may include SAT style problems.

Code	***Pre-Assessment***	
M	• Teacher checks for prerequisite and prior knowledge via warm-up and questioning activities, such as basic problems solving equations and identifying shapes by the correct name • Teacher will provide review and assessment on prerequisite geometric vocabulary knowledge to ensure all students are capable of communicating effectively	
	Summary of Key Learning Events and Instruction	Progress Monitoring
M	• Teacher review basic vocabulary and notation associated with segments, lines and angles	• Monitoring class work through board work, group work, questioning, and walk-arounds
M, A	• Students will practice communication skills by creating drawings based on given information or providing vocabulary and notation associated with a given diagram	• Check for understanding via going over homework and mediums such as reflections and exit tickets
M, A	• Teacher introduces a variety of relationships between pairs of angles and what the numeric relationship is between the pairs.	• Class worksheets with direct teacher observation or self assessment • Practice on whiteboard/chalkboard with direct teacher observation
T, M, A	• Students will identify the relationship between angles in a diagram and then calculate the measures of angles within the diagram. .	• Kahoot quiz or pear deck slideshow with review questions and direct teacher observation
T, M, A	• Students will create patterns or designs based on given criteria and then determine the appropriate measurements	• Reflective journals or exit tickets at the end of the lesson
T, M, A	• Students complete a discovery activity on the pairs of angles created by a transversal intersecting parallel lines. As part of the activity, the students will identify the numeric relationship between the pairs of angles.	• Google form/google slide review assignments • Homework assignments with direct teacher observation or self assessment

M, A M, A T, M, A T, M, A	• Students practice solving for angles within parallel lines. • Teacher introduces the concepts of segment addition and angle addition. • Students will solve problems using the segment and angle addition theorems • Students complete problems involving applications of segment and pairs of angles **Suggested Resources and supplies** Resources: All Resources and materials must adhere to all New Milford Board of Education policies and regulations and are subject to New Milford Board of Education approval. Resources and materials must be researched and vetted by the writers and department heads prior to submission for approval. • Textbook: Bass, Laurie, et.al. . *Geometry Common Core.* 1st ed. Upper Saddle River, NJ: Pearson, Prentice Hall, 2012. Print. • Resource materials provided by Pearson such as implementing the common core, differentiation and standardized test practice • Resource from the Bureau of Education and Research: *Strengthening your geometry program: Ideas, strategies and hands-on activities* • Geogebra; interactive application: Hohenwarter, Markus • Kahoot; interactive game: Wiggins and Murphy • Geometer's Sketchpad; interactive application: KCP Technologies	• Projects/performance tasks modeling real world problems involving all aspects of transformations and symmetry • Summative assessments Quizzes Unit test

	• Desmos; advanced graphing calculator • Google forms and Google slides with pear deck extension • Supplies: white boards, straight edge, graph paper, colored pencils	

Subject/Course: College Prep Geometry Unit: 2 Transformations
Grade:9/10
Time frame: approx 5-6 weeks

ESTABLISHED GOALS	**Transfer**
CCSS.MATH.CONTENT.HSG.CO.A.1 Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc. CCSS.MATH.CONTENT.HSG.CO.A.2 Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch). CCSS.MATH.CONTENT.HSG.CO.A.5	*Students will be able to independently use their learning to…* 1. Create graphic representations of data 2. Model with functions to make sense of a pattern 3. Solve problems by looking for and using rules and patterns 4. Make sense of problems and persevere in solving them **Meaning**

Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.	UNDERSTANDINGS *Students will understand that…* • Geometric terms and notation must be used correctly to ensure accurate communication of information. • Functions can be used to change a figure's position and/or size. • Functions can be used to represent a transformation in the coordinate plane. • Dilations have a direct relation to similarity and scale factors between figures • Transformations can be created using a variety of tools, including technology, • Dilations have a center and a radius	ESSENTIAL QUESTIONS *Students will keep considering…* • How does one express items in correct geometric terms? • How can one change a figure's position without changing its size and shape? • How can one change a figure's size without changing its shape? • How can one represent a transformation in the coordinate plane? • How can one recognize congruence and similarity in figures? • How can transformations be used to create designs and tessellations? • How can transformations describe a change in the position of an object? • What are the properties of a figure preserved during a dilation? • How are dilations related to similar figures and their scale factors
	Acquisition	

	Students will know…	*Students will be skilled at…*
	• A transformation of a geometric figure is a change in its position, shape, or size. • Some transformations preserve distance and angles while some do not. • A transformation can be represented as a function • A transformation can be created using a variety of mediums. • Similar figures are a direct result of a dilation and the scale factor used to create the dilation	• Identifying and using Geometric vocabulary • Observing patterns and developing definitions of reflections, rotations, and translations. • Using geometric software and/or manipulatives to model and compare transformations. • Demonstrating a sequence of transformations that will carry a figure onto another. • Showing graphic representation of data • Determining the scale factor of similar figures created by a dilation

Code	Evaluative Criteria	Assessment Evidence
T, M, A	Evaluative Criteria consists of • an explanation of which transformations were used to design the pattern. • accurate use of the transformation to create the pattern • a final design that holds to the definition of a tessellation	PERFORMANCE TASK(S): **Goal**: To design a wallpaper pattern using tessellations **Role**: Interior Designer **Audience**: Hotel Manager **Situation**: The manager of a hotel wants to redesign the lobby and has hired an interior designer to make a new geometric wallpaper pattern. **Product**: A completed tessellation design **Standards for Success**: Scoring Rubric including focus on color, size and production of a tessellatable shape **Differentiation**: Scaffolding where students can create a design from a simple transformation and basic coloring pattern or a more complex transformation and more sophisticated coloring scheme.

	Evaluative criteria consists of:	OTHER EVIDENCE:
M, A	• Is the correct transformation created based on the vocabulary and/or function notation?	• Alternative assessment projects such as a logo design activity, graphing transformations on the coordinate plane, dilations with similar figures and designing patterns
M, A	• Is the correct vocabulary and/or notations used to represent a given transformation?	• Review of standardized test questions to prep students for the challenge of the SAT and ACT exams
T, M, A	• Are the appropriate transformations chosen for a specific application?	• Participation in class discussion, group work, and responses.
T, M, A	• Does the transformation model the desired application?	• Quizzes • Unit Test - to include a variety of DOK level of problems and may include SAT style problems.

Code	***Pre-Assessment***	
M	• Teacher checks for prerequisite and prior knowledge via warm-up and questioning activities, such as basic problems on graphing vertical and horizontal lines and writing equations • Prerequisite knowledge is reinforced through algebra review assignments • Teacher will provide review and assessment on prerequisite geometric vocabulary knowledge to ensure all students are capable of communicating effectively	
	Summary of Key Learning Events and Instruction	Progress Monitoring
M	• Teacher introduces vocabulary and notation associated with translations, reflections, rotations and dilations.	• Monitoring class work through board work, group work, questioning, and walk-arounds
T, M, A	• Teacher demonstrates a variety of methods on how to complete an actual transformation using translations, reflections, rotations and dilations.	• Check for understanding via going over homework and mediums such as reflections and exit tickets
T, M, A	• Students use a variety of methods to complete transformations on worksheets, whiteboards and graph paper .	• Class worksheets with direct teacher observation or self assessment • Practice on whiteboard/chalkboard with direct teacher observation
M, A	• Students will observe patterns and develop definitions of reflections, rotations, translations and dilations	
T, M, A	• Students will complete a project where they create an original shape and complete each of the 4 transformations on that shape	• Kahoot quiz or pear deck slideshow with review questions and direct teacher observation • Reflective journals or exit tickets at the end of the lesson
M, A	• Teacher expands upon their understanding of transformations by examining similar figures and their scale factors.	• Google form/google slide show review assignments
M, A	• Students will examine similar figures created by dilations and calculate scale factors that can be used to find missing lengths	• Homework assignments with direct teacher observation or self assessment

M, A	• Teacher introduces the concepts of symmetry and demonstrates them with physical models.	• Projects/performance tasks modeling real world problems involving all aspects of transformations and symmetry
T, M, A	• Students will identify the symmetry associated with a variety of figures	• Summative assessments Quizzes Unit test
T, M, A	• Students will create a shape that tessellates and use it to make a tessellation picture on paper.	

Suggested Resources and supplies

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- Textbook: Bass, Laurie, et.al. . *Geometry Common Core*. 1st ed. Upper Saddle River, NJ: Pearson, Prentice Hall, 2012. Print.
- Resource materials provided by Pearson such as implementing the common core, differentiation and standardized test practice
- Resource from the Bureau of Education and Research: *Strengthening your geometry program: Ideas, strategies and hands-on activities*
- Geogebra; interactive application: Hohenwarter, Markus
- Kahoot; interactive game: Wiggins and Murphy
- Geometer's Sketchpad; interactive application: KCP Technologies
- Desmos; advanced graphing calculator

	• Google forms and Google slides with pear deck extension • Supplies: Patty paper, white boards, straight edge, graph paper, colored pencils	

Subject/Course: College Prep Geometry
Grade:9/10
Time frame: approx. 5-6 weeks

Unit 3: Congruence, Proof and Construction

ESTABLISHED GOALS	***Transfer***	
CCSS.Math.Content.HSG.CO.B.7 Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent. CCSS.Math.Content.HSG.CO.B.8 Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions. CCSS.Math.Content.HSG.CO.B.6 Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.	*Students will be able to independently use their learning to…* • Support ideas clearly and concisely using proper mathematical language/notation. • Construct viable arguments involving mathematics and critique the reasoning of others. • Make sense of problems and persevere in solving them	
	Meaning	
	UNDERSTANDINGS *Students will understand that…* • Congruent figures have the same size and shape. • Orientation of a triangle is not necessary for congruence if the corresponding parts are congruent. • Angle relationships exist when parallel lines are intersected by a transversal. • Geometric configurations can be constructed through the use of a variety of tools including technology • Proof is the highest level of mathematical argument. • Triangle congruence can be proven using geometric theorems	ESSENTIAL QUESTIONS *Students will keep considering…* • How does one know if triangles are congruent? • What effect do rotations have on the congruence criteria? • How does one use criteria to prove congruence? • How can one find the measure of special angle pairs given parallel lines? • How does one perform a geometric construction? • How does one formulate a proof?

	Acquisition	
	Students will know… • Vocabulary: triangle, acute, obtuse, right, isosceles, scalene, equilateral, equiangular, interior angle, exterior angle • The criteria used to prove triangles congruent (SAS, ASA, AAS, SSS and HL) • That as a result of triangles being proven congruent, additional corresponding parts can identified as congruent(CPCTC) • Vertical angles and the reflexive property play an important role in proving triangles congruent. • The four special segments in triangles: median, altitude, angle bisector, perpendicular bisector.. • Constructions can be made to identify a locus of points	*Students will be skilled at…* • Identifying which theorem can be used to prove or disprove triangles congruent. • Creating basic constructions for bisectors and congruent figures • Proving and applying theorems about angles • Using and applying the vertical angles theorem • Identifying special angle pairs and relationships given two lines and a transversal • Constructing basic geometric figures including but not limited to : congruent angles, bisectors, parallel and perpendicular lines

STAGE 2

Code	Evaluative Criteria	Assessment Evidence
T, M, A	Further information: Evaluative Criteria consists of: • comprehensive explanation of corrections • accurate use of mathematical concepts • use of appropriate proof structure • accurate completion of all tasks	PERFORMANCE TASK(S): **Goal**: To demonstrate how to communicate clearly using the medium of mathematical proof by correcting student mistakes **Role**: Teacher **Audience**: Student **Situation**: Students will be given incorrect proofs. It will be their job to correct the mistakes and provide feedback. **Product**: A completed worksheet with corrections clearly labeled with explanation. **Standards for Success**: Rubric based on understanding of different styles of proof **Differentiation:** Students will be able to choose from a variety of styles and difficulty level of proofs.

	Evaluative criteria consists of:	OTHER EVIDENCE:
M , A	• Is there a clear understanding of vocabulary in terms of the connection to congruences when comparing geometric shapes?	• Alternative assessment projects such as a group proof activities, finding the mistake exercises or constructions involving real world criteria
M, A	• Is there a clear understanding of the format of a proof?	• Review of standardized test questions to prep students for the challenge of the SAT and ACT exams
T, M, A	• Do the steps in the proof follow a logical order?	• Participation in class discussion, group work, and responses.
T, M, A	• Has a clear understanding of the purpose and outcome of the proof been communicated?	• Quizzes
M, A	• Are the correct steps followed in making a construction?	• Unit Test - to include a variety of DOK level of problems and may include SAT style problems.
T, M, A	• Does a construction accurately depict the desired outcome of a real-world application?	

Code	***Pre-Assessment***
M	• Teacher checks for prerequisite and prior knowledge via warm-up and questioning activities, such as basic problems on geometric vocabulary as marked within a diagram • Prerequisite knowledge is reinforced through algebra review assignments • Teacher will provide review and assessment on prerequisite geometric vocabulary knowledge to ensure all students are capable of communicating effectively

	Summary of Key Learning Events and Instruction	Progress Monitoring
M, A	• Teacher will introduce the methods of proof: statement/reason, flowchart and paragraph using prior knowledge on algebraic and geometric terms	• Monitoring class work through board work, group work, questioning, and walk-arounds • Check for understanding via going over homework and mediums such as reflections and exit tickets • Class worksheets with direct teacher observation or self assessment • Practice on whiteboard/chalkboard with direct teacher observation • Kahoot quiz or pear deck slideshow with review questions and direct teacher observation • Reflective journals or exit tickets at the end of the lesson • Google form/google slide show review assignments • Homework assignments with direct teacher observation or self assessment • Projects/performance tasks modeling real world problems involving all aspects of proofs and constructions • Summative assessments Quizzes Unit test
M, A	• Teacher will introduce the methods that do and do not prove triangles congruent.	
T, M, A	• Students will complete proofs, using each method, to demonstrate their understanding of the logical sequence of steps and knowledge of vocabulary	
M, A	• Teacher reviews vocabulary and guides students in basic constructions of bisectors, perpendiculars, congruent figures.	
T, M, A	• Students will apply their knowledge of vocabulary and constructions to constructions of parallel lines, isosceles and equilateral triangles and rectangles.	
T, M, A	• Students will use constructions to accurately depict solutions to real world situations	

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Subject/Course: College Prep Geometry
Grade:9/10
Time frame: approx. 3-4 weeks

Unit: 4 Triangles and Quadrilaterals

ESTABLISHED GOALS	***Transfer***	
CCSS.Math.Content.HSG.CO.C.11 Prove theorems about parallelograms. *Theorems include: opposite sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals.* CCSS.Math.Content.HSG.CO.C.10 Prove theorems about triangles. *Theorems include: measures of interior angles of a triangle sum to 180°; base angles of isosceles triangles*	*Students will be able to independently use their learning to…* • Work carefully to solve the problem and verify that calculations are accurate and solutions are reasonable. • Solve problems by looking for and using rules, patterns, and experience with similar problems. • Make sense of problems and persevere in solving them	
	Meaning	
	UNDERSTANDINGS	ESSENTIAL QUESTIONS
	• Special properties apply to isosceles and equilateral triangles • Special segments in triangles exhibit specific properties in the real world. • Points of concurrency exist in all triangles as a result of the intersection of the special segments	• What distinguishes isosceles and equilateral triangles from other triangles? • What are the special segments in triangles? • How do the properties of the points of concurrency in a triangle relate to the real world?

are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point. CCSS.Math.Content.HSG.SRT.B.4 Prove theorems about triangles. *Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity.* *CCSS.Math.Content.HSG.SRT.B.5* Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.	• Two sides of a triangle must have a sum larger than the third. • Properties of parallelograms work from specific (square) to general (parallelogram). • Parallelograms use properties of parallel lines. • Quadrilaterals can be determined through the slope and distance formula. • Squares are rectangles, but a rectangle is not necessarily a square. • Trapezoids and kites are special quadrilaterals which do not have the properties of parallelograms • Interior and exterior angles in polygons can be calculated using specific formulas	• What distinguishes the types of quadrilaterals? • How can we prove which quadrilateral we have? • What are the properties of a trapezoid and kite, which separate it from a parallelogram? • How are the interior and exterior angles in polygons calculated?
	Acquisition	
	Students will know… • Triangles can be broken into the more specific classifications: acute, obtuse, right, isosceles, scalene, equilateral, equiangular, and regular. • The specific properties of each triangle • The sum of interior angles in a triangle is 180 degrees. • The four special segments in triangles: median, altitude, angle bisector, perpendicular bisector. • Points of concurrency created by these special segments have real world applications	*Students will be skilled at…* • Identifying congruent angles and sides in an isosceles or equilateral triangle. • Applying properties of special segments in triangles to problems using algebraic thinking. • Calculating the length of a midsegment in a triangle. • Finding the missing angle measures in a triangle. • Using and applying Polygon Angle Sum Theorem. • Using and applying Exterior Angle Theorem

	• The triangle inequality theorem states that the sum of any two sides must be longer than the third. • The longest side in a triangle is across from the largest angle and the shortest side is across from the smallest angle. • Quadrilaterals can be broken into the more specific classifications of: parallelograms, rectangles, rhombus, square, trapezoid and kite. • The specific properties of each quadrilateral • The properties of midsegments in triangles and trapezoids • Polygons have interior and exterior angles that can be calculated using specific formulas	• Proving the type of quadrilateral given information about the angles and sides. • Showing the type of parallelogram by calculating slope and distance. • Identifying the classification of parallelograms given the angle and side measurements. • Giving a specific quadrilateral and coordinates (as variables) identify any missing coordinates (as variables). • Applying properties of quadrilaterals to real-world problems. • Calculating the interior and exterior angles in polygons

STAGE 2

Code	Evaluative Criteria	Assessment Evidence
T, M, A	Evaluative Criteria consists of: • accurate use of mathematical concepts • identification of the appropriate number of triangles and how to connect them • correct method for construction the triangles • final hexagon carefully pieces together	PERFORMANCE TASK(S): **Goal**: To use knowledge of triangle properties to create a hexagonal piece for a quilt. **Role**: Designer **Audience**: Owner of a textile company **Situation**: The owner of the company is looking to make quilts using hexagonal pieces created by combining a series of equilateral and isosceles triangles **Product**: A hexagonal quilt piece comprised of numerous triangles **Standards for Success**: Rubric based on knowledge of points of concurrency and constructions. **Differentiation**: Students will have the option to choose their own design and color scheme

	Evaluative criteria consists of:	OTHER EVIDENCE:
M, A	• Is the triangle identified correctly using the given properties?	• Alternative assessment projects such as a group proof activities, finding the mistake exercises or constructions involving real world criteria
T, M, A	• Are the correct properties applied based on the given triangle?	• Review of standardized test questions to prep students for the challenge of the SAT and ACT exams
M, A	• Is the quadrilateral correctly identified using the given properties?	• Participation in class discussion, group work, and responses.
T, M. A	• Are the correct properties applied based on the given quadrilateral?	• Quizzes
M, A	• Are the calculations accurate based on the desired outcome?	• Unit Test - to include a variety of DOK level of problems and may include SAT style problems.
T, M, A	• Is the correct property and calculation identified for use on a real world application?	

Code	***Pre-Assessment***	
M	• Teacher checks for prerequisite and prior knowledge via warm-up and questioning activities, such as basic problems on solving equations,order of operations and substitution • Prerequisite knowledge is reinforced through algebra review assignments • Teacher will provide review and assessment on prerequisite geometric vocabulary knowledge to ensure all students are capable of communicating effectively	
	Summary of Key Learning Events and Instruction	Progress Monitoring
M, A	• Teacher will guide students through a review of prior knowledge on triangles including median, altitude, perpendicular bisector and angle bisector	• Monitoring class work through board work, group work, questioning, and walk-arounds
M, A	• Teacher will introduce properties of triangles: sum of interior angles, exterior angle theorem, isosceles triangles, triangle inequality theorem, and longest/shortest side relationship to smallest/largest angle	• Check for understanding via going over homework and mediums such as reflections and exit tickets • Class worksheets with direct teacher observation or self assessment
T, M, A	• Student knowledge will be reinforced through a discovery lesson using linguini and measuring activities	• Practice on whiteboard/chalkboard with direct teacher observation
T, M, A	• Students will apply knowledge of vocabulary and properties of triangles on class practice with direct monitoring from the teacher	• Kahoot quiz or pear deck slideshow with review questions and direct teacher observation
M, A	• Teacher will introduce the vocabulary associated with points of concurrency	• Reflective journals or exit tickets at the end of the lesson
T, M, A	• Students will demonstrate their understanding of points of concurrency through a construction project requiring application of content to specific scenarios.	• Google form/google slide show review assignments • Homework assignments with direct teacher

M, A	• Teacher will guide students through a review of prior knowledge on quadrilaterals	observation or self assessment • Projects/performance tasks modeling real world problems involving all aspects of proofs and constructions • Summative assessments Quizzes Unit test
M, A	• Teacher will introduce the family tree of quadrilaterals.	
T, M, A	• Students will apply knowledge of vocabulary and properties of quadrilaterals on class practice with direct monitoring from the teacher	
T, M, A	• Students will demonstrate understanding of vocabulary and properties of triangles and quadrilaterals through construction activities involving equilateral and isosceles triangles, squares, rectangles, rhombus, and parallelograms.	
M, A	• Students will use a discovery lesson to determine the polygon angle sum theorem	
T, M, A	• Students will apply their knowledge of interior and exterior angles to application problems with direct monitoring from the teacher	
	Suggested Resources and supplies All Resources and materials must adhere to all New Milford Board of Education policies and regulations and are subject to New Milford Board of Education approval. Resources and materials must be researched and vetted by the writers and department heads prior to submission for approval.	

	• Textbook: Bass, Laurie, et.al. . *Geometry Common Core.* 1st ed. Upper Saddle River, NJ: Pearson, Prentice Hall, 2012. Print. • Resource materials provided by Pearson such as implementing the common core, differentiation and standardized test practice • Resource from the Bureau of Education and Research: *Strengthening your geometry program: Ideas, strategies and hands-on activities* • Geogebra; interactive application: Hohenwarter, Markus • Kahoot; interactive game: Wiggins and Murphy • Geometer's Sketchpad; interactive application: KCP Technologies • Desmos; advanced graphing calculator • Google forms and Google slides with pear deck extension • Supplies: Patty paper, compass, protractor, straight edge, graph paper, colored pencils, linguini	

Subject/Course: College Prep Geometry
Grade:9/10
Time frame: approx 5 - 6 weeks

Unit: 5 Similarity, Right triangles and Trigonometry

ESTABLISHED GOALS	**Transfer**
CCSS.Math.Content.HSG.SRT.A.2 Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides. CCSS.Math.Content.HSG.SRT.C.6 Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles. CCSS.Math.Content.HSG.SRT.C.8	*Students will be able to independently use their learning to…* • Work carefully to solve the problem and verify that calculations are accurate and solutions are reasonable. • Solve problems by looking for and using rules, patterns, and experience with similar problems. • Make sense of problems and persevere in solving them
	Meaning
UNDERSTANDINGS *Students will understand that…* • Similarity refers to any objects which have the same shape. • Ratio and proportion can be used often to find missing sides in similar figures. • Sides and angles in a right triangle can be calculated using several different methods. • Classification of a triangle as acute, right or obtuse can be found using the pythagorean theorem.	ESSENTIAL QUESTIONS *Students will keep considering…* • How can we show two triangles are similar? • How can we identify corresponding parts of similar triangles? • How can we find the length of the side in a right triangle without Pythagorean theorem? • How can the Pythagorean theorem determine the classification of a triangle

Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems. CCSS.Math.Content.HSG.GPE.A.1 Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation. CCSS.MATH.CONTENT.HSG.SRT.A.3 Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar	• Special right triangles have formulas to identify exact values for side lengths • Ratios are used in all right triangles using the sine, cosine or tangent of an angle. • Sine and cosine of complementary angles are congruent. • Angles of elevation and depression are angles formed above and below a horizontal plane.	• How can we find the missing parts of a right triangle? • How can we use ratios to find missing parts of triangles? • How do we apply the shortcuts for special right triangles? • How do trigonometric ratios relate to similar right triangles? • What is the difference between an angle of elevation and an angle of depression?
	Acquisition	
	Students will know… • Vocabulary: Right Triangle, Hypotenuse, Adjacent Leg, Opposite Leg. • Ratios are used to find missing parts of similar figures. • Similar figures are the same shape but not necessarily the same size. • Similar figures may be congruent, but congruent figures are always similar. • The shortcuts for similarity are AA, SAS, SSS • 30-60-90 and 45-45-90 are the most common configurations of right triangles. • Using the Pythagorean Theorem we can prove shortcuts to find exact lengths of sides for special right triangles. • Sine and Cosine of complementary angles are congruent . • Trigonometric ratios can be used to find a missing length or angle measure in a triangle	*Students will be skilled at…* • Using trigonometry to find a missing side or missing angle in a right triangle. • Using special right triangles, find the exact value of a side in a right triangle • Applying similarity to find the length of real-world objects like the height of an outdoor flagpole. • Proving similarity in triangles with the AA similarity criterion. • Applying the Pythagorean Theorem and its converse to triangles • Using the rules for special triangles to find coordinates of the unit circle • Applying the sine, cosine and tangent ratios to real-world application problems. • Classifying and solving problems involving angles of elevation and depression

STAGE 2

Code	Evaluative Criteria	Assessment Evidence
T, M, A	Evaluative Criteria consists of: • accurate use of mathematical concepts • identification of one of the appropriate methods for the calculation • precise measurements and calculations • complete explanation of final result	PERFORMANCE TASK(S): **Goal**: Calculate the height of the flagpole outside the high school **Role**: Engineer **Audience**: Board of Education **Situation**: The Board of Education would like to purchase a new flagpole and would like to know the height of the current flagpole. **Product**: Work shown with diagram and written summary about which size pole to purchase **Standards for Success**: Rubric based on the method of calculation and accuracy of solution **Differentiation:** Students will be able to choose which mathematical method they would like to use to complete the task.

	Evaluative criteria consists of:	OTHER EVIDENCE:
T, M, A	• Is the information provided clearly diagramed and labeled?	• Alternative assessment projects such as proving quadrilaterals based on properties, designs created by constructing specific triangles and quadrilaterals and finding angle measures in complex and real world pictures.
M, A	• Is the appropriate method chosen for finding a missing side or angle based on the data provided?	• Review of standardized test questions to prep students for the challenge of the SAT and ACT exams
M, A	• Are the calculations accurate?	• Participation in class discussion, group work, and responses.
M, A	• Is the correct trigonometric ratio used to solve for the missing side or angle?	• Quizzes
T, M, A	• Are the answers to a real world problem clearly communicated?	• Unit Test - to include a variety of DOK level of problems and may include SAT style problems.

Code	***Pre-Assessment***	
M	• Teacher checks for prerequisite and prior knowledge via warm-up and questioning activities, such as basic problems on cross multiplication, simplifying radicals and solving equations • Prerequisite knowledge is reinforced through algebra review assignments • Teacher will provide review and assessment on prerequisite geometric vocabulary knowledge to ensure all students are capable of communicating effectively	
	Summary of Key Learning Events and Instruction	Progress Monitoring
M, A	• Teacher will guide students through a review of prior knowledge on Corresponding Angles, Corresponding Sides, Congruence Statements,and Scale Factor (Similarity Ratio)	• Monitoring class work through board work, group work, questioning, and walk-arounds
M, A	• Teacher will introduce new vocabulary: Right Triangle, Hypotenuse, Adjacent Leg, Opposite Leg, Trigonometric Ratios, Angle of Elevation, Angle of Depression	• Check for understanding via going over homework and mediums such as reflections and exit tickets
T, M, A	• Students will demonstrate their understanding of the vocabulary on class practice with direct monitoring from the teacher	• Class worksheets with direct teacher observation or self assessment • Practice on whiteboard/chalkboard with direct teacher observation
M, A	• Teacher will introduce triangle similarity using AA, SAS, and SSS similarity criterion.	• Kahoot quiz or pear deck slideshow with review questions and direct teacher observation
T, M, A	• Teacher will guide students through a review of prior knowledge of the pythagorean theorem and its applications.	• Reflective journals or exit tickets at the end of the lesson
T, M, A	• Teacher will derive the formulas for special triangles using the pythagorean theorem.	• Google form/google slide show review assignments

M, A	• Teacher will introduce trigonometric ratios and SOHCAHTOA to find a missing side or missing angle in a right triangle.	• Homework assignments with direct teacher observation or self assessment
T, M, A	• Students will apply knowledge of similarity, pythagorean theorem and trigonometry to real applications with direct monitoring from the teacher and peer and self assessment	• Projects/performance tasks modeling real world problems involving all aspects of proofs and constructions
T, M, A	• Students will apply their knowledge from this unit to choose an appropriate method to find the height of the flagpole in front of the school.	• Summative assessments Quizzes Unit test
	Suggested Resources and supplies All Resources and materials must adhere to all New Milford Board of Education policies and regulations and are subject to New Milford Board of Education approval. Resources and materials must be researched and vetted by the writers and department heads prior to submission for approval.	
	• Textbook: Bass, Laurie, et.al. . *Geometry Common Core.* 1st ed. Upper Saddle River, NJ: Pearson, Prentice Hall, 2012. Print. • Resource materials provided by Pearson such as implementing the common core, differentiation and standardized test practice • Resource from the Bureau of Education and Research: *Strengthening your geometry program: Ideas, strategies and hands-on activities* • Geogebra; interactive application: Hohenwarter, Markus • Kahoot; interactive game: Wiggins and Murphy • Geometer's Sketchpad; interactive application: KCP Technologies	

	• Desmos; advanced graphing calculator • Google forms and Google slides with pear deck extension • Supplies: white boards, straight edge, graph paper, colored pencils, clinometer, measuring tape	

Subject/Course: College Prep Geometry Unit: 6 Area, Surface Area and Volume
Grade:9/10
Time frame: approx 5-6 weeks

ESTABLISHED GOALS	***Transfer***	
CCSS.Math.Content.HSG.GMD.A.3 Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.* CCSS.Math.Content.HSG.GMD.B.4 Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects. CCSS.Math.Content.HSG.MG.A.2 Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).*	*Students will be able to independently use their learning to…* • Work carefully to solve the problem and verify that calculations are accurate and solutions are reasonable. • Solve problems by looking for and using rules, patterns, and experience with similar problems. • Make sense of problems and persevere in solving them	
	Meaning	
	UNDERSTANDINGS *Students will understand that…* • Solids can be named by the shape of their base and the shape of their lateral faces. • Surface area is used to determine how much material is needed to cover a figure and the result is given in square units. • Volume is used to determine how much material will fill an object and the result is given in cubic units.	ESSENTIAL QUESTIONS *Students will keep considering…* • How do we identify a solid? • How can we locate the base or height of a solid? • How can we calculate the surface area and volume of a solid? • When do we use surface area and when do we use volume? • How can we derive the formulas for volume from the area formulas? • How is the cross section of a shape used in calculating surface area and volume?

	• Bases of a prism can be found by identifying the non-rectangular parallel faces of the solid (with the exception of a rectangular prism). • Base of a pyramid can be found by identifying the non triangular face of the solid (with the exception of a triangular pyramid) • Slant height of a shape is different than the actual height • Units which are reported in an answer are critical to the accuracy of an answer. • Cross section is the intersection of a solid and a plane. • Area and volume calculations are utilized in numerous career fields	• How are area and volume used in real life career fields? • Why are units important to the accuracy of an answer? • What is the purpose of the cross section of a solid? • How does the slant height differ from the actual height of a solid?
	Acquisition	
	Students will know… • The Formulas for area of two-dimensional figures. • Vocabulary: Polyhedron, prism, pyramid, cylinder, cone, sphere, hemisphere, height, base, apothem, slant height, lateral area, surface area, volume, face, lateral face, edge, vertex, side, cross section, oblique, great circle. • The relationship between volume of pyramids and prisms as well as cylinders and cones. • The cross section of a solid can be used to calculate surface area and volume	*Students will be skilled at…* • Applying the formulas for surface area and volume to prisms, pyramids, cylinders, and spheres. • Relating cross sections to the calculations of surface area and volume. • Applying the formulas for areas of two-dimensional figures including quadrilaterals, triangles, polygons, etc. • Finding missing measures including, but not limited to, slant height, height of the solid, lateral edges, radius, etc. • Transforming an expression from one unit to another (ex. ft per sec to yds per hr) • Using and applying the formulas for circumference and area of a circle.. .

	• The difference between slant height and the height of a solid	• Applying concepts of density based on area and volume in modeling situations.

STAGE 2

Code	Evaluative Criteria	Assessment Evidence

T, M, A	Evaluative Criteria consists of: • Accurate use of mathematical concepts • Identification of the appropriate formula for each shape • Precise measurements and calculations • Complete explanation of final results	PERFORMANCE TASK(S): **Goal**: Find the surface area and volume of various solids that are used in the manufacturing industry **Role**: Employee at a Manufacturing Company **Audience**: Client **Situation**: Manufacturer must calculate the surface area and volume of various three-dimensional objects for packaging purposes **Product**: Work/Calculations and conclusion about which solid to choose for shipping specific items. Many justifiable answers. **Standards for Success**: Rubric based on accurate data collection and presentation of conclusions. **Differentiation:** Students will work hands-on with 3-dimensional shapes that require the use of basic and familiar area and volume formulas as well as the option to work with shapes that require the use of more complex formulas and calculations.

	Evaluative criteria consists of:	OTHER EVIDENCE:
T, M, A	• Is the correct calculation(i.e. area, surface area or volume) used to solve the problem.	• Alternative assessment projects such as labs involving measuring and calculating volumes and surface areas of real objects, questioning activities that identify which measurement is the appropriate calculation for each problem and applications involving real world volume and surface area calculations.
M, A	• Is the correct solid and corresponding formula identified for use in solving the problem?	
M, A	• Are all values been measured accurately	• Review of standardized test questions to prep students for the challenge of the SAT and ACT exams
M,A	• Is the solution the result of accurate substitution and calculation	• Participation in class discussion, group work, and responses.
M,A	• Is the solution labeled with the correct units	• Quizzes
T, M,A	• Are the answers to a real world problem clearly communicated?	• Unit Test - to include a variety of DOK level of problems and may include SAT style problems.

Code	***Pre-Assessment***
M	• Teacher checks for prerequisite and prior knowledge via warm-up and questioning activities, such as basic problems on substitution, order of operations, solving equations and identification of basic shapes • Prerequisite knowledge is reinforced through algebra review assignments • Teacher will provide review and assessment on prerequisite geometric vocabulary knowledge to ensure all students are capable of communicating effectively

	Summary of Key Learning Events and Instruction	Progress Monitoring
M, A	• Teacher will guide students through a review of prior knowledge on area formulas	• Monitoring class work through board work, group work, questioning, and walk-arounds
M, A	• Teacher will introduce and demonstrate the concepts of cross sections and solids of revolutions and relate them to the calculation of volume and surface area	• Check for understanding via going over homework and mediums such as reflections and exit tickets
M, A	• Teacher will guide students through a review of prior knowledge on surface area, both by formula and the sum of individual sides	• Class worksheets with direct teacher observation or self assessment
M, A	• Teacher will guide the students through a demonstration of the volume of pyramids and cones as they relate to prisms and cylinders and will acknowledge the formulas for each shape	• Practice on whiteboard/chalkboard with direct teacher observation • Kahoot quiz or pear deck slideshow with review questions and direct teacher observation
T, M, A	• Students will practice measuring skills by calculating the surface area and volume for a wide range of three-dimensional solids. This will be in a laboratory format.	• Reflective journals or exit tickets at the end of the lesson • Google form/google slide show review assignments
T, M, A	• Teacher will brainstorm with students how to determine if a problem is asking for area, surface area and volume.	• Homework assignments with direct teacher observation or self assessment
T, M, A T, M, A	• Teacher will have students work in groups to create and solve their own application problems for surface area and volume	• Projects/performance tasks modeling real world problems involving all aspects of proofs and constructions
T, M, A	• Students will explore various occupations that use these formulas and perform some of the calculations.	• Summative assessments Quizzes Unit test

- Students will work in groups to "think, pair, and share" results about the relationship between scale factors, areas, and volumes of similar solids.

Suggested Resources and supplies

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- Textbook: Bass, Laurie, et.al. . *Geometry Common Core.* 1st ed. Upper Saddle River, NJ: Pearson, Prentice Hall, 2012. Print.
- Resource materials provided by Pearson such as implementing the common core, differentiation and standardized test practice
- Resource from the Bureau of Education and Research: *Strengthening your geometry program: Ideas, strategies and hands-on activities*
- Geogebra; interactive application: Hohenwarter, Markus
- Kahoot; interactive game: Wiggins and Murphy
- Geometer's Sketchpad; interactive application: KCP Technologies
- Desmos; advanced graphing calculator
- Google forms and Google slides with pear deck extension
- Supplies: white boards, rulers, colored pencils, 2-d and 3-d shapes, manipulatives for cross sections and solids of rotation.

Subject/Course: College Prep Geometry Unit: 7 Circles
Grade:9/10
Time frame: approx 5-6 weeks

<table>
<tr><td rowspan="4">ESTABLISHED GOALS

<u>CCSS.Math.Content.HSG.C.A.2</u>
Identify and describe relationships among inscribed angles, radii, and chords. Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.
<u>CCSS.MATH.CONTENT.HSG.C.A.1</u>
Prove that all circles are similar

<u>CCSS.MATH.CONTENT.HSG.C.A.3</u>

Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.</td><td colspan="2">Transfer</td></tr>
<tr><td colspan="2">Students will be able to independently use their learning to…

• Work carefully to solve the problem and verify that calculations are accurate and solutions are reasonable.
• Solve problems by looking for and using rules, patterns, and experience with similar problems.
• Make sense of problems and persevere in solving them</td></tr>
<tr><td colspan="2">Meaning</td></tr>
<tr><td>UNDERSTANDINGS
Students will understand that…

• A circle is the set of all points equidistant from the center.
• Arcs and angles are closely related but the notation is different.
• Area of a sector is a fractional piece of the area of the entire circle.
• Central angles and inscribed angles will have different sized arcs.
• Arc length is a fractional piece of the circumference.</td><td>ESSENTIAL QUESTIONS
Students will keep considering…

• What are the key terms for a circle?
• How are arc measure and angle measure related?
• How does one measure arc length and how is it related to the circumference of a circle?
• How can segment lengths be calculated using properties of tangents, secants and chords</td></tr>
</table>

	• Properties of tangents, secants and chords can be used to determine segment lengths in circles • Tangents and radii meet at right angles • Chords that are bisected by a diameter are also perpendicular	• How a right angle is formed by a tangent and radius • How does a diameter that is a perpendicular bisector of a chord create a right triangle within a diagram?
	Acquisition	
	Students will know… • Vocabulary: Circle, Radius, Diameter, Chord, Arc, Sector, Angle, Intercepted Arc, Inscribed Angle, Central Angle, tangent, secant. • Inscribed Angle measures are half the measure of the arc. • Central Angle measures are equal to the measure of the arc. • Segment lengths in circles can be found using the properties of tangents, secants and chords • Right angles are formed by a tangent and radius • Perpendicular bisectors of a chord create right angles	*Students will be skilled at…* • Calculating measure of an arc. • Calculating measure of an interior angle. • Calculating measure of an inscribed angle. • Calculating the arc length. • Calculating the area of a sector. • Calculating segment lengths within in circles • Applying calculations to real-world problems

STAGE 2

Code	Evaluative Criteria	Assessment Evidence

T, M, A	Evaluative Criteria consists of: • accurate use of mathematical concepts • identification of the appropriate term and formula for each computation • precise measurements and calculations • complete explanation of final results	PERFORMANCE TASK(S): **Goal**: To calculate the measures of lines, sectors and angles used to build a miniature toy ferris wheel. **Role**: Architect **Audience**: Manager of a toy company **Situation**: Use the properties of circles, tangents and chords to calculate the measure of the beams used to design a miniature ferris wheel and the angles at which they will need to be connected. **Product**: Calculated distances and angle measures for building a miniature toy ferris wheel. **Standards for Success**: Rubric based on accurate data collection and presentation of conclusions. **Differentiation**: Students will be able to choose from a variety of different methods to solve the problems.

	Evaluative criteria consists of:	OTHER EVIDENCE:
T, M, A	• Is all given information correctly labeled in the diagram?	• Alternative assessment projects such as real world applications involving the properties of circles
M, A	• Is the correct vocabulary term and corresponding formula identified in solving the problem?	• Review of standardized test questions to prep students for the challenge of the SAT and ACT exams
T, M, A	• Are the properties of the segments identified and used to determine the existence of right triangles within the diagram?	• Participation in class discussion, group work, and responses. • Quizzes
M, A	• Are calculations and solutions completed accurately?	• Unit Test - to include a variety of DOK level of problems and may include SAT style problems.

stage 3

Code	***Pre-Assessment***	
M	• Teacher checks for prerequisite and prior knowledge via warm-up and questioning activities, such as basic problems on substitution, solving equations, order of operations and identification of basic parts of a circle • Prerequisite knowledge is reinforced through algebra review assignments • Teacher will provide review and assessment on prerequisite geometric vocabulary knowledge to ensure all students are capable of communicating effectively	
	Summary of Key Learning Events and Instruction	Progress Monitoring
M	• Teacher will guide students in the definition of key terms.	• Monitoring class work through board work, group work, questioning, and walk-arounds
M, A	• Teacher will confirm with students the measure of angles using a protractor.	• Check for understanding via going over homework and mediums such as reflections and exit tickets
T, M, A	• Students will explore the measure of arc and angles using an activity to measure angles.	• Class worksheets with direct teacher observation or self assessment
M, A	• Teacher will describe how tangents, secants and line segments are related to circles	• Practice on whiteboard/chalkboard with direct teacher observation
T, M, A	• Students will demonstrate their understanding of tangents, secants, angles and arcs through class practice on whiteboards and worksheets	• Kahoot quiz or pear deck slideshow with review questions and direct teacher observation
M	• Teacher will describe the various situations where segments are divided on tangents and secants and the corresponding formulas used to determine their lengths	• Reflective journals or exit tickets at the end of the lesson
T, M, A	• Students will complete a variety of real world problems involving circles and right triangles.	• Google form/google slide show review assignments
T, M, A	• Students will complete a hands-on activity to measure the lines, sectors and angles involved in Track & Field.	• Homework assignments with direct teacher observation or self assessment

T, M, A	• Students will identify the relationship between central, inscribed interior and exterior angles and apply them to real applications **Suggested Resources and supplies** All Resources and materials must adhere to all New Milford Board of Education policies and regulations and are subject to New Milford Board of Education approval. Resources and materials must be researched and vetted by the writers and department heads prior to submission for approval. • Textbook: Bass, Laurie, et.al. . *Geometry Common Core.* 1st ed. Upper Saddle River, NJ: Pearson, Prentice Hall, 2012. Print. • Resource materials provided by Pearson such as implementing the common core, differentiation and standardized test practice • Resource from the Bureau of Education and Research: *Strengthening your geometry program: Ideas, strategies and hands-on activities* • Geogebra; interactive application: Hohenwarter, Markus • Kahoot; interactive game: Wiggins and Murphy • Geometer's Sketchpad; interactive application: KCP Technologies • Desmos; advanced graphing calculator • Google forms and Google slides with pear deck extension • Supplies: white boards, graph paper, colored pencils, 2-d and 3-d shapes, compass, ruler	• Projects/performance tasks modeling real world problems involving all aspects of proofs and constructions • Summative assessments Quizzes Unit test
