NEW MILFORD PUBLIC SCHOOLS

New Milford, Connecticut

Practical Math - Applications of Statistics

December 2021

BOE Approved March 2022

New Milford Board of Education

Wendy Faulenbach, Chairperson

Pete Helmus, Vice Chairperson

Olga I. Rella, Secretary

Tammy McInerney, Assistant Secretary

Eric Hansell

Brian McCauley

Tom O'Brien

Leslie Sarich

Keith A. Swanhall Jr

Superintendent of Schools

Ms. Alisha DiCorpo

Assistant Superintendent

Mrs. Holly Hollander

Authors of Course Guide

Deborah Murnan

BOE Approved March 2022

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.

BOE Approved March 2022

Practical Math – Applications of Statistics

11th and 12th grades

The goal of this a ½ year course (one semester) is to provide a fundamental understanding of statistics. Topics include: mean, median, mode, range of a set of data, frequency distributions, histograms, graphs of data, standard deviation of a set of data, percentiles, quartiles, *Z*-scores, normal distribution, applications associated with these topics, and the use of calculators and computers.

BOE Approved March 2022

Pacing Guide

Unit Title	# of Weeks
1. Vocabulary	2
2. Frequency tables and graphs	3
3. Applications of Measures of central tendencies and use of the graphing calculator to find the measures of central tendencies	4
4. Applications of usual values	2
5. Applications of Percentiles	2
6. Outliers and box plots	2
7. Applications of z-scores and the normal curve	3
8. Review and Final exam	2

Unit Title: Unit 1 – Vocabulary

CCSS.MATH.CONTENT.HSS.IC.B.3 Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.	***Transfer***	
	Students will be able to independently use their learning to… ● *Make sense of a problem by initiating a plan and designing an experiment* ● *Model with mathematics by choosing an appropriate sampling technique to collect data* ● *Reason abstractly and yet quantitatively to determine that the data has minimal bias.* ● *Justify reasoning or understanding by drawing appropriate conclusions based on the data collected.*	
	Meaning	
	UNDERSTANDINGS *Students will understand that…* ● Data can be gathered and classified through a variety of methods ● Data gathered inappropriately can cause a bias in the conclusions ● The purpose of sampling is to provide sufficient information so that population characteristics may be inferred. ● Data is collected for a purpose and has meaning in a context. ● Poor data collection can lead to misleading and meaningless conclusions.	ESSENTIAL QUESTIONS *Students will keep considering…* ● What are the keys to data classification and experimental design? ● What can cause results to be biased? ● What is required to plan and conduct a survey? ● What are sampling techniques and how do they reduce bias? ● What are the various methods of data collection? ● How does data collection affect conclusions for a problem? ● What are the differences between controlled experiments and observational studies?

	● In some cases a population is small enough to work with as opposed to a sample	● What considerations should be made when designing an experiment? ● When is it better to work with a sample rather than a population?
	Acquisition	
	Students will know… ● Data sets ● Sampling techniques: random, cluster, stratified, systematic and convenient. ● Levels of measurement in data as nominal, ordinal, interval and ratio ● The difference between a sample statistic and a population parameter ● Data as prospective, retrospective or cross sectional ● Data as qualitative or quantitative and discrete or continuous ● Sample statistics and population parameters	*Students will be skilled at…* ● Identifying the methods for gathering data and whether it is obtained through experimental or observational design ● Identifying common sources of bias in surveys and experiments ● Identifying sampling techniques as random, cluster, stratified, systematic or convenient. ● Differentiating between quantitative and qualitative data, and discrete and continuous data ● Differentiating between information that is a sample statistic or a population parameter ● Identifying the level of data as nominal, ordinal, interval or ratio ● Identifying data as prospective, retrospective or cross sectional ● Knowing when a population is small enough to work with and when a sample is more appropriate

STAGE 2

Code	Evaluative Criteria	Assessment Evidence
A, M, T	Evaluative Criteria consists of ● an explanation of how data was collected and which demographics were the main focus ● an explanation of how bias was avoided in data collection ● accurate display of the data ● a conclusion that provides the required information to the dealership	PERFORMANCE TASK(S): Goal: To conduct a survey to collect data about favorite car colors to be used in determination of cars to order at a car dealership Role: Manager of a car dealership Audience: People purchasing cars and having adequate inventory for them Product or Performance: Data that is representative of desired colors for cars being purchased that can be used in making decisions about the inventory needed at a car dealership. Standards & Criteria for Success: Presentation contains: - display of data and how it was collected. - explanation of how data is or is not biased - Conclusion

A, M A, M A, M A, M, T	Evaluative criteria consists of: ● Is the correct sampling technique used for collecting the data ● Were problems in the way the data was sampled identified ● Does bias exists in the way the data was sampled ● Were appropriate conclusions drawn based on the data sampled	OTHER EVIDENCE: ● Alternative assessment projects such as crossword puzzles matching activities and partner review analyzing all aspects of a sampling ● 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 statistical vocabulary that is related to work done in basic algebra courses

		Progress Monitoring
A	• Students will participate in an introductory activity that involves sampling, organizing and analyzing data. This activity will be referenced throughout the unit.	• Warm up questions • Monitoring class work through board work, group work, questioning, and walk-arounds • Check for understanding via going over homework and medium 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 • Edulastic or google form review assignments • Homework assignments with direct teacher observation or self assessment • Projects/performance tasks modeling real world problems involving all aspects of a sampling , crossword puzzles and matching activities • Summative assessments Quizzes Unit test
A	• Teacher will introduce statistical vocabulary and corresponding examples, starting with differentiating between sample and population, statistic and parameter, discrete and continuous and quantitative and qualitative	
A, M ,T	• Students will practice by relating vocabulary to real life examples	
A	• Teacher will introduce levels of measurements (nominal, ordinal, interval and ratio)	
A, M, T	• Students will engage in activities that allow them to match the measurements to specific data examples	
A	• Teacher will continue with sampling techniques: convenience, stratified, cluster, systematic and random as well as different types of studies: observational, experimental, prospective, retrospective and cross sectional	
A, M, T	• Students will use kahoots, peardeck slide shows, matching activities and crossword puzzles as ways to review vocab definitions and application to statistical scenarios	
A, M, T	• Teacher discusses sampling techniques which may cause data to be biased and key words that describe issues that cause the bias.	
A, M, T	• Teacher and students will partake in discussions involving data collection and why the data may be considered valid and therefore may be used to draw conclusions about the data	
A, M, T	• Discussions continue describing problems that may arise when collecting data and how to avoid them	

A, M, T	● Additional review assignments will be provided where students examine all aspects of a sampling to determine the validity of the data	

Unit Title: Unit 2 – Frequency tables and graphs

<table>
<tr><td rowspan="4">CCSS.MATH.CONTENT.HSS.ID.A.1

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

CCSS.MATH.CONTENT.6.SP.B.

Display numerical data in plots on a number line, including dot plots, histograms, and box plots.

CCSS.MATH.CONTENT.HSS.IC.B.3

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

● Make sense of a problem by initiating a plan and designing a method for data collection
● Make use of structure by organizing data into appropriate frequency tables
● Model with mathematics by displaying data in an appropriate graph
● Justify reasoning or understanding by making interpretations of the data based on the tables and graphs</td></tr>
<tr><td colspan="2">Meaning</td></tr>
<tr><td>UNDERSTANDINGS
Students will understand that…

● Data can be gathered and classified through a variety of methods
● Data can be presented in both chart and graph form
● The way that data is collected, organized and displayed influences interpretation.
● The purpose of sampling is to provide sufficient information so that population characteristics may be inferred.
● Data is collected for a purpose and has meaning in a context.
● Graphical displays of data may be analyzed informally.</td><td>ESSENTIAL QUESTIONS
Students will keep considering…

● How can graphs be used to communicate information and/or misinformation?
● What can cause results to be biased?
● What is required to plan and conduct a survey?
● What are different methods by which data can be displayed?
● What are the various methods of data collection?
● How does data collection affect conclusions for a problem?
● What considerations should be made when designing an experiment?
● How do graphs enhance the display of data?</td></tr>
</table>

	● Poor data collection can lead to misleading and meaningless conclusions. ● Graphs produce visual displays of data in meaningful ways. ● Spreadsheets can be used to make graphs	● How does one know which graph is appropriate to use for a given set of data? ● How can a graph be made using a spreadsheet?
	Acquisition	
	Students will know… ● A variety of frequency tables ● Graphing the data is the first step in analyzing data ● Interpretations of numerical summaries and graphical displays of data ● Quantitative displays: stem plot, dot plot, ogive, frequency polygon or histogram ● Qualitative displays: bar graph, pie chart or pareto chart ● Time plots ● Graphs made from spreadsheets	*Students will be skilled at…* ● Summarizing the distribution of a categorical variable with a frequency table ● Displaying the distribution of a categorical variable with a bar, pareto or pie chart ● Displaying the distribution of a quantitative variable with a stem plot, dot plot, pareto chart or a histogram ● Describing the distribution of a quantitative variable in terms of its shape, center and spread. ● Using spreadsheets to create and print graphs

Code	Evaluative Criteria	Assessment Evidence
A, M, T	Evaluative Criteria consists of: ● An accurate display of the data and how it was collected ● Data that is organized in a appropriate frequency table ● An appropriate graph of the data that displays the information in the frequency table	PERFORMANCE TASK(S): Goal: To gather data about the battery life of different cell phones, organize the data in a frequency table and to present the data as a graph Audience: A company purchasing cell phones for their employees Product or Performance: A graph that displays the battery life of a variety of cell phones to be used in determining which phones to purchase Standards & Criteria for Success: Presentation contains: - Data collected - An appropriate frequency table - An appropriate graph

A, M A, M A, M, T A, M, T	Evaluative criteria consists of: ● Was an appropriate sampling technique used to gather data ● Was the appropriate type of graph chosen for each data set ● Was the data set graphed appropriately by hand on paper ● Were graphs created using a spreadsheet	OTHER EVIDENCE: ● Alternative assessment projects such as creating graphs using google sheets and microsoft excel, making graphs by hand and collecting and organizing data in tables ● 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 reading basic bar and line graphs and work with calculating percentages

		Progress Monitoring
A	• Teacher will provide data and demonstrate how to organize the data in frequency tables, relative frequency tables and cumulative frequency tables	• Warm up questions
A, M, T	• Students will use additional data sets to practice organizing data in tables.	• Monitoring class work through board work, group work, questioning, and walk-arounds
A	• Teacher will give example of line graphs, including time plots, frequency polygons and ogives and explain when it is appropriate to use these graphs	• Check for understanding via going over homework and medium such as reflections and exit tickets
A, M, T	• Students organize data into frequency tables which will then be used to make their own graphs by hand	• Class worksheets with direct teacher observation or self assessment
A	• Teacher will introduce bar graphs, including histograms and pareto charts and review what types of data should be made bar graphs	• Practice on whiteboard/chalkboard with direct teacher observation
A, M, T	• Students will practice making bar graphs	
A	• Teacher will demonstrate how to make pie charts, dot plots and stemplots and explain when these graphs should be used	• Kahoot quiz or pear deck slideshow with review questions and direct teacher observation
A, M, T	• Students will practice by making these graphs by hand.	
M, T	• Students with guidance from the teacher will produce graphs using spreadsheets on the computer	• Reflective journals or exit tickets at the end of the lesson
M, T	• Students will gather their own real data to compare throughout the course. For this unit they will gather the data, organize it in appropriate tables and present it in graphic form.	• Edulastic or google form review assignments
		• Homework assignments with direct teacher observation or self assessment
		• Projects/performance tasks modeling real data collection, data organization and creating graphs
		• Summative assessments Quizzes Unit test

Unit Title: Unit 3 – Applications of the Measures of Central Tendencies and use of the graphing calculator

<u>CC.9-12.S.ID.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>CC.9-12.S.IC.3</u>

Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each

Transfer

Students will be able to independently use their learning to…

- *Make sense of a problem by initiating a plan and designing a method for data collection*
- *Make use of structure by organizing data into appropriate frequency tables*
- *Model with mathematics through calculations of mean, median, mode and midrange(measures of center)*
- *Justify reasoning or understanding by making interpretations and predictions with real life data based on the calculations of the measures of center*

Meaning

UNDERSTANDINGS

Students will understand that…

- Measures of central tendency describe how the data cluster or group.
- The values of mean, median, mode and midrange are each more applicable in specific situations
- Measures of dispersion describe how the data spread (disperse) around the center of the data.
- Data are collected for a purpose and have meaning within a context
- Technology can be used to simplify the process of working with large data sets

ESSENTIAL QUESTIONS

Students will keep considering…

- Why is data collected and analyzed?
- How do people use data to influence others?
- Which measure of center is most appropriate for a given data set?
- How can predictions be made based on data?
- How are measures of central tendency used?
- What is meant by the spread of the data?
- How can technology allow for more efficient data analysis?

	● Measures of center can be more easily calculated when large data sets are organized into frequency tables	● How can frequency tables be used as a simpler way to calculate measures of center for large data sets?
	Acquisition	
	Students will know… ● The basic properties of the median and the mean of a data set ● That the standard deviation summarizes how spread out all the data are around the mean. ● Measures of center can be calculated from frequency tables ● Measures of center can be calculated by entering data into a graphing calculator or calculator app. ● Whether mean, median or mode is more applicable for a given set of data ● When is it applicable to use the midrange	*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 ● Applying statistical calculations to real-world situations ● Entering data into a graphing calculator or calculator app and accessing calculations of central tendencies ● Calculating measures of center from frequency tables

Code	Evaluative Criteria	Assessment Evidence
A, M, T	Evaluative Criteria consists of: ● An accurate display of the data and how it was collected ● Accurate calculations of the mean and median ● Appropriate conclusions about the mean and median and what information they provide to the homeowners about the cost of houses in this town	PERFORMANCE TASK(S): Goal: To conduct a survey to collect data about housing prices in a town and present the mean and median housing prices Role: Real estate agent Audience: People purchasing houses and having adequate information about the mean and median housing prices for houses in the town in which they are looking to move Product or Performance: Data and calculations that provide prospective homeowners with information about the town. Standards & Criteria for Success: Presentation contains: - Display of data - Mean and median calculations - Conclusions

A, M A, M A, M A, M, T	Evaluative criteria consists of: ● Were the calculations of mean, median, mode and midrange for data sets computed correctly ● Was the appropriate measure of center for a real life data set selected ● Were calculations correctly accessed using the graphing calculator ● Were appropriate conclusions drawn based on the data and the calculations	OTHER EVIDENCE: ● Alternative assessment projects such as matching activities and partner review analyzing real life data and determining the appropriate measure of center or working with data gathered by the students ● 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 calculating averages and finding the mode for a set of numbers

		Progress Monitoring ● Warm up questions
A	● Teacher will demonstrate how to calculate the mean median, mode and midrange for a set of data.	● Monitoring class work through board work, group work, questioning, and walk-arounds
A, M	● Students will practice these calculations	● Check for understanding via going over homework and medium such as reflections and exit tickets
A, M, T	● Teacher will explain the concepts of mean, median mode and midrange in terms of when it is appropriate to use each of them	● Class worksheets with direct teacher observation or self assessment
A, M, T	● Students will work through practice questions that involve choosing which measure of center is appropriate based on the data set	● Practice on whiteboard/chalkboard with direct teacher observation
A, M, T	● Students, with guidance from the teacher, will enter data in the graphing calculator and access the measures of center as well as standard deviation which will be used next unit	● Kahoot quiz or pear deck slideshow with review questions and direct teacher observation
M, T	● Students will use the data they gathered in unit 2 and calculate the measure of center for their data. Then determine which measure is the best representation of center for their data	● Reflective journals or exit tickets at the end of the lesson ● Edulastic or google form review assignments ● Homework assignments with direct teacher observation or self assessment ● Projects/performance tasks modeling real world problems involving mean median and mode ● Summative assessments Quizzes Unit test

Unit Title: Unit 4 – Applications of usual values

CC.9-12.S.IC.1 Understand statistics as a process for making inferences about population parameters based on a random sample from that population. CC.9-12.S.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.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	***Transfer*** *Students will be able to independently use their learning to…* ● *Make sense of a problem by initiating a plan and designing a method for data collection* ● *Make use of structure by organizing data into appropriate frequency tables* ● *Model with mathematics by finding the range of usual values for a data set and/or determining when a value is considered 'usual'* ● *Justify reasoning or understanding by making interpretations of real life data based on the ranges of usual values*	
	Meaning	
	UNDERSTANDINGS *Students will understand that…* ● That the mean and standard deviation can be used to determine if an observation is 'usual' ● That an observation is considered 'usual' if it lies more than 2 standard deviations away from the mean. ● That the concept of 'usual' has many real applications ● That the range rule of thumb formula and empirical rules are used for normal data ● That Chebyshev's formula is used for skewed data	ESSENTIAL QUESTIONS *Students will keep considering…* ● How are the mean and standard deviation used to determine if an observation is 'usual'? ● When is an observation considered 'usual' ? ● How does the concept of 'usual' apply to real data? ● How do the range rule of thumb formula and empirical rule apply to 'usual' values for normal data? ● How does Chebyshev's formula apply to 'usual' values in skewed data?

Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).	***Acquisition***	
	Students will know…	*Students will be skilled at…*
	● The range of usual values for a set of data ● The specific value is usual for the given set of data ● The range rule of thumb and empirical rules to find 'usual' values in normal data ● Chebyshev's rule to find 'usual' values for skewed data	● Determining the range of usual values for a data set ● Determining whether or not an observation is 'usual' ● Calculating 'usual' values using the range rule of thumb formula and the empirical rule when working with normal data ● Calculating 'usual' values using Chebyshev's formula when working with skewed data

STAGE 2

Code	Evaluative Criteria	Assessment Evidence
A, M, T	Evaluative Criteria consists of: ● An accurate display of the data and how it was collected ● A display of the range of usual values and the calculations that led to it ● An explanation of how to determine if their glucose level is 'usual' or whether they will need to seek treatment	PERFORMANCE TASK(S): Goal: To provide a patient with information about the need for treatment for diabetes Role: Medical professional Audience: Patient who is being tested for diabetes Product or Performance: A range of usual values that allows the patient to understand the normal range of values for glucose levels and whether or not their value is considered 'usual' Standards & Criteria for Success: Presentation contains: - Display of data - Display of the range of usual values - Explanation

A, M A, M, T A, M, T A, M, T	Evaluative Criteria consists of: ● Was the range of usual values calculated correctly using the mean and standard deviation ● Were the usual values determined using the empirical rule and its percentiles ● Were the usual values used to correctly interpret real life normal data ● Was Chebyshev's formula used in calculating the range of usual values for non-normal data	OTHER EVIDENCE: ● Alternative assessment projects such as matching activities and work with a variety of real life data sets ● 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 calculating means and standard deviations	
M A A, M, T A A, M, T A, M, T	● Students will review entering data in the graphing calculator and finding the mean and standard deviation ● Teacher will demonstrate how to find a range of usual values for normal data using the range rule of thumb formula and the empirical rule, as well as explaining the percentages associated with the ranges ● Students will use real life data sets to practice finding ranges of usual values and then deciding if a value is within the range of what is considered 'usual' ● Teacher will explain when data is not considered normal and then introduce Chebyshev's formula which is used to find the range of usual values for data that is not normal ● Students will complete practice problems involving data that is not normal ● Students will calculate the range of usual values for the data they gathered in unit 2 and then make determination about values in their lists that are not 'usual'	Progress Monitoring ● Warm up questions ● Monitoring class work through board work, group work, questioning, and walk-arounds ● Check for understanding via going over homework and medium 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 ● Edulastic or google form review assignments ● Homework assignments with direct teacher observation or self assessment

		• Projects/performance tasks modeling real world problems involving all aspects of a sampling , crossword puzzles and matching activities • Summative assessments Quizzes Unit test

Unit Title: Unit 5 – Applications of Percentiles

CC.9-12.S.IC.1 Understand statistics as a process for making inferences about population parameters based on a random sample from that population. CC.9-12.S.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.ID.A.2 Use statistics appropriate to the shape of the data distribution to compare center (median, mean)	***Transfer*** *Students will be able to independently use their learning to…* • *Make sense of a problem by initiating a plan and designing a method for data collection* • *Make use of structure by organizing data into appropriate frequency tables* • *Model with mathematics by calculating the percentiles/quartiles for a data set and/or determining the value at a specific percentile* • *Justify reasoning or understanding by making interpretations of real life data based on the percentiles/quartiles and/or values at specific percentiles*	
	Meaning UNDERSTANDINGS *Students will understand that…* • That a data set can be divided into percentiles/quartiles to more specifically interpret the data • The percentiles of a data set are used in the calculations of usual values and outliers.	ESSENTIAL QUESTIONS *Students will keep considering…* • How is a data set divided into percentiles? • How do the percentiles aid in the determination of outliers and usual values? • How do you determine the percentile of a specific value?

<table>
<tr><td rowspan="4">and spread (interquartile range, standard deviation) of two or more different data sets.

<u>CCSS.MATH.CONTENT.HSS.ID.A.3</u>

Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).</td><td>● Each percentile has a specific value associated with it
● Each value in a data set has a percentile associated with it.</td><td>● How do you find the value at a specific percentile?</td></tr>
<tr><td colspan="2">Acquisition</td></tr>
<tr><td>Students will know…

● The division of a data set into quartiles
● The value at a given percentile
● The percentile for a given value</td><td>Students will be skilled at…

● Calculating the 4 quartiles for a data set
● Calculating which value lies at a specific percentile
● Calculating the percentile for a specific value</td></tr>
</table>

Code	Evaluative Criteria	Assessment Evidence
A, M, T	Evaluative Criteria consists of: ● An accurate display of data and how it was collected ● The calculations that show the student the percentile for their score ● The calculations that show the student the score that separates the top 10% of the population of students who took the test	PERFORMANCE TASK(S): Goal: To provide feedback to students about their scores on the SAT in comparison to all other students who took the test Role: Guidance counselor Audience: Students who took the SAT and looking to apply to college Product or Performance: Calculations that show the student the percentile their score falls into and what value separates the top 10% of students Standards & Criteria for Success: Presentation contains: - Display of data - Calculations of the percentile for their score - calculations of the score that separates the top 10%

A, M A, M A, M, T	Evaluative Criteria consists of: ● Was the percentile for a given value calculated correctly ● Were the quartiles for a data set accurately identified ● Was the value at a given percentile calculated correctly ● Were appropriate conclusions drawn based on percentiles in real life data	OTHER EVIDENCE: ● Alternative assessment projects such as calculations on real life data gathered by the students ● 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 calculating percents and evaluating expressions	
M A A, M, T A A, M, T A, M, T M, T	● Students will review calculating percents ● Teacher will explain how to calculate a percentile when using a data set and looking a specific data point ● Students will practice finding percentiles for values in real life data sets ● Teacher will explain how to find the value at a specific percentile ● Students will practice finding the values at a specific percentile for real life data sets ● Students will practice finding the values at the quartiles in preparation for the next unit ● Students will calculate percentiles and quartiles for their personal data gathered in unit 2	Progress Monitoring ● Warm up questions ● Monitoring class work through board work, group work, questioning, and walk-arounds ● Check for understanding via going over homework and medium 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 ● Edulastic or google form review assignments ● Homework assignments with direct teacher observation or self-assessment

		• Projects/performance tasks modeling real world problems involving all aspects of a sampling , crossword puzzles and matching activities • Summative assessments Quizzes Unit test

Unit Title: Unit 6 - Outliers and boxplots

CC.9-12.S.IC.1 Understand statistics as a process for making inferences about population parameters based on a random sample from that population. CC.9-12.S.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.ID.A.2 Use statistics appropriate to the shape of the data distribution to	***Transfer*** *Students will be able to independently use their learning to…* • *Make sense of a problem by initiating a plan and designing a method for data collection* • *Make use of structure by organizing data into appropriate frequency tables* • *Justify reasoning or understanding by making interpretations of real life data based on the boxplot and outliers*	
	Meaning UNDERSTANDINGS *Students will understand that…* • An outlier in a data set influences the measures of central tendencies • The 5 number summary can be used to make a box plot • A box plot is a graphic representation of the 4 quartiles of a data set	ESSENTIAL QUESTIONS *Students will keep considering…* • What is an outlier and how does it influence a data set? • Do all dispersions contain an outlier? • What is the 5 number summary and how can it be used to make a boxplot? • How is a boxplot used to represent data?

<table>
<tr><td rowspan="4">compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.

<u>CCSS.MATH.CONTENT.HSS.ID.A.3</u>

Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).</td><td>• An outlier is a value that is more than 1.5 IQR above the 3rd quartile or 1.5 IQR below the 1st quartile</td><td>• How are quartiles used to calculate outliers?</td></tr>
<tr><td colspan="2">Acquisition</td></tr>
<tr><td>Students will know…

• The values that are used to determine if a given value is an outlier
• The 5 number summary
• Box plots constructed using the 5 number summary
• If a value is an outlier using the 1.5 IQR rule</td><td>Students will be skilled at…

• Using the 1.5 IQR rule to identify possible outliers and identify outliers in boxplots
• Creating a 5-number summary of a variable
• Constructing a box plot by hand from a 5-number summary
• Determining outliers for a data set using the 5 number summary</td></tr>
</table>

Code	Evaluative Criteria	Assessment Evidence
A, M, T	Evaluative Criteria consists of: ● An accurate display of data and how it was collected ● A graph displaying the boxplot ● An explanation of what the boxplot represents and which players are in need of improvement or who is already achieving success	PERFORMANCE TASK(S): Goal: To create a boxplot that will display the separation of the quartiles for data on the batting averages for a baseball team Role: Statistician for a baseball team Audience: Manager and batting coach for the team Product or Performance: An accurate box plot displaying the batting averages for the team to determine who needs extra batting practice or who needs to move down to a lower league or who is performing extremely well Standards & Criteria for Success: Presentation contains: - Display of data - A boxplot - An explanation

A, M A, M A, M, T A, M A, M, T	Evaluative Criteria consists of: ● Was the 5 number summary for a data set determined ● Was an accurate boxplot created using the 5 number summary ● Were outliers identified that exist for a data set and was there an explanation of how they affect the data ● Were the quartiles in the box plot used to correctly calculate the outliers for each data set ● Were appropriate conclusions drawn on real life data based on the box plot and outliers	OTHER EVIDENCE: ● Alternative assessment projects such as partner review using real life data to find outliers and graphing the data or practice using data gathered by the students ● 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 includes 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 calculating percents and finding quartiles

M A A A, M, T A A, M, T M, T	• Students will review calculating percents and quartiles and accessing data in the graphing calculator • Teacher will explain what the 5 number summary is and where to find it in the calculations in the calculator. • Teacher will introduce the steps to creating a boxplot using the 5 number summary and explain what the box plot displays • Students will use real life data to create boxplots from the 5 number summaries for the data sets • Teacher will demonstrate how to use the values in the box plot to calculate the minimum and maximum values that constitute a value being an outlier using the 1.5 IQR rule • Students will practice finding outliers from boxplots • Students will use their personal data from unit 2 to create a box plot and then determine if there are any outliers in their data set	Progress Monitoring • Warm up questions • Monitoring class work through board work, group work, questioning, and walk-arounds • Check for understanding via going over homework and medium 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 • Edulastic or google form review assignments • Homework assignments with direct teacher observation or self assessment • Projects/performance tasks modeling real world problems involving all aspects of a sampling , crossword puzzles and matching activities • Summative assessments Quizzes and Unit Test

Unit Title: Unit 7 - Z-scores and the normal curve

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…

- *Make sense of a problem by initiating a plan and designing a method for data collection*
- *Make use of structure by organizing data into appropriate frequency tables*
- *Justify reasoning or understanding by making interpretations of real life data based on the probabilities that are calculated*

Meaning

UNDERSTANDINGS

Students will understand that…

- The normal distribution curve is a family of symmetrical curves defined by the mean and the standard deviation.
- Areas under the curve represent probabilities associated with continuous distributions.
- The normal curve is a probability distribution and the total area under the curve is 1.
- The distribution of outcomes of many real life events can be approximated by the normal curve

ESSENTIAL QUESTIONS

Students will keep considering…

- What is a normal curve?
- How is the probability of an event calculated?
- What are the properties of a normal probability distribution?
- How does the standard deviation and mean affect the graph of the normal distribution?
- Why is an understanding of the normal curve essential to statistics?
- In what real life situations can the normal curve be applied to data?
- How can one recognize a normal (bell shape) distribution?

	● The z-score formula can be used to calculate the probability of an event occurring ● The graphing calculator can be a valuable tool in finding normal probabilities	● How can the z-score formula be used to calculate the probability of an event occurring? ● How can the graphing calculator assist in finding normal probabilities?
	Acquisition	
	Students will know… ● Z-score calculations ● The total area under a normal curve is 1 ● A portion 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 ● Normal probabilities have a variety of real world applications ● That the graphing calculator can be used to calculate probabilities more efficiently	*Students will be skilled at…* ● Calculating a z –score ● Using the z-score formula to find a normal probability for a specific observation ● Calculating real life probabilities using the z-score and normal curve ● Using graphing calculators as a method for calculating normal probabilities more efficiently

STAGE 2

Code	Evaluative Criteria	Assessment Evidence
A, M, T	Evaluative Criteria consists of: ● An accurate display of data and how it was collected ● The calculations and explanation of how data determines the probability of catching a large fish	PERFORMANCE TASK(S): Goal: To determine the probability of catching an oversized tuna on a fishing expedition Role: Marine biologist Audience: Charter boat captain and tourists Product or Performance: Data that explains the probability of catching a 'whopper' on a fishing trip Standards & Criteria for Success: Presentation contains: - Display of data - Calculations and explanation

A, M A, M A, M, T A, M, T	Evaluative Criteria consists of: ● Were the basic characteristics of the normal curve identified ● Was the Z-score calculated correctly for a data set ● Were probabilities accurately calculated using the z-score chart ● Was the graphing calculator used to calculate probabilities ● Were appropriate conclusions drawn based on the probabilities using real life data	OTHER EVIDENCE: ● Alternative assessment projects such as partner reviews involving real life 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.

Code	*Pre-Assessment*	
M	● Teacher checks for prerequisite and prior knowledge via warm-up and questioning activities, such as evaluating and solving simple equations and finding the mean and standard deviation	
		Progress Monitoring
A	● Teacher will introduce the z-score formula and demonstrate how it can be used to determine 'usual' values for a data set	● Warm up questions ● Monitoring class work through board work, group work, questioning, and walk-arounds ● Check for understanding via going over homework and medium 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 ● Edulastic or google form review assignments ● Homework assignments with direct teacher observation or self-assessment ● Projects/performance tasks modeling real
A, M, T	● Students will practice finding the mean and standard deviation for a data set and then using them to calculate a z-score	
A	● Teacher will introduce the z-score table and explain how to use it to determine the probability of an event occurring	
A, M, T	● Students will practice find probabilities of real life events occurring	
A	● Teacher will demonstrate how to use the graphing calculator to find these same probabilities	
A, M, T	● Students will practice finding the probabilities using the graphing calculator	
A	● Teacher will explain how to find the value associated with a specific probability or percentile using the z-score chart and the graphing calculator	
M, T	● Students will explore find probabilities of real life events occurring using their data sets from unit	

		world problems involving all aspects of a sampling , crossword puzzles and matching activities ● Summative assessments Quizzes Unit test