Middle School - 8th Grade Math

North Boone CUSD 200

UNITS (6/6 SELECTED)	SUGGESTED DURATION
Unit 1: Real Numbers, Exponents, & Scientific Notation	*25 lessons*
Unit 2: Proportional & Nonproportional Relationships & Functions	*30 lessons*
Unit 3: Solving Equations & Systems of Equations	*30 lessons*
Unit 4: Transformational Geometry	*25 lessons*
Unit 5: Measurement Geometry	*25 lessons*
Unit 6: Statistics	*25 lessons*

Unit 1: Real Numbers, Exponents, & Scientific Notation

Middle School - 8th Grade Math - *Last Updated on June 4, 2019*

STANDARDS

CCSS.Math.Content.8.NS.A.1: Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number.

CCSS.Math.Content.8.NS.A.2: Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., π^2).

CCSS.Math.Content.8.EE.A.1: Know and apply the properties of integer exponents to generate equivalent numerical expressions.

CCSS.Math.Content.8.EE.A.3: Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other.

CCSS.Math.Content.8.EE.A.4: Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.

CCSS.Math.Content.8.EE.A.2: Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that $\sqrt{2}$ is irrational.

PRIORITY STANDARDS

8.EE.1	Know and apply the properties of integer exponents to generate equivalent numerical expressions.

Unit 1: Real Numbers, Exponents, & Scientific Notation

Middle School - 8th Grade Math - *Last Updated on June 4, 2019*

DESIRED RESULTS

Enduring Understandings	Essential Question(s)
Not all numbers are rational. Numbers are used in almost every area of mathematics. Real numbers are the numbers used every day to solve real world and mathematical problems. The ability to fluently perform addition, subtraction, multiplication, and division with real numbers is an essential skill for solving real-world and mathematical problems	How can you use real numbers to solve real world problems? How can you use scientific notation to solve real world problems?

Students will know (Knowledge):	Students will be able to do (Skills):
• Key concepts and vocabulary associated with real numbers, exponents, and scientific notation including: cube root, irrational numbers, perfect cube, perfect square, principal square root, rational number, repeating decimal, square root, terminating decimal, real numbers, scientific notation • A square root is irrational when the number under the square root symbol is not a perfect square • The decimal form of an irrational number neither terminates nor repeats • Any nonzero number raised to the zero power equal 1 • The properties of integer exponents • Scientific notation is used to represent very large and very small numbers in an efficient way which is easy to write and read • The rules of exponents: ◦ Product Rule: $a^m \cdot a^n = a^{m+n}$, for $a \neq 0$ ◦ Quotient Rule: $a^m \div a^n = a^{m-n}$, for $a \neq 0$ ◦ Power Rule: $(a^m)^n = a^{m \cdot n}$, for $a \neq 0$	• Correctly use key concepts and vocabulary associated with real numbers, exponents, and scientific notation in discussions and explanations of problem solving • Rewrite rational numbers and decimals, take square roots and cube roots, and approximate irrational numbers • Describe relationships between sets of real numbers • Order a set of real numbers • Develop and use the properties of integer exponents • Use scientific notation to express very large and very small quantities • Add, subtract, multiply, and divide using scientific notation

Unit 2: Proportional & Nonproportional Relationships & Functions

Middle School - 8th Grade Math - *Last Updated on June 4, 2019*

STANDARDS

CCSS.Math.Content.8.EE.B.6: Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation y = mx for a line through the origin and the equation y = mx + b for a line intercepting the vertical axis at b.

CCSS.Math.Content.8.EE.B.5: Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways.

CCSS.Math.Content.8.SP.A.1: Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.

CCSS.Math.Content.8.F.A.1: Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.

CCSS.Math.Content.8.F.A.2: Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).

CCSS.Math.Content.8.F.A.3: Interpret the equation y = mx + b as defining a linear function, whose graph is a straight line; give examples of functions that are not linear.

CCSS.Math.Content.8.F.B.4: Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.

CCSS.Math.Content.8.F.B.5: Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.

CCSS.Math.Content.8.SP.A.2: Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.

CCSS.Math.Content.8.SP.A.3: Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept.

Unit 2: Proportional & Nonproportional Relationships & Functions

Middle School - 8th Grade Math - *Last Updated on June 4, 2019*

PRIORITY STANDARDS

8.EE.6	Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation y = mx for a line through the origin and the equation y = mx + b for a line intercepting the vertical axis at b.
8.SP.2	Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.
8.SP.A.3	Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept.
8.F.2	Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).
8.F.3	Interpret the equation y = mx + b as defining a linear function, whose graph is a straight line; give examples of functions that are not linear.
8.F.4	Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.
8.F.5	Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.

Unit 2: Proportional & Nonproportional Relationships & Functions

Middle School - 8th Grade Math - *Last Updated on June 4, 2019*

DESIRED RESULTS

Enduring Understandings	Essential Question(s)
Proportional and nonproportional relationships can model many real-world situations, including measurement conversions and geometric relationships. Functions describe situations where one quantity determines another. Proportional relationships and functions that describe quantitative relationships are used every day to solve real world and mathematical problems.	How can you use proportional relationships to solve real-world problems? How can you use nonproportional relationships to solve real-world problems? How can you use linear equations to solve real-world problems? How can you use functions to solve real-world problems?

Students will know (Knowledge):	Students will be able to (Skills):
• Key concepts and vocabulary associated with proportional and nonproportional relationships and functions, including: constant of proportionality, proportional relationship, rate of change, slope, unit rate, linear equation, slope-intercept form of an equation, y-intercept, bivariate data, nonlinear relationship, function, input, output, linear equation, linear function • A proportional relationship is sometimes called a direct variation • How to interpret the unit rate as slope • How to distinguish between proportional and nonproportional situations • A nonproportional linear relationship is represented by a line that does not go through the origin • A slope can be positive, negative, zero, or undefined • The magnitude of the slope describes the steepness of the line • Actual data from a relationship that tends to be somewhat linear will not be perfectly linear. A line of	• Correctly use key concepts and vocabulary associated with proportional and nonproportional relationships in discussions and explanations of problem solving • Use tables, graphs, and equations to represent proportional situations • Find a rate of change or a slope • Use tables, graphs, and equations to represent linear nonproportional situations • Determine the slope and the *y*-intercept of a line • Graph a line using the slope and *y*-intercept • Write an equation to model a linear relationship given a graph or a description • Write an equation to model a linear relationship given a table • Identify and represent functions • Sketch a graph given a description of a relationship

Students will know (Knowledge):	Students will be able to (Skills):
best fit can be used to approximate values from a real-world linear relationship. • How to contrast linear and nonlinear sets of bivariate data • Some characteristics that can be used to describe functions • The set of all inputs for a function is called the domain. The set of all outputs of a function is called the range. • How to use tables, graphs, and equations to compare functions • How to describe a relationship given a graph	

Unit 3: Solving Equations & Systems of Equations

Middle School - 8th Grade Math - *Last Updated on June 4, 2019*

STANDARDS

CCSS.Math.Content.8.EE.C.7: Solve linear equations in one variable.

CCSS.Math.Content.8.EE.C.7a: Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form x = a, a = a, or a = b results (where a and b are different numbers).

CCSS.Math.Content.8.EE.C.7b: Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.

CCSS.Math.Content.8.EE.C.8a: Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.

CCSS.Math.Content.8.EE.C.8b: Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection.

CCSS.Math.Content.8.EE.C.8: Analyze and solve pairs of simultaneous linear equations.

CCSS.Math.Content.8.EE.C.8c: Solve real-world and mathematical problems leading to two linear equations in two variables.

PRIORITY STANDARDS

8.EE.C.7	Solve linear equations in one variable.
8.EE.C.7a	Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form x = a, a = a, or a = b results (where a and b are different numbers).
8.EE.C.7b	Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.
8.EE.8	Analyze and solve pairs of simultaneous linear equations.
8.EE.C.8a	Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.
8.EE.C.8b	Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection.
8.EE.C.8c	Solve real-world and mathematical problems leading to two linear equations in two variables.

Unit 3: Solving Equations & Systems of Equations

Middle School - 8th Grade Math - *Last Updated on June 4, 2019*

DESIRED RESULTS

Enduring Understandings	Essential Question(s)
Linear equations and systems of linear equations are used to represent, analyze, and solve a variety of real-world and mathematical problems. Equations for proportions are special linear equations where the constant of proportionality is the slope and the graphs are lines through the origin.	How can you use equations with the variable on both sides to solve real-world problems? How can you use systems of equations to solve real-world problems?

Students will know (Knowledge):	Students will be able to (Skills):
• Key concepts and vocabulary associated with solving equations and systems of equations, including: solution of a system of equations, system of equations, substitution method, elimination method • The Distributive Property only holds true for multiplication over addition or subtraction • A one variable linear equation may have no solution, one solution, or infinitely many solutions • Examples of equations with a given number of solutions • A system of linear equations may be solved by graphing or algebraically. Graphing has the limitation that the solutions may be approximations that must be verified by substitution. • Algebraic methods for solving a system of linear equations include: substitution, elimination, or using matrices • A system of to linear equation may have no solution (the lines are parallel), one solution (the lines intersect in one point), or infinitely many solutions (the lines are the same line)	• Correctly use key concepts and vocabulary associated with solving equations and systems of equations in discussions and explanations of problem solving • Represent and solve equations with the variable on both sides • Solve equations with rational number coefficients and constants • Use the Distributive Property to solve equations • Solve a system of equations by graphing • Use substitution to solve a system of linear equations • Solve a system of linear equations by adding or subtracting • Solve a system of linear equations by multiplying • Solve systems with no solution or infinitely many solutions

Unit 4: Transformational Geometry

Middle School - 8th Grade Math - *Last Updated on June 4, 2019*

STANDARDS

CCSS.Math.Content.8.G.A.1: Verify experimentally the properties of rotations, reflections, and translations:

CCSS.Math.Content.8.G.A.2: Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.

CCSS.Math.Content.8.G.A.3: Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.

CCSS.Math.Content.8.G.A.4: Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.

CCSS.Math.Content.8.G.A.1a: Lines are taken to lines, and line segments to line segments of the same length.

CCSS.Math.Content.8.G.A.1b: Angles are taken to angles of the same measure.

CCSS.Math.Content.8.G.A.1c: Parallel lines are taken to parallel lines.

PRIORITY STANDARDS

8.G.A.3	Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.

Unit 4: Transformational Geometry

Middle School - 8th Grade Math - *Last Updated on June 4, 2019*

DESIRED RESULTS

Enduring Understandings	Essential Question(s)
Two-dimensional figures are described using ideas about: • distance and angles and how they behave under translations, rotations, reflections, and dilations; and • congruence and similarity Two-dimensional figures and the ideas about them are used to solve many real-world and mathematical problems.	How can you use transformations and congruence to solve real-world problems? How can you use dilations and similarity to solve real-world problems?

Students will know (Knowledge):	Students will be able to (Skills):
• Key concepts and vocabulary associated with transformational geometry, including: image, preimage, transformation, translation, line of reflection, reflection, center of rotation, rotation, congruent, center of dilation, dilation, enlargement, reduction, scale factor, similar • Translations, reflections, and rotations are examples of rigid transformations. A rigid transformation preserves the size and shape of a figure, and are also known as isometries. Dilations are an example of a similarity transformation. A similarity transformation changes the size of a figure. • Algebraic representations for translations (right/left and up/down), reflections (across x- axis and y-axis), and rotations (90^0 clockwise or counterclockwise and 180^0) • The properties of translation and their effect on the congruence and orientation of figures • The properties of reflection and their effect on the congruence and orientation of figures	• Correctly use key concepts and vocabulary associated with transformational geometry in discussions and explanations of problem solving • Use an algebraic representation to describe the effect of a translation, rotation, or reflection • Use an algebraic representation to describe the effect of a dilation on coordinates

Students will know (Knowledge):	Students will be able to (Skills):
• The properties of rotation and their effect on the congruence and orientation of figures • The connection between transformations and figures that have the same shape and size • The properties of dilations • The connection between transformations and the orientations of similar figures	

Unit 5: Measurement Geometry

Middle School - 8th Grade Math - *Last Updated on June 4, 2019*

STANDARDS

CCSS.Math.Content.8.G.A.5: Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles.

CCSS.Math.Content.8.G.B.6: Explain a proof of the Pythagorean Theorem and its converse.

CCSS.Math.Content.8.G.B.7: Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.

CCSS.Math.Content.8.G.B.8: Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.

CCSS.Math.Content.8.G.C.9: Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.

CCSS.Math.Content.8.EE.B.6: Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation y = mx for a line through the origin and the equation y = mx + b for a line intercepting the vertical axis at b.

CCSS.Math.Content.8.EE.C.7: Solve linear equations in one variable.

CCSS.Math.Content.8.EE.C.7b: Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.

PRIORITY STANDARDS

8.G.B.7	Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.
8.G.C.9	Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.
8.EE.B.6	Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation y = mx for a line through the origin and the equation y = mx + b for a line intercepting the vertical axis at b.
8.EE.C.7	Solve linear equations in one variable. b. Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.

Unit 5: Measurement Geometry

Middle School - 8th Grade Math - *Last Updated on June 4, 2019*

DESIRED RESULTS

Enduring Understandings	Essential Question(s)
The Triangle Sum Theorem says that the sum of the measures of the interior angles of a triangle is always 180^0 . The Pythagorean Theorem and its converse says that a triangle is a right triangle if and only if $a^2 + b^2 = c^2$ where a, b, and c are side lengths and c is the longest side. The Triangle Sum Theorem, The Pythagorean Theorem and its converse, and the formulas for the volume of cylinders, cones, and spheres are used to solve many real-world and mathematical problems.	How can you use angle relationships in parallel lines and triangles to solve real-world problems? How can you use the Pythagorean Theorem to solve real-world problems? How can you use volume to solve real-world problems?

Students will know (Knowledge):	Students will be able to (Skills):
• Key concepts and vocabulary associated with measurement geometry, including: alternate exterior angles, alternate interior angles, corresponding angles, same-side interior angles, transversal, exterior angle, interior angle, remote interior angle, similar figures, similar, hypotenuse, legs, cylinder, cone, radius of a sphere, sphere • The conclusions about the angles formed by parallel lines that are cut by a transversal: ◦ corresponding angles, alternate interior angles, and alternate exterior angles are congruent ◦ same-side interior angles are supplementary • The sum of the measures of the interior angles of a triangle is always 180^0 • The Pythagorean Theorem and its converse says that a triangle is a right triangle if and only if $a^2 + b^2 = c^2$ where a, b, and c are side lengths and c is the longest side.	• Correctly use key concepts and vocabulary associated with measurement geometry in discussions and explanations of problem solving • Prove the Pythagorean Theorem and use it to solve problems • Test the converse of the Pythagorean Theorem and use it to solve problems • Use the Pythagorean Theorem to find the distance between two points on a coordinate plane • Find the volume of cylinders, cones, and spheres

Students will know (Knowledge):	Students will be able to (Skills):
• The measure of an exterior angle of a triangle is equal to the sum of its remote interior angles • Two triangles are similar if ◦ their corresponding angles are congruent and the lengths of their corresponding sides are proportional ◦ two angles of one triangle are congruent to two angles of another triangle	

Unit 6: Statistics

Middle School - 8th Grade Math - *Last Updated on June 4, 2019*

STANDARDS

CCSS.Math.Content.8.SP.A.1: Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.

CCSS.Math.Content.8.SP.A.3: Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept.

CCSS.Math.Content.8.SP.A.4: Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables.

CCSS.Math.Content.8.SP.A.2: Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.

PRIORITY STANDARDS

8.SP.A.2	Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.
8.SP.A.3	Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept.
8.SP.A.4	Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables.

Unit 6: Statistics

Middle School - 8th Grade Math - *Last Updated on June 4, 2019*

DESIRED RESULTS

Enduring Understandings	Essential Question(s)
A scatter plot of bivariate data (data for which there are two variables for each observation) may suggest an association or correlation between the two variables. Associations may be linear or nonlinear, but correlations are always linear. Associations and correlations may be negative or positive. Frequencies of data that is categorized two ways are show in two-way tables. The relative frequencies in two-way tables can be used to draw conclusions about whether or not there is an association between the two categories	How can you use scatter plots to solve real-world problems? How can you use two-way frequency tables to solve real=world problems?

Students will know (Knowledge):	Students will be able to (Skills):
• Key concepts and vocabulary associated with statistics, including: association, cluster, outlier, scatter plot, trend line, frequency, relative frequency, two-way table, conditional relative frequency, joint relative frequency, marginal relative frequency, two-way frequency table, two-way relative frequency table • Scatter plots may suggest a linear relationship between two variables so that a line, called the trend line or line of best fit, can be drawn to represent the data. • Categorical data can be organized and analyzed using two-way tables	• Correctly use key concepts and vocabulary associated with statistics in discussions and explanations of problem solving • Construct and interpret scatter plots • Use a trend line to make a prediction from a scatter plot • Construct and interpret two-way frequency tables